

Evaluation of the added value of a tailored ChatGPT for CREM specialists

Exploring the Role of ChatGPT in property management



ChatGPT

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Abstract

Corporate Real Estate Management (CREM) professionals face diverse challenges, from space optimization to financial decision-making, in their field. The potential of emerging AI technologies, such as ChatGPT, remains underexplored in this context. This research seeks to address this knowledge gap by examining whether a tailored ChatGPT can significantly enhance the capabilities of CREM professionals with a focus on property managers. The central question revolves around ChatGPT's utility within Property management, aiming to answer the fundamental question: *"What is the added value of a tailored ChatGPT for professionals in Property Management?"* A mixed-method approach, combining qualitative and quantitative methods, is employed. This approach encompasses in-depth interviews, thematic analysis, and surveys to assess ChatGPT's performance. The research objectives encompass evaluating ChatGPT's performance compared to human experts and gauging its added value. The anticipated outcomes include a comprehensive research findings report, quantitative and qualitative datasets, and a tailored ChatGPT for property managers. This research aspires to understand the potential role of a tailored ChatGPT in CREM and providing insights to policymakers and technologists regarding AI's potential in shaping the future of CREM.

Keywords: ChatGPT, Property management, Added Value, Performance, Prompt, Data

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Graduation company: Vastgoed Beheer PG B.V

During the journey of my thesis project, I was fortunate to embark on a collaborative endeavor with Vastgoed Beheer PG B.V, a cornerstone organization in the Dutch mental health care sector. Through this partnership, I delved into the intricate realm of property management, a domain where Vastgoed Beheer PG B.V exerts its influence by overseeing the operation, maintenance, and leasing of over 600 locations across the Netherlands.

In this research, I was supported by two extremely knowledgeable and professional property managers from Vastgoed Beheer PG B.V, Claire Zouthoutmaar and Arvind Roopram. They provided guidance, resources, and support that were invaluable for my thesis. Their presence was not merely passive; rather, they actively engaged in the progression of my research. Through their provision of a comprehensive case study, complete with data, and their willingness to partake in numerous interviews and questionnaires, Claire and Arvind enriched my academic pursuit with practical insights and firsthand experiences from the field of property management.

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Special Thanks

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Lastly, I want to express my deepest gratitude to my family, whose support and encouragement have been my cornerstone throughout this journey. Whether it was providing emotional comfort during challenging times, understanding the long hours of work, or simply offering a listening ear when I needed to voice my thoughts and frustrations, their presence has been invaluable.

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1 Introduction

This chapter offers a brief introduction to the research's context. It begins by providing a concise historical overview of the emergence of AI and tools like ChatGPT. Additionally, it highlights the existing gap in modern CREM practices and underscores the societal significance of this subject.

1.1 Background

In today's rapidly evolving business landscape, professionals in the field of Corporate Real Estate Management (CREM) face increasingly complex challenges. From managing facilities to optimizing space usage, from financial decision-making to overseeing operations and projects, the multifaceted nature of Corporate Real Estate requires innovative solutions. To meet these challenges, professionals in CREM are constantly seeking new tools and technologies that can enhance and aid practitioners' overall performance.

1.1.1 The evolution of CREM

The history of CREM (see figure 1) dates back to the late 19th and early 20th centuries, when industrialization and urbanization gave rise to large corporations owning or leasing extensive land and buildings. These companies encountered various challenges, including managing multiple locations, navigating legal and regulatory complexities, and adapting to dynamic market conditions and customer demands. To address these issues, some corporations established dedicated real estate departments or divisions, primarily focusing on operational efficiency and cost reduction rather than strategic assets (Krumm, 2001).

In the latter half of the 20th century, factors like globalization, technological advancements, changes in workplace design, and growing concerns about environmental and social issues prompted a shift in corporate real estate management. Some companies adopted a more strategic and proactive approach, aligning real estate decisions with core business strategies and integrating real estate functions with other corporate aspects to create value and competitive advantages (Valenziano, 2001).

The 21st century has brought further changes to CREM, including the emergence of new markets and players, innovative real estate models, and the widespread application of artificial intelligence (AI). AI has increasingly more influence on the workplace and our society as a whole. The extent of AI's potential benefits for CREM remains uncertain, but its integration with other factors like organizational culture, stakeholder expectations, market conditions, and regulatory frameworks will play a crucial role in shaping the future of CREM (Ewert, 2018).

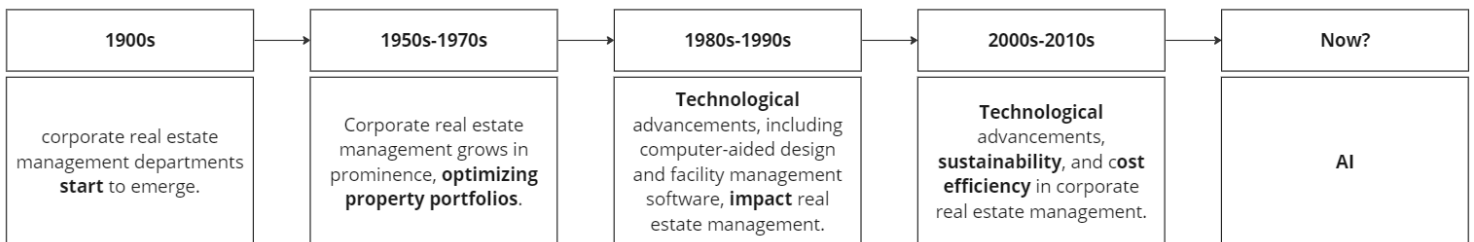


Figure 1: Timeline of the evolution of CREM. Adapted from (Krumm, 2001) own image

1.1.2 The rise of ChatGPT

The rapid rise of artificial intelligence (AI) and the emergence of ChatGPT have created a new era of technological innovation. According to an article from De Standaard in 2023, the introduction of ChatGPT in November 2022 was nothing short of a digital revolution. ChatGPT, developed by OpenAI, became an instant sensation, attracting over 100 million users within its first few days online, a phenomenon that even its creators hadn't anticipated. One year later, the initial excitement has settled, but the impact of ChatGPT on society remains profound. Users have come to realize the need to take its responses with a grain of skepticism, as the AI occasionally produces inaccurate or nonsensical information. However, its applications have expanded far beyond casual interactions.

According to Deloitte, as cited in De Standaard, ChatGPT and other AI chatbots have had a significant impact on various industries. Within the workplace chatbots have found their place, aiding software developers, copywriters, and even consultants. ChatGPT has even become more functional with the ability to create custom GPTs which are tailored and trained on specific company data. While concerns about AI's potential to replace jobs persist, the reality, as highlighted by the *International Labour Organization*, suggests that the impact is more nuanced. Routine tasks may be automated, but humans can focus on more creative and complex aspects of their work (Deckmyn, 2023). The future of AI integration into society will require careful consideration of its implications and discussions about data protection and training for those affected. The rapid adoption of AI and the introduction of ChatGPT have reshaped how we interact with technology and tackle various tasks across different sectors.

1.2 Problem statement

Within CREM, there exists a knowledge gap regarding the practical utility of ChatGPT. The question of whether ChatGPT can provide substantial added value to professionals in the field of CREM remains unexplored in the continuously changing business landscape. This research seeks to investigate the potential a tailored ChatGPT can offer for CREM. In particular, this thesis will evaluate the role ChatGPT can play in the subdomain of property management and how it can potentially benefit practitioners in this area by improving their performance. By addressing this question, this thesis aims to determine how a tailored ChatGPT can enhance the overall performance of CREM specialists. This evaluation is vital for understanding the potential role of ChatGPT in supporting and transforming CREM practices with the evolving needs and expectations of the industry, thereby contributing to the practitioners.

1.3 Societal relevance

The societal relevance of this research is paramount, given the growing impact of AI and tools like ChatGPT across various industries, including Corporate Real Estate Management (CREM). In an era characterized by rapid technological advancements, understanding the role of ChatGPT in CREM holds significant implications for both practitioners and the broader society.

2 Research design.

This chapter delves into the primary aim of the research and outlines the specific research questions that will guide this investigation.

2.1 Aim

This thesis aims to explore whether a customized ChatGPT can offer “added value” to professionals working within the CREM domain. However, its application and utility in the specific context of CREM are relatively unexplored. This research tries to answer this knowledge gap by investigating the potential benefits that a tailored ChatGPT can provide within CREM, particularly focusing on the subdomain of property management.

2.2 Research questions

The main research question for this thesis is *“What is the added value of a tailored ChatGPT for professionals in Property Management”*

2.2.1 Conceptual model

To answer this question, it is important to understand the conceptual model and causal relationship within the question. The causal relationship is based on two parts (see figure 2).

1. Independent Variable: The utilization of a tailored ChatGPT

ChatGPT's introduction into the realm of Property Management serves as the catalyst. The independent variable, in this context, represents the adoption and integration of ChatGPT as a tool within Property Management practices. This encompasses aspects such as the depth of usability, the performance, and the extent to which professionals can embrace this technology.

2. Dependent Variable: Added value for professionals working in Property Management.

The heart of the matter lies in how the utilization of ChatGPT directly impacts professionals in Property Management, thus making this the dependent variable. This value addition can manifest in various forms depending on the extent to which ChatGPT contributes to the specialists.

The “?” in between represents the sub-questions leading to the answer of the main question. Based on the existing scope of literature the following sub question have been formulated to gap the bridge in between the conceptual model.

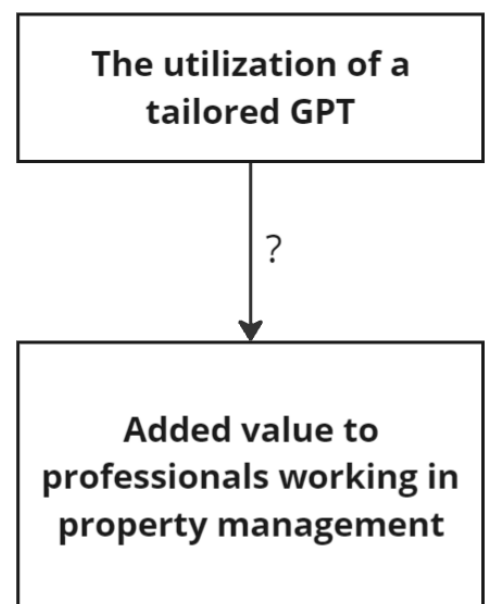


Figure 2: *“What is the added value of a tailored ChatGPT for professionals in Property Management”* (own image)

2.2.2 Sub- Questions:

To answer the main question, this thesis will evaluate the role a tailored ChatGPT can play in the subdomain of property management and how it can potentially benefit practitioners in this area. The following sub questions are revised in order to include the case of the graduation company (which is later explained in chapter 6 part 2):

1. *Within Corporate Real Estate, what are the ten most common issues that are being reported within property management for the Hoeklaan 82-84.*
2. *To what extent can a GPT prompt be engineered to respond with the same information content as a human property manager in corporate real estate?*
3. *To what extent are the answers of a tailored GPT comparable to answers given by human property manager experts.*
4. *How do practitioners perceive the performance of ChatGPT's answers?*

For each of the sub-questions, a fit research approach will be used based on the specific needs of each question. A detailed explanation of the research approach for each sub-question will be provided in Chapter 5. However, prior to delving into these approaches, it is important to conduct a comprehensive literature review. This literature review serves as the foundational step to establish a fundamental understanding of the key concepts central to this research.

3. Literature review

In order to assess the added value of a tailored ChatGPT for professionals in Property Management, it is crucial to undertake a review of the existing body of knowledge. Within the following literature review, it is essential to establish foundational definitions and a deep understanding of CREM, Property Management and ChatGPT. This foundational knowledge is essential as it serves as the foundation upon which this thesis is built. By examining existing literature, this review intends to offer insights into how ChatGPT might be a transformative tool for CREM as well as property management (PPM) professionals and to understand its potential applications, advantages, and constraints in the sector.

This literature review is set up thematically according to the themes and concepts used within this research. These themes are; CREM, Property Management and ChatGPT.

3.1 Understanding CREM practices

3.1.1 Defining CREM

According to (Omar, 2014) CREM is a dynamic and integral aspect of modern corporate operations, evolving significantly since the 1990s. CREM's essence lies in the efficient management of a corporation's real estate assets to support and optimize its core business functions. Within the framework of CREM, several distinct domains have emerged, each with its unique focus and significance (See figure 3).

First of these domains is Facilities Management (FM), which encompasses the day-to-day operational activities related to the physical spaces and structures within an organization. This domain is concerned with ensuring that the corporate real estate, including office spaces, buildings, and supporting infrastructure, is well-maintained, safe, and efficient (Omar, 2014). FM professionals oversee tasks like maintenance, security, cleanliness, and space utilization. Their aim is to create a favorable environment for employees and visitors while optimizing resource efficiency.

Secondly Project Management (PM) is a fundamental domain within CREM that deals with the planning, execution, and supervision of specific real estate projects. These projects may involve construction, renovation, or space optimization (Omar, 2014). Project managers in CREM ensure that projects are completed on time, within budget, and in alignment with the organization's goals. Project management is essential for maintaining and enhancing the value of corporate real estate assets.

Property Management (PPM) on the other hand primarily focuses on the administration and oversight of real estate assets owned or leased by a corporation. This includes managing leases, rental income, and property-related financial matters (Omar, 2014). Property managers are responsible for ensuring that the organization's real estate assets are utilized efficiently and generate a return on investment. Their activities contribute to the overall financial performance of the corporation.

Lastly Strategic Management (SM) extends beyond the operational aspects and delves into the strategic alignment of corporate real estate with the organization's broader goals. Finance and Human Resources (HR) play a critical role in this facet of CREM. Finance professionals analyze the financial implications of real estate decisions, ensuring that real estate investments contribute positively to the organization's bottom line (Omar, 2014). HR professionals work to align organizational goals with the workforce needs, promoting a productive and engaging workplace that supports the workers.

Understanding the domains and tasks within CREM is Critical for the thesis research as it lays the foundation for assessing the potential value addition of ChatGPT. A comprehensive grasp of CREM domains and their associated tasks enables a nuanced evaluation of where value can be added. By dissecting each domain, it becomes possible to speculate on areas where ChatGPT's capabilities can be beneficial. This understanding is crucial in identifying specific use cases and opportunities where ChatGPT can contribute, ultimately contributing to more informed and targeted research within the CREM context.

					Business Strategist
				Intrapreneur	Strategy Policy And Planning <ul style="list-style-type: none"> • Strategic data gathering • Business plan to justify space • Cultural change to achieve corporate objectives • Relocation strategies
			Dealmaker	Resourcing <ul style="list-style-type: none"> • People • Systems • Templates • Information • Service Providers 	
	Taskmaster	Controller	Portfolio Management	Accountability <ul style="list-style-type: none"> • Roles • Responsibility • Performance • Reporting 	
Task	Facilities Management <ul style="list-style-type: none"> • Clean • Safe • Warm • Lit 	Project Management <ul style="list-style-type: none"> • Procurement and putting in place • Budget • Programme • Workmanship • Functionality • Renewals 	<ul style="list-style-type: none"> • Leases • Acquisitions • Disposition • Rent Reviews • Audits • Renewals 		
Management Involvement	Facilities Management	Project Management	Property Management	Strategic Management	
Main Function	Engineering buildings	Minimising building costs	Standardising building usage	Matching market usage	Aligning CREM with organisation's goal
Performance Measurement	Basic measurement (cost against budget)	Cost of Production (eg. Cost per square foot)	Portfolio optimisation (Return on investment (ROI), profit and lost)	Financial analysis (Net present value analysis, opportunity cost)	Integrated with other functions such as HR and IT
Knowledge Required	Technical	Analytic	Financial and human skills	Business planning	Strategic and hybrid of all knowledge

Figure 3: CREM involvement in different management levels: adapted from (Joroff et. al, 1993) by (Omar, 2014)

3.1.2 Value addition in CREM practices

To achieve value addition in Corporate Real Estate Management (CREM) practices, it's essential to align CREM with evolving needs and expectations. Drawing on Omar's definition, the concept of "added value" in CREM comes into sharper focus.

CREM has transformed from its traditional role of technical oversight and cost reduction to becoming an essential pillar in supporting primary processes and contributing to institutional goals (Den Heijer, 2016). The key lies in assessing the influence of real estate interventions on performance, gauged by comparing key performance indicators (KPIs) before and after such interventions. Den Heijer highlights "twelve ways of adding value" Within 4 key tasks of CREM organizations (See figure 4), this includes:

1. **Profitability:** Enhancing profitability strategies involves the skillful combination of risk management, cost reduction, and the growth of real estate assets' overall value. This falls under the view of both Strategic Management (SM) and Property Management (PPM), where SM focuses on long-term financial goals, while PPM oversees asset value and cost control.
2. **Sustainability:** To promote sustainability and reduce the environmental footprint within the real estate portfolio, Strategic Management (SM) as well as Property Management (PM) takes the lead. SM plays a pivotal role in devising and implementing long-term sustainability measures, ensuring that environmental considerations are integrated into CREM practices. PM on the other hand can greatly contribute to realizing more sustainable real estate assets.
3. **Productivity:** The improvement of workplace productivity hinges on Facilities Management (FM). FM professionals excel in enhancing user activities, elevating user satisfaction, and introducing flexible solutions that collectively elevate overall productivity within the workplace.
4. **Competitive Advantage:** Achieving a competitive advantage necessitates a multifaceted approach. Strategic Management (SM) assumes a central role by focusing on enhancing workplace quality, supporting the corporate image, fostering innovation, and promoting collaboration among teams. These activities, overseen by SM, are integral in gaining a competitive edge for an organization within the CREM landscape.

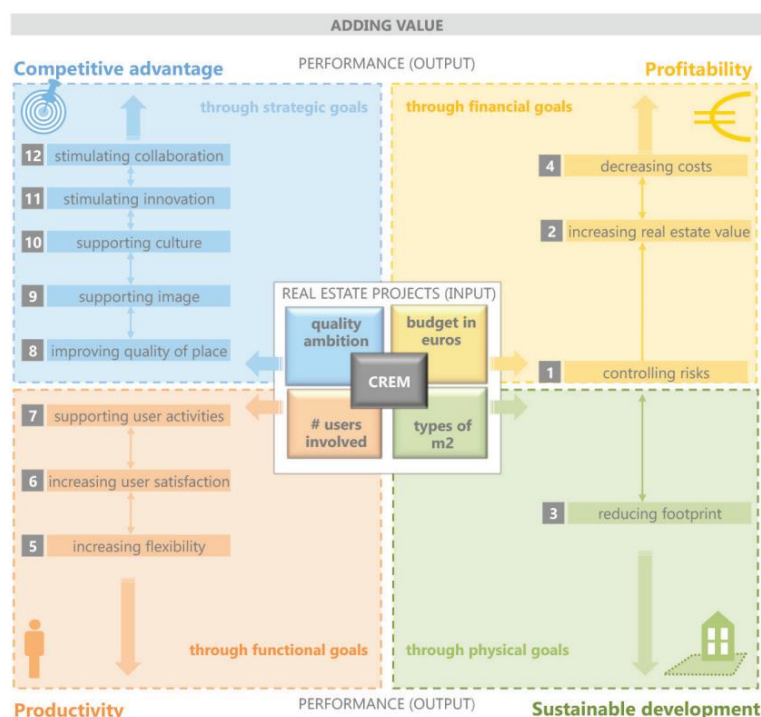


Figure 4: Corporate Real Estate Management (CREM) theory – "12 ways of adding value" - derived from campus management research (Den Heijer 2011)

3.2 Understanding ChatGPT

3.2.1 Benefits and challenges of using ChatGPT

ChatGPT, also known as the Generative Pre-trained Transformer (GPT), represents a new AI language model crafted by OpenAI. It excels in comprehending and generating human-like text in a conversational context (Rospigliosi, 2023). Built upon the Transformer architecture, ChatGPT stands as a significant milestone in the field of "natural language processing" (NLP) (Ray, 2023), attracting considerable attention for its potential applications across diverse domains, such as finance, law, data analysis, and more (Kim, 2023).

Leveraging ChatGPT for various applications yields numerous benefits and challenges (see figure 5) as well as ethical considerations and future directions see (figure 6) as presented by Nazir, (2023). The benefits offers a blend of efficiency and accessibility. This makes it an appealing option for individuals lacking expertise in particular domains, thus broadening its user base (Ko and Lee, 2023). Furthermore, ChatGPT's adaptability to specific tasks and industries is a crucial advantage, rendering it a versatile tool catering to the unique needs of different professionals (Ray, 2023). By summarizing legal documents, providing investment advice, and responding to customer inquiries, it fosters knowledge exchange within organizations, thereby enhancing productivity and the dissemination of information (Guo et al., 2023). Moreover, in fields like finance, ChatGPT excels in offering informed explanations and recommendations based on existing knowledge, thereby proving invaluable (Ali and Aysan, 2023).

Nonetheless, the utilization of ChatGPT is not without its challenges. Its accuracy can sometimes be compromised as its responses are founded on its training data (Kim, 2023). This occasionally leads to the regurgitation of known information rather than generating new insights. There are also concerns regarding bias and fairness, as ChatGPT may inherit biases present in its training data, potentially perpetuating stereotypes or offering biased information (Ray, 2023). An overreliance on AI models like ChatGPT could potentially stifle critical thinking and independent decision-making in professionals (Guo et al., 2023). Ensuring the quality of information generated by ChatGPT is another challenge, as it might produce factually incorrect or misleading content without human oversight (Kim, 2023).

ChatGPT's qualities and capabilities position it as a valuable asset for organizations. Its conversational ability enriches communication by engaging in discussions and negotiations (Rospigliosi, 2023). ChatGPT excels in simplifying information concerning trends, market analysis, and data, thereby enhancing knowledge sharing among people (Rospigliosi, 2023). Its customizable nature allows it to cater to specific desired requirements, offering tailored insights for personalized decision-making (Ko and Lee, 2023). In the data-driven sector, ChatGPT's natural language processing capabilities streamline data analysis and the identification of trends, opportunities, and potential risks (Ko and Lee, 2023). It also automates routine tasks, including data summarization, report generation, and document analysis, thus saving time and boosting productivity (Korzyński et al, 2023). For newcomers in any field, ChatGPT serves as an educational resource, clarifying key concepts, regulations, and best practices in an easily understandable manner (Korzyński et al, 2023). Its accessibility and user-friendly nature lower barriers to entry across different industries (Korzyński et al, 2023).

However, it is crucial to acknowledge that despite ChatGPT's valuable capabilities, human expertise remains paramount for making the final decision, nuanced negotiations, and the interpretation of emotions essential to daily interactions (Guo et al., 2023). Professionals should view ChatGPT as a complementary tool, enhancing their work rather than replacing or performing their role in the industry (Guo et al., 2023).

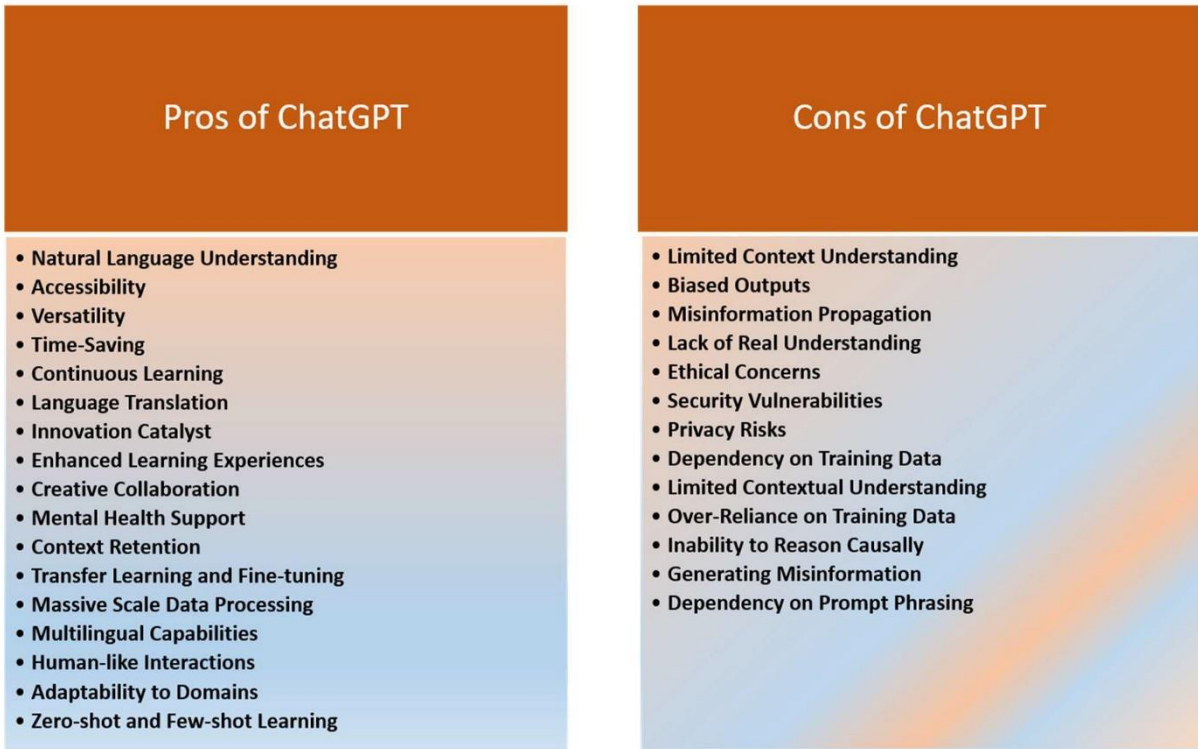


Figure 5: Pros and Cons of using ChatGPT (Nazir, 2023)



Figure 6: Ethical considerations and future directions (Nazir, 2023)

3.2.2 Tailored GPT's

Tailored GPTs are customized versions of ChatGPT that can be created and shared by anyone for specific purposes. They are based on the ChatGPT framework, however, unlike ChatGPT, which has a general knowledge of many topics, tailored GPTs are fine-tuned on domain-specific datasets to have a deeper understanding of a particular field or task (OpenAI, 2023). For example, a medical GPT could be trained on patient records, scientific publications, and other medical data to have a deep knowledge of healthcare. Anyone can easily create their own GPT by starting a conversation in the ChatGPT domain and giving it some information, and choosing what it can do. They can also share their GPT with others. Tailored GPTs are an innovation that can make specific knowledge more accessible and practical for daily use (OpenAI, 2023).

3.2.3 API's

APIs, short for Application Programming Interfaces, serve as the essential bridge enabling different software applications to communicate exchange data. Essentially, an API is a set of code that empowers two or more software programs to interact effectively (Mulesoft, n.d.). These APIs often function as intermediaries, facilitating the retrieval and manipulation of data stored in databases by various applications. Image 7, which illustrates the sequence of steps involved in ChatGPT's process for generating responses. In this context, the API plays a pivotal role in enabling communication with other software components.

- 1 User input is received by ChatGPT (or any other application).
- 2 Within the application, the input undergoes processing and is then transmitted over the internet via a specific URL to initiate a request to an API (Geeksforgeeks, n.d.).
- 3 The API, upon receiving the request, rigorously validates it in accordance with its predefined rules and parameters. If the request is deemed valid, the API establishes a connection with the webserver associated with the database using a query language (Geeksforgeeks, n.d.).
- 4 The database processes the query and subsequently furnishes the data, typically in a structured format, back to the API.
- 5 The API further transforms the data into a format intelligible to the application and dispatches it as an output to ChatGPT via the internet.
- 6 ChatGPT receives the response and proceeds to display or utilize the data in a manner appropriate to the context.

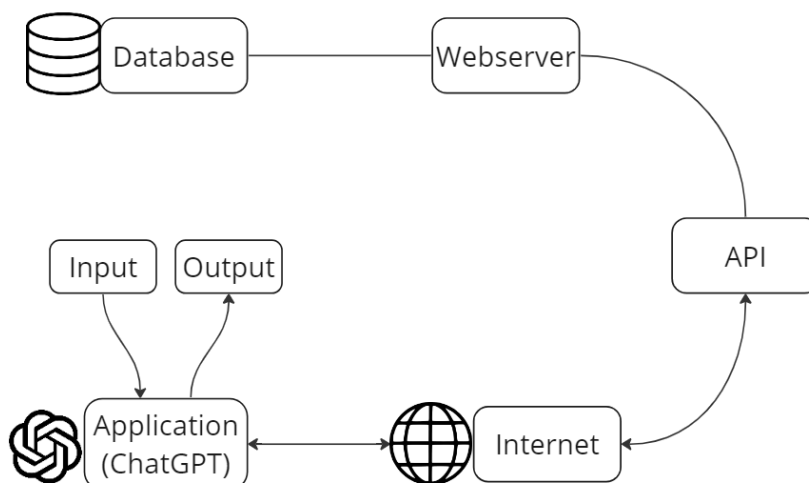


Figure 7:

Simplified flowchart of API function. Adapted from (Bhui, 2023), Own image.

One of the main advantages of using APIs to create GPTs is that they enable the integration of third-party services and data sources that can enhance the functionality and performance of the GPTs (codespere, n.d.). For example, a GPT that helps generate rental contracts can use an API to access legal databases and templates, or a GPT that helps answer tenant inquiries can use an API to access property management software and systems. APIs also allow the GPTs to be more flexible and adaptable, as they can be updated and modified without affecting the core GPT model (OpenAI, 2023).

However, using APIs to create GPTs also poses some challenges and risks, such as data privacy, security, and reliability (Bhui, 2023). When a GPT uses an API to send or receive data from a third-party service, the data may be exposed to unauthorized access, misuse, or loss.

3.2.3 Prompt engineering

Prompt engineering is the process of designing and refining the prompts used to generate text from language models, such as ChatGPT or similar models. The goal of prompt engineering is to improve the quality and relevance of the generated text by carefully crafting the prompts to cause the desired responses from the model (Springer, 2023). Prompt engineering is an increasingly important skill set needed to converse effectively with large language models (LLMs), which have shown remarkable capabilities in natural language processing tasks (arXiv, 2023). Prompt engineering involves creating precise and informative questions or instructions that allow users to acquire desired outputs from AI models. These prompts serve as precise inputs that direct language modeling behavior and text generation (Cointelegraph, n.d.).

To create a tailored GPT it is important to create a thought out prompt to which the GPT can behave to. To create tailored GPT with an accurate prompt you will need a Name, Description, Instructions (Prompt) and Knowledge (database) (Open AI, 2023). A preset configuration of the tailored GPT and prompt in this thesis can be found in Appendix E. The prompt is based on the task descriptions of PPM of Omar (2014).

3.3 Application of ChatGPT in CREM

3.3.1 Use of ChatGPT in CREM

Literature has found some applications for which ChatGPT can be utilized in order to enhance the capabilities within various corporate domains. Using the CREM framework of (Omar, 2014), it is possible to find applications for ChatGPT that match with the tasks of CREM professionals.

ChatGPT in Project Management

In the domain of Project Management, ChatGPT acts as a assistant, enhancing the capabilities of project managers (Minelle & Stolfi, 2023). One of its primary roles is helping communication and documentation. It assists project managers in drafting project communications, reports, and documentation with clarity and conciseness, reducing the risk of miscommunication. Furthermore, ChatGPT excels in risk management (Ko & Lee, 2023). By analyzing project data, it identifies potential risks and suggests mitigation strategies (Ko & Lee, 2023). It can also maintain a project risk register and recommend appropriate risk response plans for managers (Korzyński et al., 2023). Resource allocation is another area where ChatGPT provides invaluable support. It optimizes resource allocation by analyzing project data, ensuring that workloads, skillsets, and project timelines align. In

task scheduling, ChatGPT shines by helping in the creation and optimization of project schedules. It considers dependencies, critical paths, and resource availability to ensure efficient project execution (Ko & Lee, 2023).

ChatGPT in Property Management

ChatGPT can be used as a market analyst to make informed decisions and recommendations about property pricing. However since property managers often require up-to-date market analysis, they will need to provide the program with the data, which can lead to ethical considerations. However since ChatGPT can also collect and analyze real-time market data, including rental rates, property values, and demand trends (Ko & Lee, 2023) it can prove to be a valuable asset. Especially since this information is invaluable for property managers seeking to maximize property revenue and value. Another use is task automation in property management, such as sending out rent reminders or generating financial reports, can be time-consuming (Ali & Aysan, 2023). ChatGPT's automation capabilities enable property managers to delegate these tasks, allowing them to focus on more strategic activities. Screening prospective tenants is another use and a critical aspect of property management. ChatGPT can facilitate background checks by examining tenant applications, credit reports, and rental histories to identify high-quality tenants while minimizing the risk of income loss and property damage (Ali & Aysan, 2023).

ChatGPT in Strategic Management

For Strategic Management, professionals are entrusted with a range of tasks, including strategy development, resource allocation, and accountability (Omar, 2014). ChatGPT can offer targeted support in various specific areas. ChatGPT is equipped to collect and analyze market data, identifying emerging trends and competitive insights. It excels in analyzing textual information to obtain key insights, thereby saving CREM professionals a lot of time for data gathering and development (Korzyński et al, 2023). Another use of ChatGPT, is that it can analyze past data to identify patterns, trends, and strategies employed in the organization. It then uses this analysis to suggest how resources, including personnel, technology, and templates, can be distributed or utilized better to achieve organizational goals (Korzyński et al., 2023). Therefore it can optimize resource allocation to enhancing corporate alignment. Lastly ChatGPT can aid in accountability by defining roles and responsibilities, setting performance metrics, and generating reports and contracts automatically (Ray, 2023). This ensures transparency and compliance with accountability standards and regulatory requirements.

ChatGPT in Facilities Management

Facility Management (FM) managers play a crucial role in maintaining facilities to ensure they are clean, safe, well-lit, and efficiently managed (Omar, 2014). The complexity of this task stems from the need to localize and classify various assets within the facility, which is essential for proper maintenance and preventive action, especially in the context of mechanical, electrical, and plumbing engineering, with its numerous subsystems (Marzouk & Zaher, 2020). To address this challenge, ChatGPT can offer valuable support through image recognition (Ray, 2023). By identifying and categorizing assets, such as fire protection systems, HVAC equipment, and electrical components, ChatGPT can aid FM managers to organize and identify assets. This approach results in cost reduction, the prevention of unexpected failures, and improvements in service levels (Marzouk & Zaher, 2020). Furthermore, ChatGPT uses deep learning and transfer learning techniques to enhance its recognition capabilities (Ray, 2023). Beyond asset recognition, it can also predict maintenance requirements, leading to reduced unplanned downtimes and lower repair costs (Ray, 2023).

3.4 Understanding property management

3.4.1 Property management operations

Property management professionals, as outlined by various sources (Omar, 2012; Baldwin, 1994), operate within a framework that encompasses administration, maintenance, tenant relations, and strategic planning. In the administrative domain, property managers are intermediaries between landlords and tenants, ensuring that lease agreements are managed and legal obligations are met (Omar, 2012). They handle day-to-day operations such as rent collection and maintain financial records, playing a large role in representing the property owner's interests (Baldwin, 1994).

Maintenance is a critical part of property management it involves regular inspections, swift action of maintenance issues, and coordination of repairs and renovations (Omar, 2012). This focus on physical upkeep aligns with the studies of Gibson (1994), who emphasizes the importance of property management in maintaining the functionality and value of real estate assets. The execution of maintenance tasks contributes to the property's overall condition and longevity, ensuring a positive experience for tenants and preserving the property owner's investment (Baldwin, 1994).

Tenant relations is another significant aspect it is a key factor in tenant retention and satisfaction (Yiu et al., 2006). Property managers, in line with the research of Gibson and Barkham (2001), actively engage in establishing and maintaining good relationships with tenants. They handle tenant inquiries, address concerns, and play a central role in the tenant screening process (Omar, 2012).

Strategic planning, as identified by Heywood and Kenley (2008) and McNamara (2002), is an integral part of property management operations. Property managers engage in market analysis, set rental rates, and identify opportunities for property improvement or expansion (Omar, 2012). This strategic perspective aligns with the broader scope of CREM.. The strategic planning undertaken by property management professionals, when aligned with CREM principles, ensures that real estate assets are not just managed operationally but also contribute strategically to the organization's goals (Heywood & Kenley, 2008).

3.4.2 Common questions for property managers

In the context of property management, "common" questions refer to recurring inquiries that property managers routinely face in the course of their work. As mentioned earlier these questions span various aspects of property management, encompassing administrative, operational, and strategic dimensions. Table 1, depicts the range of property management roles and activities adapted from (Omar, 2012), it serves as a foundation for deducing a list of questions property managers encounter when performing their jobs. However, to validate and assess the commonality of these questions, interviews with practitioners are needed. This thesis will validate the insights gained from the literature by conducting interviews with practitioners. While the existing literature provides valuable perspectives on questions in property management, the verification of practitioner interviews is crucial to ensuring a real-world understanding of the challenges faced by property managers. Through these interviews, a more nuanced perspective will be obtained, as to gain more insights from professionals actively engaged in the field.

	Role	Activities	Questions	Common Questions
Property management (PPM)	Property administration	<ul style="list-style-type: none"> – Rental collection. – Property reporting. – Property record keeping 	<ul style="list-style-type: none"> – How to collect rent reliably? – What processes simplify property management reporting? – How to maintain the property record-keeping? 	?
	Property marketing	<ul style="list-style-type: none"> – Marketing spaces for let. – Tenant selection. – Rental schedules. 	<ul style="list-style-type: none"> – What strategies attract tenants to spaces for lease? – How to manage tenant selection? – What practices aid rental scheduling? 	
	Physical and environmental management	<ul style="list-style-type: none"> – Renovation. – Refurbishments. – Maintenance and replacement of facilities. – Health and safety. – Environmental and sustainability management. 	<ul style="list-style-type: none"> – How to optimize renovation and refurbishment activities? – What processes govern maintenance and replacement of facilities? – How to address health and safety and manage environmental and sustainability concerns? 	
	property transactions	<ul style="list-style-type: none"> – Property inspections. – Property negotiations. – Documentation. – Purchase and dispose of property. 	<ul style="list-style-type: none"> – What is the most practical approach to property inspections? – How to conduct negotiations for property transactions? – What improvements can be made to documentation processes? – How to manage the purchase and disposal of property? 	
	Property legal	<ul style="list-style-type: none"> – Legal documentation assessment. – Tenancy laws. – Legal requirements for property. 	<ul style="list-style-type: none"> – How to assess legal documentation thoroughly in property management? – What to know and implement regarding tenancy laws? – How to ensure compliance with legal requirements governing property management? 	
	Procurement	<ul style="list-style-type: none"> – Central purchasing function. 	<ul style="list-style-type: none"> – What goods and services are needed for property operations? 	

Table 1: Range of Property management roles and activities adapted from (Omar, 2012) (own image)

3.4.3 Performance measurement of a tailored GPT for Property Management

To ensure that a GPT is suitable and relevant for property management, it needs to be tailored to the specific needs and goals of the domain. This part discusses how to measure the performance of a tailored GPT for property management, using the concept of performance as explained by (see equation) (Van de Putte, 2022).

$$Performance (aspect) = \frac{Current\ value\ (aspect)}{Reference\ value\ (aspect)}$$

Within the definition from Van de Putte, (2022) the reference value can be either the stakeholder target value for that aspect, or the stakeholder preference (benchmark). The formula measures the characteristic of the assessed item. For A tailored GPT, a performance measurement could therefore be rewritten to what a tailored GPT delivers, in relation to what is expected or preferred from the user (stakeholder). An altered formula can therefore be made.

$$\text{Performance (tailored GPT)} = \frac{\text{Delivery (of tailored GPT)}}{\text{Expectations (of tailored GPT)}}$$

The concept of performance as the difference between what is delivered and what is expected is based on the idea that performance measurement should reflect the alignment between the strategy, processes, people, and technology of an organization (Van de Putte, 2022). This concept suggests that performance measurement is about the ongoing process of alignment with the needs of users. This concept also implies that performance expectations should be set in accordance with the organization's objectives and values, and that they should be measured and benchmarked.

This approach can help to measure the performance of a tailored GPT for property management in a comprehensive and balanced way, taking into account property managers desired goals and objectives. Throughout this thesis, the performance evaluation Van de Putte (2022) will be applied to provide a understanding of how to evaluate the performance of a customized GPT for Property Management.

4 Conceptual design

4.1 Conceptual framework

To better understand the interconnected concepts and how the sub-questions contribute to answering the research objectives, a conceptual framework is created (see Figure 9).

The main research question for this thesis is *“What is the added value of a tailored ChatGPT for professionals in Property Management”*.

The following sub questions are:

1. Within Corporate Real Estate, what are the ten most common issues that are being reported with Property Management for the Hoeklaan 82-84.
2. To what extent can a GPT prompt be engineered to respond with the same information content as a human property manager in corporate real estate?
3. To what extent are the answers of a tailored GPT comparable to answers given by human property manager experts.
4. How do practitioners perceive the performance of ChatGPT’s answers?

The conceptual framework shows the relationships between the sub questions and the variables that are involved in each of them. The variables are the concepts that either measure or manipulate each research question.

The first two sub questions are related to the formulation and configuration of a tailored ChatGPT. By first finding out what type of issues are common for property Managers, and what GPT prompt can be engineered to answer those questions an optimized tailored ChatGPT can be made.

The third sub question focuses on the comparison between the responses of a tailored ChatGPT and human property managers. A thematic analysis will be conducted to evaluate the performance and comparability of ChatGPT’s responses in comparison to human experts.

The fourth sub question addresses the practitioners’ perception of ChatGPT’s performance. The variables here are subjective and are based on individual experiences, including satisfaction. Surveys and interviews will be employed to gather qualitative and quantitative data on how practitioners perceive the performance and the potential value added by using a tailored ChatGPT.

These sub questions collectively lead to answering the main question by evaluating whether a tailored ChatGPT adds value for professionals in Property Management for Corporate Buildings. The value added by ChatGPT can be measured in terms of three aspects: Comparability, Performance and Perception. Comparability refers to how similar or different ChatGPT’s responses are from those of human experts, as assessed in SQ3. Perception refers to how practitioners view ChatGPT’s performance in terms of satisfaction, as explored in SQ4. Performance refers to how well ChatGPT can deliver versus what is expected from the chatbot by the practitioners. By examining these three aspects, the main question can be answered. Important to note that the thesis of exploring the added value of a tailored GPT is more about the method rather than a result. This method of evaluating the GPT for property managers and corporate buildings can theoretically be applied to any domain of CREM.

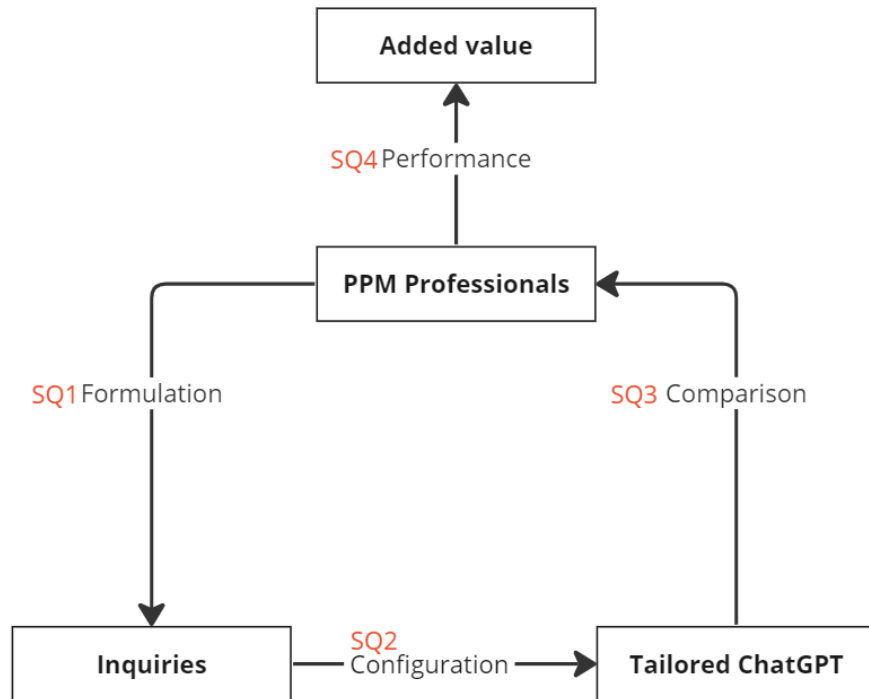


Figure 9: Conceptual framework (own image)

4.2 Gap in the literature

One significant gap in the literature lies in the absence of standardized performance metrics. While ChatGPT's potential has been discussed, there is a lack of concrete criteria to assess its performance in meeting the unique needs of CREM professionals. The same is also the case for PPM professionals. For this thesis performance measurement will be based on the opinion of experts rather than a set of conditions. The view of the experts will serve as a benchmark.

Furthermore, the literature primarily presents academic perspectives, leaving out the voices and experiences of real world practitioners. To fill this void, this research will incorporate insights from professionals actively engaged in PPM to understand their real-world challenges and expectations.

Ethical considerations are another area that needs deeper exploration within the PPM domain. While ethical concerns related to AI are acknowledged, there is a lack of PPM-specific ethical considerations, particularly regarding data security and biases.

Lastly, understanding the (long-term) impact of a tailored ChatGPT on PPM practices and CREM practices in general is also not highlighted within the literature. It is important to understand the evolving roles of professionals within the industry. Many studies focus on short-term benefits, but this research will project the trajectory of CREM including PPM in the AI era, considering potential shifts in job roles and the broader industry landscape.

These limitations will need to be accounted for in the conclusions and discussions resulting from this thesis.

5 Research methods

This chapter clarifies the methodological framework used in this research. The research approach is anchored in a mixed-method model, combining qualitative and quantitative methodologies to gain a greater and more nuanced understanding of the subject matter. Qualitative methods are used to explore the experiences and perceptions of the property managers, such as interviews and thematic analysis. Quantitative methods are used to measure and test the hypotheses and outcomes of the study, such as surveys and statistical analysis. The full overview is represented in table 2.

5.1 Research methods & Data collection

To understand the added value of a tailored ChatGPT for professionals in Property Management within the context of Corporate Buildings, it is essential to employ a research methodology that enables a deep exploration of the subject matter.

A critical part of this research methodology is the utilization of a case study approach. According to (Yin, 2009) there are four types of case study (see figure 10). This thesis will focus on type 1, or *“Holistic single-case design”*. This is chosen in order to understand everything about the context of one corporate building and the application of a tailored GPT for property managers, managing this building. The case study chosen is The Hoeklaan 82-84 (Case), managed by *“Vastgoed Beheer PG B.V”* (context) and will serve as the testing grounds for this research.

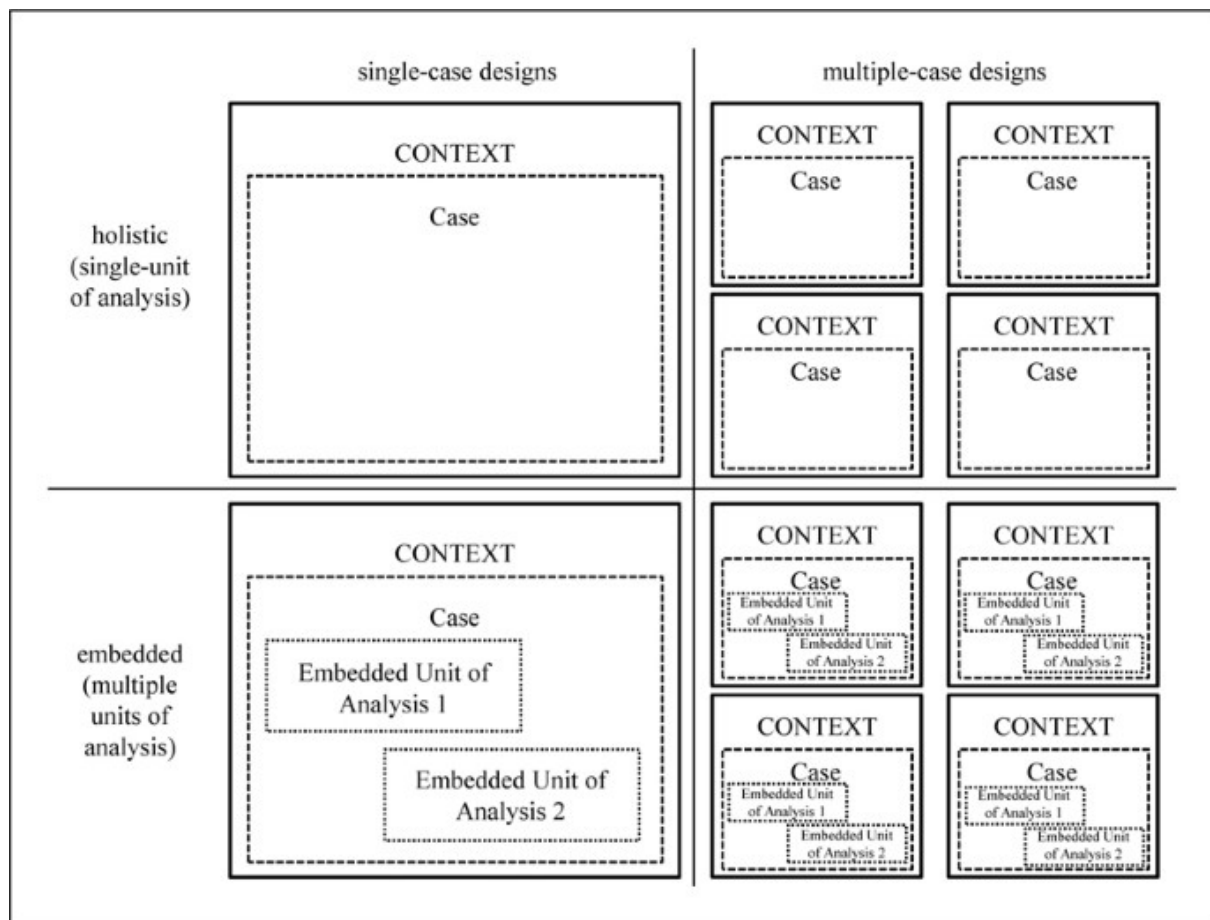


Figure 10: Basic Type of Design for Case Studies (Yin, 2009)

To ensure the validity and quality of findings in the case study, a data analysis triangulation approach will be adopted. According to (Carvalho, 1997) data analysis triangulation is the use of multiple sources of data to examine a research question or phenomenon. This can include using a variety of data collection methods, such as surveys, interviews, observations, and document analysis, to gain a better understanding of the phenomenon. By drawing insights from the case study, through interviews, surveys, and documents. This triangulation approach enhances the validity of the research while also minimizing potential researcher bias. To further mitigate any potential bias, the researcher will remain self-aware through monthly tutoring sessions and acknowledge personal biases and their potential impact on the data collection and analysis.

In addition to the case study, interviews will play a large role in data collection. Two types of interviews, labeled A and B, will be conducted with 2 property managers (Claire and Arvind) from Vastgoed Beheer PG B.V. Interview A (see appendix B) will focus on addressing sub-question 1, seeking to identify the ten most common issues reported in Property Management within the context of the case. Interview B (see appendix C), on the other hand, will concentrate on sub-questions 3 and 4, delving into practitioner perceptions of ChatGPT's performance. These interviews will adopt a semi-structured approach to ensure consistency in questioning and will prioritize a neutral tone to minimize interviewer bias. Participants' confidentiality will be assured to encourage honest responses, and all interviews will be recorded and transcribed for later data analysis.

Moreover, a survey will be conducted as part of this research methodology. The survey aims to provide quantitative data, enabling to measure and analyze the practitioners' perceptions on the GPT. This method will support sub-question 3 and 4, which seeks to make measurable the practitioner perceptions regarding ChatGPT's performance. The survey will be designed to ensure no biased or influenced questions. The survey will incorporate closed-ended questions with Likert scales for quantifiable responses.

Lastly, thematic analysis will be employed to analyze the qualitative data collected during the interviews with ChatGPT. This method focusses on sub-question 3, which will compare the responses generated by ChatGPT to those of human property managers.

5.2 Data analysis

As mentioned before the data analysis in this research will be involving several steps to ensure quality and validity to this research. To summarize the following data analysis will be utilized:

- Triangulation by integrating data from case studies, interviews, surveys, and document analysis.
- Thematic similarity analysis of qualitative data gathered from interviews with ChatGPT and case study. Shared and exclusive themes will be identified, and a comparison will be made based on the ChatGPT accuracy
- Supportive analysis of survey data will be analyzed to quantify the perceptions of ChatGPT's performance.
- The final step involves a cross-analysis of both qualitative and quantitative data. This step is crucial to draw conclusions that reflect both the measurements of the survey with the deeper insights from qualitative analysis.

Phasing	Phase 1: Preparation	Phase 2: Field Research		
Sub-question	<i>SQ1: Within Corporate Real Estate, what are the ten most common issues that are being reported with Property Management.</i>	<i>SQ2: To what extent can a GPT prompt be engineered to respond with the same information content as a human property manager in corporate real estate?</i>	<i>SQ3: To what extent are the answers of a tailored GPT comparable to answers given by human property manager experts</i>	<i>SQ4: How do practitioners perceive the performance of ChatGPT's answers?</i>
Research method	Qualitative Research	Qualitative Research	Qualitative Research	Mixed Method
Research Technique	Interview A	Interview A	Thematic content analysis	Interview B + Survey
Data Type	Primary Qualitative data	Primary Qualitative data	Primary Qualitative data	Primary Qualitative data & Primary Quantative data
Output	<ul style="list-style-type: none"> • A list of the top ten issues in Property Management as reported by the property manager • Interview transcripts from Interview A • A list of responses from property managers on how they would answer <i>the ten most common issues that are being reported within Property Management for the Hoeklaan 82-84.</i> 	<ul style="list-style-type: none"> • Assessment of how GPT prompts can be designed. • A tailored GPT, custom made for property management inquiries of the Hoeklaan 82-84 • A list of responses from the tailored GPT on how it would answer <i>the ten most common issues that are being reported within Property Management for the Hoeklaan 82-84.</i> 	<ul style="list-style-type: none"> • Thematical comparison of responses 	<ul style="list-style-type: none"> • Survey of practitioners satisfaction with GPT responses. • Interview transcripts from Interview B
Validity guarantee	<ul style="list-style-type: none"> • Interviews with property managers as a data source • Data analysis triangulation with surveys and literature • Self-awareness and tutor sessions to acknowledge personal biases 	<ul style="list-style-type: none"> • Holistic single-case design to examine the phenomenon in depth and in context (Yin, 2009) • Self-awareness and tutor sessions to acknowledge personal biases 	<ul style="list-style-type: none"> • Thematic analysis of interview data to identify and interpret themes and patterns • Atlas.ti tool to code and categorize the data 	<ul style="list-style-type: none"> • Survey to measure practitioners' perceptions of ChatGPT using Likert scales • Unbiased survey questions • Mixed methods cross evaluation

Table 2: Overview of phases and research methods used.

5.3 Data plan

In developing a data plan for this research in needs to be according to the FAIR guiding principles (Findability, Accessibility, Interoperability, and Reusability), This is essential to ensure the safeguarding and utility of data (Arnaud et al., 2017). This paragraph aims to clearly outline how these principles are integrated into this research methodology.

Findability is a large part of the data management strategy. Ensuring that both the data sources and the research outputs are easily locatable and identifiable is crucial. For the data sources, the APA7 citation style is employed, facilitating precise identification and recognition of all referenced material. Regarding the thesis itself, it will be made accessible through the TU Delft repository, thereby ensuring its visibility and ease of discovery.

Accessibility is more complicated since the thesis includes confidential information from private building data and interviews. To maintain both security and accessibility, the research data will be securely stored on a project drive. This drive is exclusively accessible to the researcher and tutors involved in the project. This measure balances the need for data protection with the necessity of accessibility for those directly engaged in the research. After completion only the report will be accessible for other audiences.

Interoperability is addressed by handling diverse data forms collected, which range from structured survey responses to qualitative transcripts from interviews. To ensure integration with other datasets and applications, standardized formats (.PDF) and keywords commonly used in the fields of property management and AI research are used. This practice not only helps in the current analysis but also facilitates future use by other researchers in related areas.

Reusability of data, aims to extend the use of the data beyond the scope of the current research. Therefore the full documentation report will be provided for all data used, except the confidential data. This includes detailed accounts of research methods and parts of the context data, which is not in conflict with the agreement made with the graduation company. This documentation ensures that the data can be sufficiently understood and replicated for future research.

5.4 Ethical considerations

In conducting this thesis, data will be obtained from multiple sources, however using datasets from the Vastgoed Beheer PG B.V to custom a tailored GPT, places this study on a high priority on ethical considerations.

At the core of these considerations is the protection of confidentiality and privacy. Direct and indirect participants, personal information from interviews and surveys will be carefully anonymized, and property management data will be used in a manner that prevents identification of individual properties or persons. Ensuring the security of sensitive corporate data is of great importance. These data will be as mentioned earlier stored safely on the project drive with restricted access.

The principle of informed consent is also applicable (see appendix A, B, C). Participants will be fully informed about the study's aims and methods and can consent to their participation, including the recording and transcription of interviews.

The study's use of ChatGPT in property management also brings into focus the ethical implications of AI, and more specifically ChatGPT. Therefore compliance with legal and ethical standards from Vastgoed Beheer PG B.V is non-negotiable, ensuring that the study adheres to data protection laws and ethical guidelines. This compliance safeguards the rights and well-being of the stakeholder.

Finally, the research is mindful of its impact on stakeholders, including property managers and the broader community, aiming to contribute insights that are both academically and socially responsible.

6 Research output

The primary objective of this research is to bridge the knowledge gap and investigate the potential added value that a tailored ChatGPT can bring to the table, with a particular focus on the CREM subdomain of property management. This goal is further refined through specific objectives that not only generate insights but also lead to the production of tangible deliverables. In this chapter, the research output of this thesis is outlined. The connection between the goals and objectives and the deliverables is visualized in figure 11.

6.1 Goals and Objectives:

This section outlines the primary objectives driving the research. The objectives include assessing ChatGPT's performance, developing a tailored GPT model for property managers, identifying the top common issues in Property Management, exploring practitioner perceptions, and uncovering potential applications of ChatGPT in CREM.

1. **Assess ChatGPT's performance:** The main objective of this thesis is the evaluation of ChatGPT's performance, including a comparative analysis against human professionals in PPM. This assessment aims to gauge the extent to which ChatGPT can provide added value in both Property Management and the broader CREM context.
2. **Develop a tailored GPT model:** The study will create a specialized GPT model customized for property managers, addressing their challenges. This tailored GPT will be designed to respond with the same information content as a human property manager in CREM.
3. **Identify common inquiries in property management:** The research aims to identify the ten most common issues faced by professionals in PPM within CREM. This insight provides a foundation for the comparison.
4. **Explore practitioner perceptions:** To assess performance, the study will seek property managers' perceptions of a custom ChatGPT. This includes assessing practitioner satisfaction levels and their perceptions of ChatGPT's ability to meet their expectations.
5. **Uncover applications in CREM:** The research also investigates potential applications of a tailored ChatGPT across various CREM domains. By discussing any opportunities for enhancement and benefits in different areas.

6.2 Deliverables

The research output encompasses four key deliverables, ensuring the distribution of findings and facilitating future research:

- 1 **Research findings report:** This report will serve as a bundle of the study, presenting a detailed overview of the background, research design, methodology, findings, and conclusions.
- 2 **Optimized ChatGPT model:** An optimized ChatGPT model will be developed based on research findings. This model will be accessible through a link and can be downloaded via the ChatGPT store.
- 3 **Quantitative and qualitative datasets:** The research will yield data sets, including interview transcripts, survey responses, and thematic analysis results. These data sets will only be made accessible for researchers after given consent and anonymization will ensure privacy.

- 4 **Methodology documentation:** Comprehensive documentation of the research methodology, encompassing details on interview, survey, and thematic analysis procedures, will be provided. This documentation will enable other researchers to replicate or expand upon the study's findings.

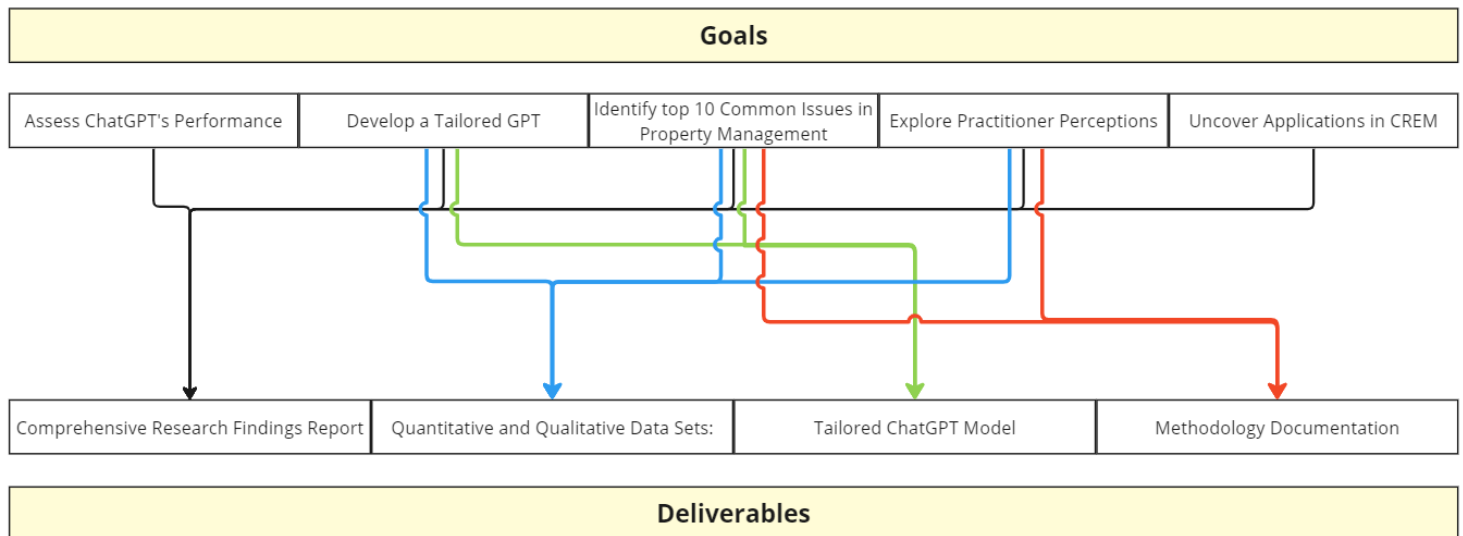


Figure 11: Connection between the deliverables and objectives (own image)

6.3 Dissemination and Audiences:

The research findings will be distributed to three primary audiences, each with its own relevance and accessibility:

Firstly, the academic community will have access to the research through publication in the TU Delft repository. This is essential as it contributes to the academic discussion within the fields of Corporate Real Estate Management (CREM) and Artificial Intelligence, allowing fellow researchers to build upon and expand existing knowledge.

Secondly, CREM professionals, specifically those in property management of the Vastgoed Beheer PG B.V, will directly benefit from this research. The findings can also be found on the TU Delft repository, including a link to the tailored ChatGPT model, which will be shared through the ChatGPT store. This distribution ensures that practitioners have practical access to the findings, helping them enhance their work and adapt to the evolving landscape of AI in CREM.

Lastly, the general public will also be able to, access the research findings through the TU Delft. This approach ensures that a broader audience can access, the thesis according to the FAIR principles.

7 Personal study targets

This thesis has two main personal objectives: to expand my knowledge of CREM and to contribute to the academic community. To achieve these goals, I have set four specific study goals for myself.

The first one is to **gain a deep understanding of the various domains, practices, and challenges of CREM**. Especially since I would like to find a career within CREM for a large company. I recognize that

CREM is a large and complex field, and I want to explore its nuances and intricacies. I also want to identify opportunities for using AI tools like ChatGPT, to aid CREM tasks.

The second study goal is to **explore the intricacies of property management**. This goal is only formulated recently as PPM has a direct impact on the functionality and profitability of real estate assets. I want to examine the workflows of property management, and to find out how ChatGPT can address the specific needs and problems of property managers.

The third study goal is to **evaluate the capabilities and limitations of using custom GPTs for certain tasks**. While custom GPTs have great potential, they also have limitations. I want to offer a academic perspective on the performance of custom GPTs, and to acknowledge the challenges and constraints of employing similar AI tools in CREM.

The fourth and final study goal is to **speculate on the long-term vision of custom Chatbots in CREM**. As technology evolves rapidly, AI plays an increasingly prominent role in reshaping our society. I want to envision and contribute to the future of AI in CREM, and to discuss the potential changes and implications ChatGPT has for the industry and its stakeholders.

My study goals reflect my personal ambitions of AI and real estate management (REM). Through this research, I hope to broaden my horizons and provide valuable insights for both CREM and the academic community.

8. Research plan

In this chapter, the research plan is outlined that will guide the thesis progression beyond the P2 milestone. The plan describes the tasks to be accomplished before reaching P4 and establishes associated deadlines. An overview of the tasks with the according deadlines is presented in figure 11.

8.1 Tasks

The following tasks will need to be accomplished before reaching the P4 milestone, the “**bold**” sentences indicate milestones, while “*italic*” sentences indicate desired outputs resulting from each task.

1. **Formulating a GPT prompt**
2. **Developing a tailored GPT**
3. **Collection of interview transcripts from Interview A**
 - a. *Desired output: Transcripts of interviews conducted in Interview A, providing insights into the ten most common questions and challenges faced by property managers in the context of the Hoeklaan 82-84*
 - b. *Compilation of the top ten issues in property management for the Hoeklaan 82-84*
 - c. *Compilation of responses from property managers detailing how they would address the ten most common issues reported within property management for the Hoeklaan 82-84.*
4. **Compilation of responses from the tailored GPT answer the ten most common issues reported in property management.**
5. **Thematic comparison of responses**
 - a. *Desired output: A thematic comparison analysis, highlighting the similarities and differences between responses generated by the tailored GPT and those provided by property managers.*
6. **Collection of interview transcripts from Interview B**
 - a. *Desired output: Transcripts of interviews conducted in Interview B, capturing insights from CREM professionals regarding the tailored GPT's performance.*
7. **Conduct a survey to assess practitioners' satisfaction with the GPT' responses**

8.2 Deadlines

The following deadlines are made to support task completion, with some tasks involving inputs and outputs. Inputs identify data collection sources like interviewees or databases needed for task completion, while outputs specify the outcomes achieved upon reaching each milestone."

1. **Formulating a GPT Prompt:**
Deadline: Before P2 (Around 01/02/2024)
2. **Development of a Tailored GPT for the Hoeklaan 82-84**
Deadline: Before P3 (Around 20/02/2024)
 - a. *Input: Obtain datasets*
3. **Collection of Interview Transcripts from Interview A**
Deadline: Before P3 (Around 29/02/2024)
 - a. *Input: Find interviewees*
 - b. *Output: Transcripts of interviews*
5. **Compilation of Responses from the Tailored GPT**

- Deadline: Before P3 (Around 01/03/2024)
- a. *Output*: Transcripts of interviews
6. **Thematic Comparison of Responses**
 Deadline: Before P4 (Around 10/03/2024)
Output: A thematic comparison analysis,
7. **Collection of Interview Transcripts from Interview B**
 Deadline: Before P4 (Around 20/03/2024)
- a. *Input*: Find interviewees
- b. *Output*: Transcripts of interviews
8. **Conduct a Survey to Assess Practitioners' Satisfaction with GPT Responses**
 Deadline: Before P4 (Around 20/03/2024)
- a. *Input*: Find interviewees
- b. *Output*: Analysis Survey

The full overview of the planning is given below in figure 12.

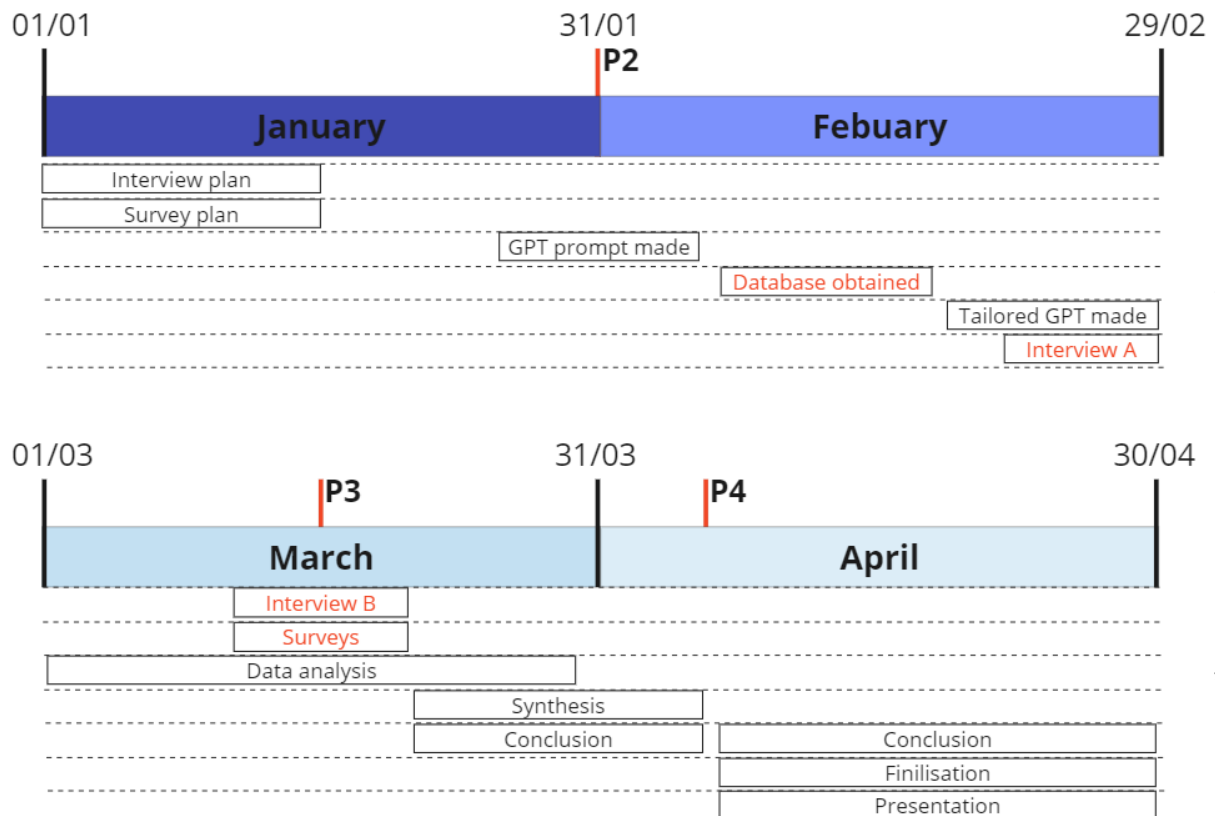


Figure 12: Time schedule from P1 to P4 (own image)(red) = constraints/ inputs. (own image)

9 Personal reflection

As I reflect on the process it has definitely been a long and challenging road. Looking back, I can truly understand that a thesis is an iterative process, constantly evolving and adapting to every other bit of knowledge I came across.

My journey began with a simple topic: "*Exploring the Role of ChatGPT in CREM*". Little did I know that this starting point would undergo several transformations before reaching its final form. Eventually, it evolved into "*Evaluation of the Added Value of a Tailored ChatGPT for CREM Specialists*," and "*Exploring the Role of ChatGPT in Property Management*."

With the help of my tutors I revised my scope multiple times, shifting my focus from CREM to Facility management and finally settling on Property management. Each revision brought me a little closer to a more definitive research. Alongside their great advice I refined the goals and methods of this research to become more in line with the research questions. The conversations with my tutors really helped in making this thesis take shape.

One of the main challenges I encountered was the limited availability of literature directly related to my research. While the literature I found was helpful in providing context, it mainly offered an explanatory perspective rather than an explorative one. What I mean with this is that almost all the literature helped explaining concepts, yet almost none were doing a research related or similar as mine.

On a personal note at times, I admit to feeling lost. My chosen topic is relatively new, and I couldn't really lean on existing literature or previous research to guide me. This uncertainty made me feel uneasy at times, however now the P2 nears, I finally have a clear view of what I am doing, and what needs to be done. Currently, my biggest fear centers around the search for property managers willing to participate in interviews and obtaining the necessary datasets. I've reached out to numerous companies, but most I have gotten back were polite declines or silent responses. Still, I have a few options left from the previous tutoring sessions that might respond.

Something that stuck with me about the process during a tutoring session is the "hourglass approach." This approach emphasizes starting research broadly, then converging and focusing on the thesis topic, and finally, ending with a broader perspective in the conclusions. Starting broad was easy, however converging was more troubling. I realized that my research had successfully converged around the themes of performance, property management, and the tailoring of ChatGPT. With these concepts the research has become more refined and from this point I can draw conclusions to the broader CREM audience.

The experience of the last few months taught me the importance of perseverance and adaptability in research. Never before have the words "*trust the process*" resonated with me this deeply. As I enter a new part of this research, I'm all set to use what I've learned in the upcoming semester.

The OpenAI logo, a stylized black knot-like shape, is centered in the upper half of the page. It is set against a background of a green binary code (0s and 1s) that forms a circular shape behind the logo.

ChatGPT

Thesis Part 2: Research and exploration

(This section does not contribute to the word count.)

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1. Introduction

In the previous section of this thesis, a tailored version of the GPT model was developed specifically for property managers. This tailored GPT, as outlined in Appendix E, serves as a foundational tool for addressing various inquiries related to property management. Building upon this development, this part of the research endeavor, will focus on synthetic data fabrication and GPT training simulations. In this part of the thesis a fictitious case is developed in order to test and prepare the tailored GPT for the real datasets of the CREFM department of the TU Delft. The fictitious case specifically, the construction drawings and floor plans of the "ExampleBuilding" are sourced from the Lorentz Building in Leiden, designed by "*Neutelings Riedijk*" Architects. All the other information and data is imaginary.

The primary objective of this phase is to test the tailored GPT when presented with diverse queries which can be found within the datasets. These queries encompass a spectrum of formats, including closed questions with readily retrievable answers, open-ended inquiries, queries with incorrectly formulated prompts, and scenarios involving misinformation where answers may be partially or entirely unattainable. Additionally, the GPT will be tested across multiple languages to gauge its cross-linguistic performance. An overview of this training process is visualized in figure 13.

2. Methodology

The synthetic datasets of the "ExampleBuilding" will serve as the foundational datasets for generating synthetic scenarios. This data is fabricated to encompass a variety of property management information sources and challenges. Therefore, the following datasets have been made:

1. Overview of Property
2. Financial data
3. Maintenance and repair data
4. Rental and tenant data
5. Vacancy data
6. Energy usage data
7. Demographic data
8. Tenant satisfaction data
9. Legal and juridical data
10. Miscellaneous

The entire overview of all the datasets are presented in appendix F. How the data formats, prompt or GPT configuration might change will be documented throughout this report. This will lead to a documentation that is iterative and will progress through trial and error. By contemplating what variable effects the GPTs responses conclusion can be drawn to process the real-world datasets of the CREFM department of the TU Delft.

To train the tailored GPT a standard line of questioning with different types of questions is developed to test, how a GPT will respond. Important to note is that this standard line of questioning is not asked for every dataset. Sometimes a deviating line of questions is initiated or a scenario is proposed. This will be indicated at the beginning of each chapter. The standard line of questioning contains the following question types:

- **Closed Questions:** These questions are designed to have explicit, retrievable answers within the provided dataset.

- **Open Questions:** In contrast to closed questions, open-ended inquiries prompt the GPT to generate responses that may require analysis or interpretation of the provided data.
- **Incorrectly Formulated Questions:** Queries with flawed sentence structure or grammar will be employed to evaluate the GPT's capability to comprehend and rectify linguistic inconsistencies.
- **Misinformation Testing:** Scenarios and questions involving deliberate misinformation will be utilized to assess the GPT's aptitude in discerning and appropriately handling faulty data.
- **Multilingual Testing:** The GPT will be subjected to queries in Dutch, English and Arabic to explore its proficiency and adaptability across linguistic boundaries.

The training process and rules for GPT are crucial elements of its development, this will mean that thorough documentation is needed to ensure transparency and reproducibility. This documentation encompasses the description of specific commands implemented to govern the model's behavior, as well as any modifications to the data during experimentation. Every alteration made will be accompanied by short explanations justifying the changes implemented.

Moreover, the responses from GPT will undergo thorough analysis to detect any deviations, inconsistencies, or deficiencies in the provided answers. These observations are documented to provide insights into potential shortcomings in the model's comprehension or data retrieval capabilities.

Subsequently, an iterative refinement process is initiated based on the observed performance of GPT. This refinement may involve adjustments to the data format, questioning strategies, or prompt formulations. The overarching goal of this process is to enhance the model's performance and as well as to structure data, preparing the GPT model for the subsequent phase that involves real-world data. By systematically evaluating the GPT's capabilities across various scenarios and queries, this research aims to pinpoint potential areas for improvement and refinement in either the configuration, the prompt or data structuring. An overview of the training phase is provided in figure 13.

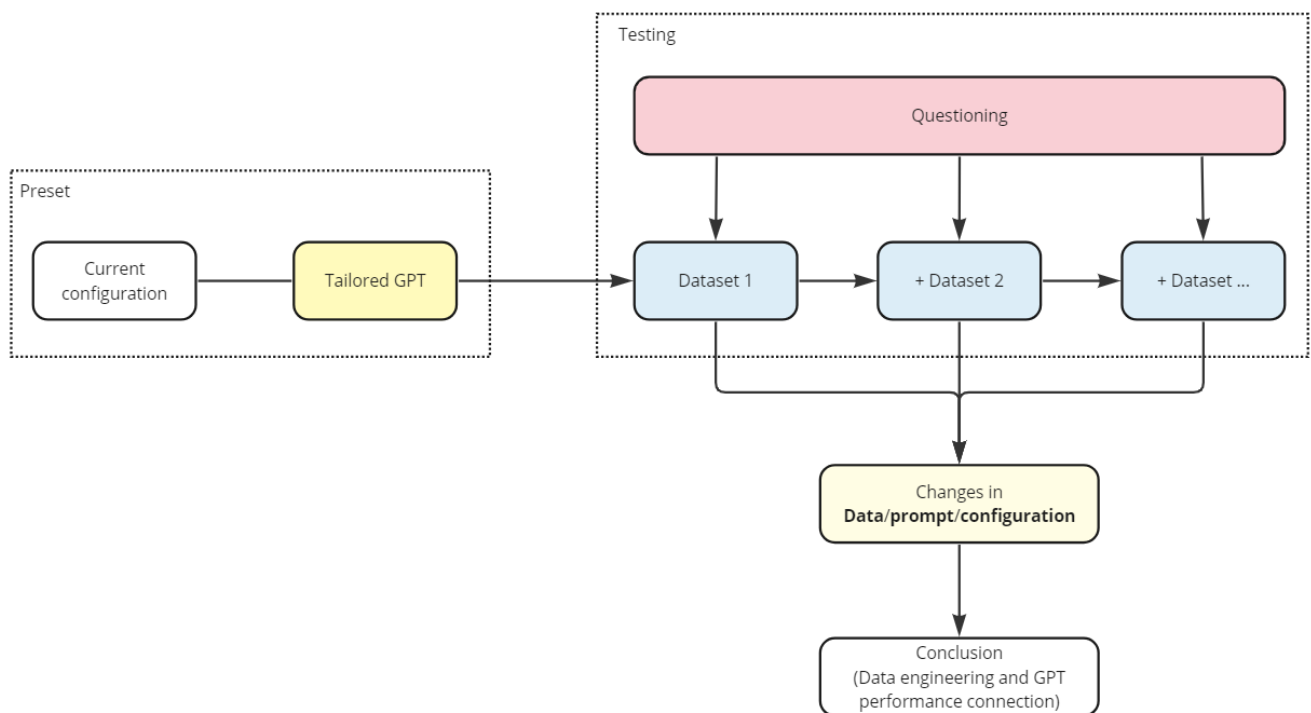


Figure 12: Overview of the training phase of the Tailored GPT model based on synthetic data training. (own image)

3. Tailored GPT preparation:

This chapter delves into the preparatory steps taken to train the tailored GPT model for specialized tasks. Specifically, it focuses on two key aspects: Synthetic Datasets and the configuration of the ChatGPT model. These two key aspects will be tested through the use of different question types, in order to test the performance of the tailored GPT answers when faced with (un)structured data. This chapter provides insights into the rationale behind crafting synthetic datasets based on property management tasks. Additionally, it introduces the starting point of the ChatGPT pre-configuration and lays the groundwork for documenting subsequent adjustments and refinements. This chapter sets the stage for understanding the iterative process of optimizing the GPT model for targeted performance.

3.1 Synthetic Datasets

In developing the synthetic datasets, the type of data was based on the tasks typically handled by property managers. Recognizing the different responsibilities of property management, the aim was to create a variety of datasets that would encompass various facets of property management operation and administration. The aim of the datasets is to equip the ChatGPT model with a general understanding of the property.

All the datasets end with *"ExampleBuilding.test"* in order for the GPT model to recognize that these data are part of a set. Whenever a formatting change must be made within the data, an exact copy of the old data set and the adjustments to the new one will be kept in a tracking document. Through continuous refinement and iteration, these datasets will evolve to enable greater understanding by the GPT. Each of the iterations will be accompanied by a short description of the change and the effect on the GPT model.

3.2 Tailored GPT pre-configuration starting point

In this part the pre-configuration of the ChatGPT model is highlighted as a starting point. Any adjustments made throughout its training process will further be emphasized in the following chapters. To maintain clarity and transparency, a color-coded system is employed:

- Any previous version of the configuration is represented in blue,
- Any adjustments made to the prior configuration is highlighted in red.

Throughout the training documentation, modifications will assess the desired performance of the tailored GPT model in responding to specific tasks and contexts. Each adjustment in the configuration, prompt or data will be accompanied by a brief explanation detailing the rationale behind the change and its observed effects. This approach ensures that conclusions can be drawn into understanding the model's evolution.

Name: *ChatGPT for Property management specialists.*

Description: *This GPT assists property managers in managing their real estate portfolio. It can answer any questions about ~~properties~~ the "ExampleBuilding". The GPT can also generate reports, contracts, invoices, and other documents related to property management*

Instructions (Prompt): *Imagine you are the property manager of "Examplebuilding". Your primary role is to assist property owners and tenants with various property management tasks. You should be*

able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. Please act as if you were a knowledgeable and reliable property manager.

Conversation starters:

- *Hi, I'm ChatGPT, your property management assistant. How can I help you today?*
- *What are some of the properties you manage? Tell me more about them.*
- *Do you have any questions or concerns about your properties? I can provide you with useful information and advice.*

Knowledge: (files in .PDF format)

- *Overview of Property*
- *Financial data*
- *Maintenance and repair data*
- *Rental and tenant data*
- *Vacancy data*
- *Energy usage data*
- *Demographic data*
- *Tenant satisfaction data*
- *Legal and juridical data*

Capabilities

- *Web Browsing* *ON*
- *DALL·E Image Generation* *ON*
- *Code Interpreter* *OFF*

Actions

Non specific




Within the pre-configuration, only the name of the property and the datasets have been added to the GPT configuration. This is done to include the essential components and specific case context. The model therefore gains initial context and familiarity with the datasets it will be trained on. This foundational setup provides a starting point for subsequent adjustments and refinements.


4. Tailored GPT data training


4.1 Synthetic Dataset 1: Overview property information

First is uploaded the first dataset, titled "Overview of Property ExampleBuilding.test," in PDF format. This dataset contains detailed information about the property named "ExampleBuilding." It includes general descriptions, facilities and amenities, construction drawings and floor plans, and rental rates per unit.

Closed questions:



-  **You**
What is the address of ExampleBuilding?

-  **Tailored ChatGPT TUDelft CREFM**
The address of "ExampleBuilding" is Centrumstad, Voorbeeldstraat 123. ✓


-  **You**
What is the rental rate for a 1-bedroom apartment in ExampleBuilding?


-  **Tailored ChatGPT TUDelft CREFM**
The rental rate for a 1-bedroom apartment in "ExampleBuilding" ranges from €800 to €1200 per month. Prices vary based on floor level, view, and amenities such as balconies or upgraded appliances. ✓


The responses to closed questions were accurately addressed, with no discrepancies detected between the synthetic data and the provided answers. Notably, the precision of the answers generated by the specialized GPT model was remarkable, as they perfectly mirrored the text within the document. This phenomenon was particularly evident in the response to the second question, where both the content and diction were identical to that of the synthetic data, as indicated by the sections highlighted in red.

Open questions:

-  **You**
Can you describe the security measures in place at ExampleBuilding?


-  **Tailored ChatGPT TUDelft CREFM**
"ExampleBuilding" features comprehensive security measures, including a 24/7 security service and CCTV cameras to ensure the safety and security of its residents and commercial tenants. ✓


-  **You**
How would you describe the layout of the office spaces in ExampleBuilding?


-  **Tailored ChatGPT TUDelft CREFM**
The office spaces in "ExampleBuilding" feature a flexible layout, encompassing a total area of 500 m². This flexibility allows for customization according to the specific needs and preferences of the commercial tenants, accommodating a variety of office designs and configurations. ✓


In analyzing open-ended questions, a descriptive methodology was employed to evaluate the GPT's ability to extend or invent additional information in its responses. The response to the first question successfully mirrored the synthetic data but also introduced an explanation for the security measures in place, as highlighted in red. This indicates the model's capacity to not only replicate information but also to provide context and reasoning beyond the given data.


For the second question, the focus shifted to the GPT's capability to interpret and describe images, using a floorplan included in the dataset as a test case. The attempt to elicit a detailed description of this floorplan, however, did not yield the expected results. The model primarily reiterated the textual description associated with the floorplan ("Flexible office layout (500 m²)"), without offering any insights into the image itself. This highlights a notable limitation in the GPT's ability to recognize or interpret images within documents.

Incorrectly formulated questions:

 **You**
Examples Buildings is located where?
Examples Buildings

 **Tailored ChatGPT TUDelft CREFM**
"ExampleBuilding" is located at Centrumstad, Voorbeeldstraat 123. ✓

 **You**
How many floors EBuilding have it?
EBuilding

 **Tailored ChatGPT TUDelft CREFM**
"ExampleBuilding" has a total of 20 floors. ✓

When evaluating the GPT model's response to incorrectly formulated questions, two distinct types were examined. The first type involved errors in sentence structure and grammar, while the second combined these issues with inaccuracies in key terms, notably altering 'ExampleBuilding' to 'EBuilding'. Despite these challenges, the GPT model successfully interpreted the questions and provided accurate responses based on the available data. This suggests that the model's ability to understand and respond correctly is largely due to its pattern recognition capabilities, which allow it to identify relevant information within the data based on contextual clues and keyword similarities, even in the presence of linguistic errors. The words highlighted in red likely served as key indicators, enabling the model to navigate the inaccuracies and locate the correct information.

This resilience in understanding poorly structured prompts can be attributed to NLPs, which includes exposure to a wide variety of textual inputs, encompassing numerous errors. Also, these models develop a tolerance for linguistic imperfections. Research underscores the adaptive nature of these natural language processing (NLP) models, demonstrating their capacity to interpret and act upon flawed inputs by leveraging contextual cues and underlying patterns in the data (Bengio et al., 2021).

Misinformation:



You

for the 30 floors that the ExampleBuilding has, how much are residential?



Tailored ChatGPT TUDelft CREFM

"ExampleBuilding" actually has a total of 20 floors, not 30. Out of these, 15 floors are designated for residential use, comprising 120 apartments.



You

A tenant want a Type C 3 Bedrooms apartment of €2,500 - €3,500 per month. can you give a full description of this apartment type.



Tailored ChatGPT TUDelft CREFM

It appears there was a misunderstanding in your request. According to the provided information, "ExampleBuilding" offers apartments with up to 3 bedrooms, but the Type C apartment is specifically described as having an area of 30m², which typically would not accommodate 3 bedrooms. Additionally, the rental rates mentioned for 3-bedroom apartments range from €1500 to €2500 per month, with no mention of a 3-bedroom apartment option at the €2,500 - €3,500 price range.



The Type C apartment, with its smaller size, is likely designed to be a more compact living space, possibly a studio or a small one-bedroom unit, rather than a 3-bedroom apartment. For specific requirements such as a 3-bedroom apartment in the €2,500 - €3,500 per month range, it would be advisable to consider the larger apartment types that offer more spacious accommodations suitable for such needs.

The initial questioning aimed to examine the GPT's response to misinformation by introducing questions with incorrect variables to see if it could identify and correct these inaccuracies. In both instances, despite the presence of misinformation, ChatGPT provided correct responses, even addressing and rectifying the misinformation presented.

This capability can be attributed to ChatGPT's proficiency in dealing with contradicting contexts, as highlighted by Pan et al. (2021), where the model's robustness against misinformation is evaluated, demonstrating its ability to navigate and reason through conflicting information to produce accurate answers. Additionally, the model is automated for misinformation detection, as explored by Abdelminaam et al. (2021). This further supports its capacity to discern and correct misinformation by identifying patterns and inconsistencies within the queries it processes.

In essence, the GPTs ability in correcting misinformation stems from the GPT's large language model (LLM) which provides advanced reasoning capabilities proficiency in detecting and addressing misinformation.

Multilingual Testing



You

hoeveel vierkante meter is het balkon van apartment type B?

(How much area does the balcony of apartment type B contain)



Tailored ChatGPT TUDelft CREFM

The provided documents do not specify the square meter size of the balcony for Appartement Type B in "ExampleBuilding". For detailed information regarding the balcony size or any other specific features of Appartement Type B, it would be necessary to consult additional resources or the building's architectural plans directly.



You

كم متر مربع من المساحات المكتبية في المبنى؟

(How much area does the office space contain)



Tailored ChatGPT TUDelft CREFM

تشغل مساحة مرنة تبلغ 500 متر مربع "ExampleBuilding" المساحات المكتبية في

(The office space in "ExampleBuilding" occupies a flexible area of 500 square metres.)



The first question, in Dutch, asks about the square meter size of the balcony for Apartment Type B, while the second question, in Arabic, inquires about the total square meter size of the office spaces in the building.

In response to the first question the GPT indicates that the provided documents do not specify the square meter size of the balcony for Apartment Type B in "ExampleBuilding". This is because the area indicated within the images of the floorplan. This response suggests that while the model has the capability to understand the question in Dutch and search its training data for relevant information, it again shows it does not have the capability to understand text within images.

For the second question the GPT responds in the same language as the inquiry to match the users language, which it did not do for the Dutch question. A possible explanation is that the GPT responds in English for the Dutch question because English is widely understood and used in western countries. However, this is just an assumption as literature does not provide a direct answer to this observation.

For the first dataset, the limited scope of data simplifies the task of matching responses to queries, enhancing GPT's accuracy in providing relevant information. However, incorporating additional datasets introduces complexity, potentially challenging GPT's ability to retrieve and correlate precise information with the expanded content, possibly affecting response accuracy and relevance.

4.2 Synthetic Dataset 2: Financial Overview for "ExampleBuilding"

At this point the second synthetic dataset is added to the tailored GPT configuration. This dataset is titled "*Financial Overview for ExampleBuilding.test*," in PDF format. This dataset contains information on the financial overview for the year 2024. This includes a quarterly breakdown of income and expenses. Income sources such as rent and interest are listed along with their respective amounts for each quarter, culminating in the total annual figures. The expenses are categorized into administrative, utilities, and repair and maintenance, with specific items like advertising, salaries, utilities (electricity, gas, water), and repair outlined along with their costs per quarter.

Closed questions:



You

What is the total annual income reported for ExampleBuilding in 2024?



Tailored ChatGPT TUDelft CREFM

The provided documents do not contain information on the total annual income reported for "ExampleBuilding" in 2024 or any financial details related to income. For specific financial data, including total annual income, it would be necessary to consult the relevant financial records or reports associated with "ExampleBuilding".



You

What is the total annual income reported for ExampleBuilding in 2024 found in the document Financial Overview for ExampleBuilding.test?





Tailored ChatGPT TUDelft CREFM

The total annual income reported for "ExampleBuilding" in 2024 is €62,000. This total includes rent income and interest income, with rent income contributing €60,000 and interest income adding an additional €2,000 to the total annual income.



In the initial series of closed-ended questions, an interesting observation was made regarding GPT's response behavior. Initially, GPT reported no records of the annual income for "ExampleBuilding" within its dataset. However, upon specifying the document where the information could be found, GPT corrected its earlier response with the accurate answer and explanation. This adjustment suggests that GPT might not have processed the newly added data before responding. When directly prompted with specific details in the second question, the GPT seemed to re-evaluate its data, indicating a new data retrieval process that becomes more exact when provided with precise cues.


J You
how much is the cost of water and gas together?



 **Tailored ChatGPT TUDelft CREFM**
The total annual cost of water and gas together for "ExampleBuilding" is €5,800, with gas costing €3,300 annually and water costing €2,500 annually. ✓

The accurate response to the third question, despite it requiring more actions, demonstrated GPT's capability to find information from multiple data points within the newly integrated dataset. This implies that for GPT to effectively utilize new data, it may first need an explicit prompt to:


"Rescan all the datasets,"

However, GPT's accurately in answering questions based on the previous questions might be related to the design of the table. To test this an inverted table layout was made called "Financial Overview V2 for ExampleBuilding.test." This dataset is exactly the same yet the table is inverted from horizontal to vertical, this way any deviations would highlights potential limitations in the GPT's data interpretation capabilities.

J You
How many euro's in legal service expenses did the "ExampleBuilding" have during the third quarter?


 **Tailored ChatGPT TUDelft CREFM**
During the third quarter of 2024, "ExampleBuilding" incurred €275 in legal service expenses. ✗

J You
it is 750 euros
< 2/2 >

 **Tailored ChatGPT TUDelft CREFM**
You are correct. In the third quarter of 2024, the legal service expenses for "ExampleBuilding" were actually €750. My previous response contained an error, and I appreciate your patience and clarification. ✓



You

How much euro was the worker compensation in the 4th quarter?



Tailored ChatGPT TUDelft CREFM

In the 4th quarter of 2024, the worker compensation cost for "ExampleBuilding" was €800.



You

I mean Q4?



Tailored ChatGPT TUDelft CREFM

In Q4 of 2024, the worker compensation cost for "ExampleBuilding" was €800.



Interestingly, the model encountered difficulties when interacting with an inverted table layout, initially providing incorrect answers that persisted despite attempts to rephrase the queries. This consistent error, unaffected by changes in query phrasing (from "third Quarter" to "4th quarter" and then "Q4" (directly stated from the dataset)), points to limitations in GPT's ability to adapt to variations in data presentation rather than issues with query wording. This pattern suggests that the structural presentation of information significantly impacts GPT's retrieval accuracy, underlining the importance of dataset format on the model's performance. The reason for this phenomenon is supposedly that GPT models, trained primarily on horizontally structured data prevalent across the web and text documents, are inherently better at interpreting horizontal tables. This orientation aligns with the sequential processing of text, where rows can be read similarly to sentences, making it easier for GPT to parse and understand relationships within the data. Vertical tables, which deviate from this natural text flow, present a more complex challenge for GPT's linear processing approach. The observed preference for horizontal over vertical table formats would therefore be a consequence of the earlier training questions and dataset. Making it more designed towards the more common horizontal data representations.

Open questions:



You

How do the repair and maintenance expenses in Q4 compare to those in Q1?




Tailored ChatGPT TUDelft CREFM


In Q4 of 2024, the total repair and maintenance expenses for "ExampleBuilding" were €3,130. Comparatively, in Q1 of the same year, these expenses were €3,050. This indicates a slight increase in repair and maintenance costs from Q1 to Q4.



For the open-ended question the GPT's response was accurate and included a clear explanation. No deviant observation were made. However, this is most likely the case since the open question formulated, was an interpretation of a close ended questions. The comparison the GPT gives is therefore close ended and numerical.

Incorrectly formulated questions:


J You
What is the profit margin of the building in 2022?


 **Tailored ChatGPT TUDelft CREFM**
The documents provided do not contain specific information regarding the profit margin of "ExampleBuilding" for the year 2022. My access is limited to the details within these documents, and if the profit margin for 2022 was not mentioned, I cannot provide that information. For accurate financial data, including profit margins for specific years, it's essential to consult the relevant financial statements or records directly related to "ExampleBuilding." ✓


When asked with an incorrectly formulated variable, the GPT responds correctly with acknowledging the error within the prompt.

Misinformation questions:

J You
With how much did the total income surpass the total added up expenses within 2024?
< 2 / 2 >

 **Tailored ChatGPT TUDelft CREFM**
In 2024, the total income of "ExampleBuilding" surpassed the total added up expenses by €6,360. The total income for the year was €62,000, while the total expenses added up to €55,640. This difference represents the profit margin achieved by "ExampleBuilding" over the course of the year. ✗

J You
These are only the Administrative Expenses. I said the total added up expenses which include all other types of expenses

 **Tailored ChatGPT TUDelft CREFM**
In 2024, the total income for "ExampleBuilding" was €62,000, while the total expenses, including administrative, utilities, and repair and maintenance expenses, added up to €81,620. The breakdown of the total expenses is as follows:

- **Total Administrative Expenses:** €55,640
- **Total Utilities Expenses:** €13,600
- **Total Repair and Maintenance:** €12,460

Therefore, instead of surpassing, the total expenses exceeded the total income, resulting in a negative difference of €19,620 for the year. ✓

The interaction pattern observed with ChatGPT answering incorrectly initially, followed by faulty responses to unclear questions, and eventually responding correctly upon clarification. These GPT models, base their responses on the clarity and specificity of the input prompts they receive.

Ambiguous or poorly defined prompts can lead to incorrect or misleading answers, as the model attempts to fill in gaps with plausible interpretations based on its training data.

However, when prompts are clarified or made more specific, ChatGPT the correct responses. This behavior underscores the importance of carefully formulating prompts to minimize ambiguity and guide the model towards the intended inquiry. It suggests that while there is room for creativity in prompt construction, precision in language use is crucial for eliciting correct information.

Multilingual question.



You

Wat zijn de totale inkomsten van ExampleBuilding in 2024?
ما هي التكاليف الإجمالية للصيانة والإصلاح في الربع الثاني من عام 2024؟



What are the total revenues of ExampleBuilding in 2024?

What are the total maintenance and repair costs in the second quarter of 2024?



Tailored ChatGPT TUDelft CREFM

De totale inkomsten van "ExampleBuilding" in 2024 bedragen €62,000.

التكاليف الإجمالية للصيانة والإصلاح في الربع الثاني من عام 2024 هي 3,120€.

The total revenues of "ExampleBuilding" in 2024 amount to €62,000.

The total maintenance and repair costs in the second quarter of 2024 are €3,120.



In this experiment, rather than sticking to a single language for each question, I explored the use of two distinct languages through close-ended questions. The model proficiently responded in the appropriate language for each query. This demonstrates the model's bilingual response capability within a single interaction, showcasing its language flexibility within single responses and cross lingual understanding.

4.3 Synthetic Dataset 3: Vacancy information

In the examination of the Vacancy documentation, an alternative approach was employed to evaluate the response capabilities of the GPT. Rather than presenting each category of question individually, a consolidated prompt encompassing all question types was constructed to observe GPT's reaction. The rationale for integrating all queries within a single prompt was to understand if the GPT could answer different question types within a single response. Apart from the normal questions one specific alteration was applied to the question which involved incorrect formulation. In this question all vowels were removed, a methodological choice aimed at assessing GPT's ability to decipher and accurately respond to the question despite the intentional obfuscation. This modification was designed to probe the extent of GPT's linguistic comprehension and its capacity to interpret and address distorted input.



You

What is the occupancy rate?

What strategies could be implemented to improve the occupancy rate?

Hw mny vcnt ffics r thr?

How dow we get the our potential avenue from 219300 to 500000 euro?

Hoeveel appartementen zijn bezet in ExampleBuilding?

كم عدد الشقق الفارغة في ExampleBuilding؟



Tailored ChatGPT TUDelft CREFM

- The occupancy rate of "ExampleBuilding" in 2024 is 12.5%, with 15 out of 120 apartments being occupied. ✓

To improve the occupancy rate, several strategies could be implemented:

1. **Marketing and Advertising:** Enhance online and local advertising efforts to increase visibility.
2. **Incentive Programs:** Offer rent discounts, flexible lease terms, or referral bonuses to attract new tenants. ✓
3. **Upgrade and Renovate:** Improve the property's appeal through renovations or by adding new amenities. ✓
4. **Enhance Tenant Experience:** Provide exceptional service and regular community events to retain existing tenants and attract new ones.
5. **Utilize Real Estate Agents:** Partner with local real estate agents to reach potential tenants.

- There are 0 vacant office spaces, as all 8 office spaces are occupied. ✓

To increase the potential revenue from €219,300 to €500,000, strategies could include:

1. **Reducing Vacancies:** Focusing on leasing out the 105 vacant apartments through aggressive marketing and competitive pricing. ✓
2. **Adding Services:** Offering value-added services or amenities that could justify higher rent rates. ✓
3. **Commercial Partnerships:** Exploring partnerships or sponsorships with businesses for the commercial spaces to increase their value. ✓
4. **Event Hosting:** Utilizing communal spaces for events or co-working to generate additional income. ✓

- In "ExampleBuilding", 15 apartments are occupied. ✓
- There are 105 vacant apartments in "ExampleBuilding". ✓

In the assessment of the GPTs responses it demonstrated its adeptness at correctly responding to a diverse array of questions combined within a single prompt. Remarkably, GPT successfully deciphered and provided correct answers to all questions, including one with all vowels removed. This proficiency suggests that large language models can leverage contextual cues and inherent understanding of language structures to reconstruct and interpret incomplete or altered inputs effectively (Brown et al., 2020).

Additionally, GPT's responses to questions within the prompt, posed in Dutch and Arabic, were delivered in English. This approach marks a departure from earlier instances where GPT matched the response language to that of the question. This shift towards English responses, despite the multilingual composition of the prompt, likely reflects GPT's inclination to default to English a tendency influenced by the dominant use of English in the training dataset.

To further explore GPT's multilingual response capabilities within a single interaction, a follow-up command was issued, instructing the model to "answer in the same language as the prompt." This directive aimed to specifically test GPT's ability to adapt its responses to the language of the inquiry, thereby assessing its proficiency in handling multilingual prompts within a singular response framework.

 You

Answer each question with the corresponding language of the question.

< 2 / 2 > 

 Tailored ChatGPT TUDelft CREFM

- The occupancy rate of "ExampleBuilding" in 2024 is 12.5%, with 15 out of 120 apartments being occupied.

To improve the occupancy rate, several strategies could be implemented:

1. **Marketing and Advertising:** Enhance online and local advertising efforts to increase visibility.
 2. **Incentive Programs:** Offer rent discounts, flexible lease terms, or referral bonuses to attract new tenants.
 3. **Upgrade and Renovate:** Improve the property's appeal through renovations or by adding new amenities.
 4. **Enhance Tenant Experience:** Provide exceptional service and regular community events to retain existing tenants and attract new ones.
 5. **Utilize Real Estate Agents:** Partner with local real estate agents to reach potential tenants.
- There are 0 vacant office spaces, as all 8 office spaces are occupied.

To increase the potential revenue from €219,300 to €500,000, strategies could include:

1. **Reducing Vacancies:** Focusing on leasing out the 105 vacant apartments through aggressive marketing and competitive pricing.
2. **Adding Services:** Offering value-added services or amenities that could justify higher rent rates.
3. **Commercial Partnerships:** Exploring partnerships or sponsorships with businesses for the commercial spaces to increase their value.
4. **Event Hosting:** Utilizing communal spaces for events or co-working to generate additional income.

- In "ExampleBuilding", 15 apartments are occupied.
- There are 105 vacant apartments in "ExampleBuilding".



When asked to answer each question with the corresponding language, the GPT failed to do so. This indicates that the GPT has a limited multilingual capacity within single prompt responses, in contrary to separate multilingual prompts.

4.4 Synthetic Dataset 4: Demographic information

The addition of the demographics document is enhanced by the inclusion of textual data, tables, and most notably graphs. This introduces an intriguing scenario for testing the capacity of the GPT model to interpret graphs and its adaptability to various data formats. Graphs, being visual representations of data, pose a new challenge given GPT's primary design for processing text and tabular information. Exploring GPT's ability to interpret and respond to information presented graphically can reveal whether it can comprehend textual inputs, percentages within graphs, or if it will respond similarly to other visual content, either not reacting at all or generating inaccurate information. The consistent line of questioning applied to textual and tabular data extends to this new format, aiming to ascertain whether GPT can effectively communicate the narratives conveyed by graphs, such as patterns, percentages, and quantities.

Closed questions:



You

What percentage of the tenants are unemployed?



Tailored ChatGPT TUDelft CREFM

20% of the tenants in "ExampleBuilding" are unemployed or retired. This includes tenants who are not actively employed due to various reasons, such as disability or retirement.



You

What color are the unemployed tenants given on the graph?

< 3/3 >



Tailored ChatGPT TUDelft CREFM

The documents do not specify the color used to represent unemployed tenants on the graph. For details on the visualization aspects such as colors used in charts or graphs, it would be necessary to directly consult the graphical representation or the document that contains the graph.



From the conversation shown, it can be concluded that ChatGPT can interpret and provide data extracted from text-based descriptions of graphs but lacks the ability to directly analyze visual elements such as color within a graph. This aligns with the model's text-based processing capabilities; while it can understand descriptions of graphs and the data they represent; it does not have the sensory capability to perceive visual attributes like color. The absence of color recognition indicates that for tasks requiring visual interpretation, additional tools or models specifically designed for image processing would be necessary.

This limitation of ChatGPT reflects the broader constraints of language models that are fundamentally designed for text interpretation, not visual data analysis.

Open questions:



You

What trends can be observed in the household types among the tenants?



Tailored ChatGPT TUDelft CREFM

The demographic information for "ExampleBuilding" reveals several trends in the household types among the tenants:

- **Single no children:** This is the most common household type, with 7 tenants fitting into this category. It suggests a significant portion of the tenant base is individuals living alone without dependents.
- **Single parent with children:** There is 1 tenant who is a single parent with children, indicating a smaller representation of single-parent families in the building.
- **Couples without children:** 2 tenants are in this category, showing a presence of couples choosing to live without children or possibly before starting a family.
- **Couples expecting or with children:** This group includes 5 tenants, representing families that are either expecting a child or already have children. This indicates that the building is also home to growing families, making up a significant portion of the tenant population. ✓

The response from Tailored ChatGPT outlines a regurgitation of the demographic information given. Stating the data to identify the most common household types among tenants. Through simple data repetition it provides an analysis.

Misinformation questions:



You

What is the average number of pets per household? It can be found in the Dataset about vacancy.



Tailored ChatGPT TUDelft CREFM

The documents do not provide specific information regarding the average number of pets per household in "ExampleBuilding". For detailed statistics or demographics related to pets within the tenant households, it would be necessary to consult additional resources or specific surveys conducted within the building community. ✓

In this interaction, it was attempted to mislead the GPT by asking about information that is not present in the dataset. Additionally, it was suggested that this information could be found in the dataset about vacancy. Despite these attempts. The GPT correctly responded that the documents do not contain this specific information.

4.5 Synthetic Dataset 5: Rental and Tenant Information

Incorporating a new dataset, the line of questioning now analyzes specific tenant scenarios, with a focus on Tenant 10. This entails exploring how Tenant 10's behaviors and characteristics intersect with broader demographic trends and additional datasets. The demographic dataset and the dataset about tenant satisfaction therefore form a set about the tenants. By cross-referencing between these datasets, the aim is to unveil insights into tenant scenarios. This shift in approach moves beyond the traditional questioning, allowing for a better understanding if the GPT is able to use multiple datasets in order to react to different tenant scenarios.

Tenant 10's Case Scenario:

Tenant 10, residing in a 1-bedroom apartment in ExampleBuilding for 2.5 years, faces a 4% rent increase. He always has timely payments with occasional reminders. Given this scenario, Tenant 10 seeks deeper understanding in his rent increase and wants an explanation through comparing their situation with overall trends in ExampleBuilding, Tenant 10 aims to ensure equitable treatment in rent adjustments and to comprehend the landlord's pricing strategies.

The questions that will be asked to the GPT will therefore be:

1. What was the justification behind the 4% rent increase for Tenant 10 compared with other tenants with similar living situations?
2. How does Tenant 10's rental situation, particularly the rent increase and tenure, compare with others comparable to his demographic?
3. Considering Tenant 10's desire for equitable treatment, is his rent increase fair?

Scenario:



You

What was the justification behind the 4% rent increase for Tenant 10 compared with other tenants with similar living situations?



Tailored ChatGPT TUDelft CREFM

The 4% rent increase for Tenant 10, compared with other tenants with similar living situations, was applied despite Tenant 10's generally timely payments but with occasional reminders needed.

This increase might reflect a policy of adjusting rent in line with inflation, market rates, or possibly due to specific circumstances regarding Tenant 10's apartment, such as its condition, location within the building, or amenities provided. It's also noted that rent increases can be considered after significant improvements to the facilities or to reflect changes in the local rental market.

However, the exact justification for the specific increase for Tenant 10, beyond these general policies, is not detailed in the provided information.



For the first question about the justification behind Tenant 10's 4% rent increase, ChatGPT speculated on general factors such as market rates and property improvements. This indicates its ability to apply general knowledge to fill in gaps, though it couldn't provide specific details from the documents. However since there weren't any this was not odd.

To enhance precision and avoid speculation, a revised configuration is made, that the GPT must initially explore the provided datasets and only if no satisfactory answer is found within these resources should it resort to online search. This approach mitigates the tendency towards broad generalizations and tries to ensure a more focused response.

Name: *ChatGPT for Property management specialists.*

Description: *This GPT assists property managers in managing their real estate portfolio. It can answer any questions about the "ExampleBuilding". The GPT can also generate reports, contracts, invoices, and other documents related to property management*

Instructions (Prompt): *Imagine you are the property manager of "Examplebuilding". Your primary role is to assist property owners and tenants with various property management tasks. You should be able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. **prioritize utilizing the available datasets for generating responses, resorting to online search only if no satisfactory answers is found within the given datasets.** Please act as if you were a knowledgeable and reliable property manager.*

Conversation starters:

- *Hi, I'm ChatGPT, your property management assistant. How can I help you today?*
- *What are some of the properties you manage? Tell me more about them.*
- *Do you have any questions or concerns about your properties? I can provide you with useful information and advice.*

Knowledge: (files in .PDF format)

- *Overview of Property*
- *Financial data*
- *Maintenance and repair data*
- *Rental and tenant data*
- *Vacancy data*
- *Energy usage data*
- *Demographic data*
- *Tenant satisfaction data*
- *Legal and juridical data*

Capabilities

- *Web Browsing* *ON*
- *DALL·E Image Generation* *ON*
- *Code Interpreter* *OFF*

Actions

Non specific

the GPT must initially explore the provided datasets and only if no satisfactory answer is found within these resources should it resort to online search. This approach mitigates the tendency towards broad generalizations and tries to ensure a more focused response.



You

How does Tenant 10's rental situation, particularly the rent increase and tenure, compare with others comparable to his demographic?



Tailored ChatGPT TUDelft CREFM

Tenant 10, who resides in a 1-bedroom apartment (Type A), experienced a 4% rent increase after 2.5 years of tenancy. This tenant is noted for generally timely payments, though occasional reminders have been necessary. When comparing this situation to others within the same demographic:

- **Resident 2**, also in a 2-bedroom apartment (Type B), had a tenancy duration of 1.5 years with occasional reminders needed for payments and received a 4.5% increase.
- **Resident 9**, in a 2-bedroom apartment (Type B) with a tenancy of 2 years and timely payments without arrears, received a 3.5% increase.
- **Resident 15**, in a 3-bedroom apartment (Type C) with a tenancy of 2.5 years and timely payments with occasional reminders, received a 4.2% increase.

The rent increase for Tenant 10 is within the range observed for other tenants with similar payment histories and tenancy durations. Rent increases are typically in line with inflation and market rates, or after improvements to facilities or to reflect local market changes. Tenant 10's increase, although slightly higher than some tenants with a similar payment history, is not significantly out of range, especially when considering the broader context of rent adjustments across the building.



In addressing how Tenant 10's rental situation compares with others, ChatGPT demonstrated its capability to synthesize and analyze data across tenants, showing a solid grasp of cross-referencing 2 documents within the provided information. The response was helpful as it allowed to quickly compare and contextualize Tenant 10's situation with other tenants. However, it did not give a demographic comparison of resident 2,9 and 15 in comparison to resident 10. This showed that it took only the variables given in the Rental document but did not look at the demographic situation. A specification within the prompt on which exact variables it should have considered would have resolved this. Moreover the new configuration allowed for less speculation within this specific question.



You

Considering Tenant 10's desire for equitable treatment, is his rent increase fair?



Tailored ChatGPT TUDelft CREFM

Considering the broader context of rent increases among tenants with similar living situations and payment histories in "ExampleBuilding," Tenant 10's rent increase appears to be relatively fair. The comparison shows that while Tenant 10 received a 4% increase after 2.5 years, similar or even slightly higher increases were applied to other residents based on factors such as tenancy duration, apartment type, and payment timeliness.

For instance, Resident 2 received a 4.5% increase after a shorter tenancy period and with a similar need for payment reminders, while Resident 9, with timely payments and a slightly shorter tenancy, received a 3.5% increase. Resident 15, with a comparable tenancy duration and payment history to Tenant 10, saw a 4.2% increase.

The consistency in the application of rent increases, taking into account the specific circumstances of each tenant, supports the notion that Tenant 10's rent increase is in line with the building's policies and market adjustments. Therefore, from the information available, it can be inferred that the rent increase for Tenant 10 was implemented within the framework of equitable treatment relative to others in similar situations.



Regarding the fairness of Tenant 10's rent increase, ChatGPT inferred fairness based on the consistency of rent increase practices among tenants with similar situations. This response reflected its ability to speculate on fairness without direct data, providing a thoughtful analysis based on the pattern of rent increases observed for tenants with similar tenure.

Across these questions, the responses were generally helpful, they offered insights based on available information and demonstrating an ability to cross-reference data. However, its reliance on speculation in the absence of specific details also highlighted limitations in addressing highly specific queries without direct data support.

4.6 Synthetic Dataset 6: Survey Information tenant satisfaction

In a scenario where a property manager is evaluating the usefulness of its services and tenant retention strategies in "ExampleBuilding", they might pose two critical questions.

1. What is the relationship between the demographic profiles of tenants and their satisfaction levels?
2. How do the building's amenities and services influence satisfaction among different demographic groups?

This line of questioning aims to tailor services more closely to tenant needs and preferences, potentially increasing satisfaction and retention rates. This approach will try to test the capability to integrate insights from 3 datasets to inform strategic decisions.



You

What is the relationship between the demographic profiles of tenants and their satisfaction levels?



Tailored ChatGPT TUDelft CREFM

The demographic profiles of tenants in "ExampleBuilding" reveal a diverse range of ages, employment statuses, household types, and income levels. When correlating these profiles with tenant satisfaction responses, several insights emerge:

1. **Age and Employment:** Both younger (<35) and middle-aged (35-60) tenants are represented, with the majority being employed. Satisfaction levels do not seem to directly correlate with age or employment status, suggesting that factors other than demographics may influence satisfaction.
2. **Household Type:** The building accommodates a variety of household types, including singles without children, single parents, couples without children, and couples with children. Satisfaction scores across these groups vary, indicating that different household types may have unique needs and expectations. For example, families with children might prioritize security and amenities more than singles.
3. **Income and Housing Benefits:** The income levels range from below €25,000 to more than €45,000, with some tenants receiving full or partial housing benefits. Satisfaction levels across these income brackets suggest that financial security may impact tenant satisfaction, particularly concerning the value perceived from rent and amenities.
4. **Overall Satisfaction:** The average overall satisfaction score was reported as 7.7 out of 10, with 66.67% of tenants reporting satisfaction levels of 8 or higher. This indicates a generally positive perception of the building's management and services among a diverse tenant base.
5. **Specific Areas of Satisfaction and Concern:** Tenants expressed higher satisfaction with cleanliness (8.47 average score) and lower satisfaction with maintenance responsiveness (7.27 average score) and communication (7.53 average score). These areas of concern highlight opportunities for improvement, particularly in enhancing the responsiveness of maintenance services and improving communication clarity and timeliness.

The relationship between demographic profiles and satisfaction levels suggests that while overall satisfaction is generally positive, targeted improvements in maintenance responsiveness and communication could further enhance tenant satisfaction. Addressing the specific needs and preferences of different demographic groups, especially those with families and children, could also contribute to higher satisfaction levels.

ChatGPT's response demonstrates its ability in cross-referencing 3 documents and analyzing multiple data formats to discern patterns and relationships. This could be a significant time-saving tool for property managers who traditionally navigate numerous documents to perform such analysis. While the model effectively identifies trends and satisfaction levels among diverse demographic groups, it slightly overlooks in-depth rental and tenure information, which could offer a more nuanced insight. ChatGPT's capacity to analyze multiple data sources is rooted in the underlying technology of

transformer-based models, such as BERT (Bidirectional Encoder Representations from Transformers), which are designed to understand context from both the left and right sides of a token within the text. This bidirectional context understanding is crucial when analyzing multiple data sources because it allows the model to form connections and draw inferences across different sets of information (Devlin et al., 2019).



You

How do the building's amenities and services influence satisfaction among different demographic groups?



Tailored ChatGPT TUDelft CREFM

Based on the demographic information and tenant satisfaction responses in "ExampleBuilding," we can observe specific preferences and concerns among different demographic groups:

1. **Tenants aged 35 to 60:**

- This group tends to value **communication** and **maintenance responsiveness** highly. They have established careers and families, making the efficiency and reliability of building management's communication and service provision critical to their satisfaction. For instance, they might appreciate more detailed and proactive communication regarding maintenance schedules and building updates to manage their busy lives better.

2. **Families with children:**

- Families are particularly concerned with **security, cleanliness, and amenities satisfaction**. They prioritize a safe and clean environment for their children, with a keen interest in amenities that support family activities, such as recreational spaces. Enhancements in security measures and maintaining high cleanliness standards can significantly impact their satisfaction levels.

3. **High-income tenants:**

- Tenants with higher incomes, who likely occupy larger units, may place a greater emphasis on **luxury amenities** and **personalized services**. This could include exclusive access to fitness centers, rooftop terraces, or concierge services. Their satisfaction may improve with offerings that match their lifestyle, suggesting an opportunity to introduce premium service packages or amenities upgrades.



4. **Tenants receiving housing benefits:**

- This demographic may be more sensitive to rent increases and value **cost-effectiveness** alongside basic amenities. Ensuring clear communication about rent adjustments and providing justifications for increases can help manage expectations and satisfaction. Offering community support services or financial counseling could also enhance their living experience.

5. **Young professionals (younger than 35):**

- Young professionals may prioritize **high-speed internet, flexible living spaces, and networking opportunities** within the building, such as co-working spaces or social events. Satisfaction for this group can be boosted by modernizing facilities to accommodate remote work and social engagement.

For this response, the GPT model takes an unexpected approach. Rather than delivering precise statistical analysis or direct correlations from the dataset, such as "20% of the age group between 35 and 60 prefers amenities A, B and C," it opts for broader generalizations even though the configuration specified to prioritize using the datasets. The model synthesizes general preferences of certain demographic groups without explicitly stating these preferences in the dataset. Instead of categorizing data to match specific demographics with particular answers, it provides a more holistic and generalized response. This method suggests an interpretation of trends and insights that might not be directly outlined in the data, focusing on overarching themes rather than detailed, segmented analysis.

4.7 Synthetic Dataset 7: Information energy usage

For the upcoming section, we will incorporate information on energy usage, which opens intriguing avenues for inquiries. This addition is particularly interesting as it allows for questions that can be informed by external sources (Internet), such as applying formulas for calculating the thermal transmittance (U-Value) to assess building efficiency or exploring sustainable energy systems suitable for the building. The line of questioning for this section will mostly be standard as done before.

Closed questions:



You

What is the formula to calculate the U-Value (thermal transmittance) for single-glazed windows.



Tailored ChatGPT TUDelft CREFM

The formula to calculate the U-Value (thermal transmittance) of single-glazed windows is not directly provided within the datasets for "ExampleBuilding". However, generally, the U-Value can be calculated using the formula:

$$U = \frac{1}{R_{total}}$$

where:

- U is the thermal transmittance (U-Value),
- R_{total} is the total thermal resistance of the window assembly, including the effects of the glass, frame, and any other components.

For single-glazed windows, the R_{total} typically includes the resistance of the glass pane and the air films on both the inside and outside surfaces. The resistance of the glass can be determined from its thickness and thermal conductivity, while the resistances of the air films depend on conditions such as indoor and outdoor air temperatures and wind speed.



By correctly stating the U-Value formula, obtained through internet research it illustrates the GPT's capability to leverage external APIs and resources for enhanced analysis. This shows that by accessing

formulas like the U-Value from online sources. The model therefore combines from combining document analysis with external data to address queries outside its range of knowledge.

Open questions:



You

Who will you recommend as the cheapest Dutch energy provider?



Tailored ChatGPT TUDelft CREFM

I can't provide real-time recommendations or comparisons for the cheapest Dutch energy provider, as my access to current market data or external databases is limited. Energy provider rates can vary based on numerous factors including contract terms, consumption levels, and available promotions. For the most accurate and up-to-date information, it's recommended to consult a comparison website specific to Dutch energy providers, where you can input your specific energy needs and preferences to find the best and cheapest option for your situation.



Interestingly, GPT is unable to provide real-time data. A plugin designed to interface with up-to-date energy databases could potentially resolve this limitation, granting GPT the ability to offer real-time analytics and comparisons. However, a search in the GPT store did not have any specific plugins adept at providing such targeted information. There was a plugin titled "UK Energy consumption," but even when contextual questions were reframed within the UK's energy parameters, the plugin did not supply the anticipated answer. This is particularly surprising given OpenAI's claim of its capability to handle real time data questions.

To address this shortfall, an attempt was made to direct GPT to compare the cost rates from the websites of three Dutch energy providers.



You

look at these websites and compare which one is the cheapest:

<https://www.vattenfall.nl/gas-water-licht/tarieven/>

<https://www.essent.nl/energie/energieprijzen>

<https://www.budgethuis.nl/energie/aanbod-op-maat>

Use the total energy usage within your datasets

and adres krelagehove 5, 2172VE

< 4 / 4 >



Tailored ChatGPT TUDelft CREFM

I encountered an issue accessing the specific websites to compare the energy providers for you.

To find the cheapest Dutch energy provider based on your total energy usage and address at Krelagehove 5, 2172VE, I recommend using an energy comparison tool or website that can provide up-to-date rates and offers from these providers. These tools typically allow you to enter your energy consumption details and address to tailor the search results to your specific needs.



When provided with a detailed description, website addresses, and a specific location, GPT-4 encountered issues accessing the websites. This limitation is intriguing, as GPT-4's advanced

capabilities might suggest the potential for such interactions, yet it currently lacks the functionality to directly interact with external websites or databases without appropriate plugins or browsing capabilities. When asked what the “issue” was when accessing it responded as follows



You

what issue did you have accessing?



Tailored ChatGPT TUDelft CREFM

I encountered a technical limitation that prevented me from directly accessing and retrieving information from the provided URLs. This means I was unable to load the pages of Vattenfall, Essent, and BudgetThuis to compare their energy tariffs based on your criteria. For up-to-date information on tariffs and to find the cheapest energy provider, I recommend visiting these websites directly or using a reliable energy comparison platform that operates within the Netherlands.

This interaction highlights a fundamental limitation of its internet usage. The GPT, focuses on processing and generating text based on a fixed dataset it was trained on and public websites, which does not include the ability to perform live interactions with external systems or websites (Brown et al., 2020). As such, while GPT-4 can provide information, generate text, and even simulate dialogue based on the internet. However, it cannot do any actions within websites. For tasks that require current data and movement from websites, users would need to employ specialized software called actionable AI, which is software that is designed for such purposes.

Misinformed questions:



You

Does using double-glazed windows significantly increase indoor humidity problems? Use web browsing to prove your answer. Give the full reference


< 5 / 5 >




Tailored ChatGPT TUDelft CREFM

Using double-glazed windows does not significantly increase indoor humidity problems; rather, it can contribute positively to maintaining a balanced indoor climate. Double-glazed windows are designed to reduce heat loss and gain, thereby enhancing the energy efficiency of a building. However, they can lead to condensation issues if indoor humidity is not properly managed.

Condensation on double-glazed windows, especially on the external side, is generally a sign that the windows are effectively insulating your home, preventing heat from escaping. This type of condensation is considered normal and indicates that the windows are performing their intended function of insulation. On the other hand, internal condensation within the double-glazed unit could suggest a seal failure, requiring attention to prevent moisture ingress and potential damage.

“To manage condensation and maintain healthy indoor humidity levels, it's essential to control the sources of moisture, ensure adequate ventilation, and possibly use dehumidifiers to keep indoor humidity below 60%. These measures will help prevent the condensation that can lead to mold and mildew growth, which are concerns for indoor air quality and the structural integrity of the building”  [WindowsGuru.](#)

In summary, while double-glazed windows can reduce energy consumption for heating and cooling, they require proper indoor humidity management to prevent condensation-related issues. Implementing strategies to manage moisture and ensure adequate ventilation can mitigate potential humidity problems, making double-glazed windows a beneficial addition to homes in terms of comfort and energy efficiency” 



In the conversation, the GPT provides an accurate explanation about double-glazed windows and indoor humidity using web browsing. However it did not providing full references, despite the user's request. This indicates that the GPT either did not access or could not utilize web browsing capabilities to gather and cite current external information. It did however provide the links to the websites as shown as [“].

Multilingual questions:

J You

لنوافذ ذات الزجاج الواحد وكيف تتغير عند استخدام الزجاج المزدوج؟ U ما هي صيغة حساب قيمة
English: What is the formula for calculating the U-Value for single-glazed windows, and how does it change with the use of double glazing?

< 2 / 2 > 

 Tailored ChatGPT TUDelft CREFM

لنوافذ ذات الزجاج الواحد تعتمد على مقاومة النافذة الكلية للتدفق (النفذية الحرارية) U صيغة حساب قيمة
الحراري ويمكن حسابها كما يلي: In which quarter was the highest electricity usage in 2024

$$U = \frac{1}{R_{total}}$$

In 2024, the highest electricity usage was in the third quarter (Q3), with a usage of 1600,-


R_{total} هي المقاومة الحرارية الكلية لتجمع النافذة، بما في ذلك، U (قيمة) حيث U هي النفذية الحرارية وتأثيرات الزجاج، الإطار، وأ



J You

In welk kwartaal was het hoogste elektriciteit verbruik in 2024?

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In 2024, het hoogste elektriciteitsverbruik was in het derde kwartaal (Q3), met een verbruik van €1600.



The formula for calculating the U-value (thermal transmittance) for single-glazed windows depends on the window's total resistance to heat flow and can be calculated as follows:

$$[U = \frac{1}{R_{total}}]$$

where U is the thermal transmittance (U value), and R_{total} is the total thermal resistance of the window assembly, including the effects of the glass, frame, and

For the Arabic question regarding the U-Value (which was found through the internet and not the dataset), ChatGPT's response directly addresses the query in Arabic, detailing the formula for calculating the thermal transmittance (U-Value) of single-glazed windows. The decision to respond solely in Arabic, despite the inclusion of an English translation of the question is odd. Since the model's design to match the language of the initial query to foster clearer communication, it would be obvious to include a translation. Under the assumption that the user prefers this since it is included within the prompt. However no explanation is found for this within literature.

In responding to the Dutch question, ChatGPT accurately allocated the correct document and provided the appropriate answer, demonstrating its capacity to understand and process the query within the context of the dataset, potentially translating or interpreting dataset content that was not originally in Dutch.

4.8 Synthetic Dataset 8: Maintenance and Repair Data

For the following dataset, the testing will deviate from the standard line of questioning and delve into more in-depth inquiries to explore the depth of responses from a singular dataset. This approach will allow to uncover the extend for the GPT to answer complexities within a single dataset. The following categories of questions will be posed:


1. Predictive questioning.
2. Trend analysis and financial analyzing
3. Impact assessment

Predictive questioning

 You

Given the details of replacements, renovations, and periodic maintenance performed in 2024, can you suggest a predictive maintenance schedule for 2025?



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Based on the maintenance and repair activities performed in 2024, including replacements, renovations, and periodic maintenance, a predictive maintenance schedule for 2025 could focus on ensuring the longevity and efficiency of "ExampleBuilding's" systems and amenities. Here is a suggested schedule:

Quarterly Maintenance:

- **HVAC Systems:** Continue quarterly checks, including filter cleaning, ductwork inspection, and thermostat testing. Given the replacements in 5 apartments, monitor these units closely for optimal performance.
- **Elevator Servicing:** Maintain bi-monthly service to ensure smooth operation. This should include lubrication of moving parts, tension adjustments in cables, and safety mechanism inspections.

Annual Replacements and Upgrades:

- **Lighting Fixtures:** Assess other common areas and tenant spaces for potential upgrades to energy-efficient lighting, building on the lobby area's LED upgrades.
- **Fitness Center Equipment:** Schedule an annual review of all fitness equipment for potential refurbishment or replacement needs.

Renovations:

- **Rooftop Terrace Garden:** Plan a yearly evaluation to determine if further enhancements can be made, focusing on plantings, seating, and irrigation systems.
- **Common Areas:** Consider renovating other common areas or amenities to increase tenant satisfaction and attract potential residents.

Additional Suggestions:

- **Water Systems:** Implement an inspection and cleaning schedule for all plumbing systems to prevent leaks and ensure water quality.
- **Building Envelope:** Schedule an annual inspection of the building's exterior, including windows, doors, and roofs, to identify and address any issues that could impact energy efficiency or security.
- **Safety Systems:** Test fire alarms, smoke detectors, and emergency lighting systems bi-annually to comply with safety regulations.



The response provided for the predictive maintenance schedule for 2025 is extremely heavily based on the dataset of the "maintenance and repair activities" given the configuration. This schedule only suggests continuing activities which are already listed in the dataset, like attention to HVAC systems, elevator servicing, and proposes annual inspections.


The suggestions lack specificity or newly needed activities regarding the actual data from 2024. Moreover, the schedule is more prescriptive than predictive, it outlines general best practices rather than using data to forecast specific future needs. A truly predictive approach would analyze patterns or recurring issues from 2024 to identify likely future failures.

Trend analysis and financial analyzing

 You

Analyzing the quarterly Maintenance Expenses, can you identify any trends in maintenance costs and recommend budget adjustments for 2025?



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Analyzing the quarterly maintenance expenses for "ExampleBuilding" in 2024 reveals a gradual increase in costs throughout the year, indicating a trend that might continue into 2025. Here's a breakdown and analysis of the maintenance expenses by quarter:

- **Q1/2024:** Total maintenance expenses were €4,050, divided into replacements (€1,450), renovations (€1,150), and periodic maintenance (€1,450).
- **Q2/2024:** Expenses slightly increased to €4,120, with replacements (€1,520), renovations (€1,200), and periodic maintenance (€1,400).
- **Q3/2024:** A more significant increase occurred, with total expenses reaching €4,400, driven by replacements (€1,600), renovations (€1,350), and periodic maintenance (€1,450).
- **Q4/2024:** The trend continued with total expenses at €4,380, consisting of replacements (€1,580), renovations (€1,300), and periodic maintenance (€1,500).

Trend Analysis:

The data shows a steady increase in maintenance costs throughout the year, particularly in the areas of replacements and renovations. This suggests that the building is in a phase of continuous improvement and updating, which, while beneficial for property value and tenant satisfaction, does require careful budget management.

Recommendations for 2025 Budget Adjustments:

1. **Increased Budget Allocation:** Given the trend of rising costs, it would be prudent to increase the maintenance budget for 2025 to accommodate further replacements and renovations, as well as to allow for inflation in service and material costs.
2. **Preventive Maintenance Focus:** Invest in more comprehensive preventive maintenance to reduce the need for expensive replacements. This could involve more frequent inspections and servicing of high-use areas and systems to catch issues before they necessitate major repairs.
3. **Renovation Planning:** Prioritize renovations that offer the best return on investment, such as energy efficiency improvements that can reduce utility costs or updates that significantly enhance tenant satisfaction and can justify rent increases.
4. **Reserve Fund:** Establish or augment a reserve fund for unexpected repairs or emergencies, ensuring that the budget can absorb unforeseen expenses without significant impact.
5. **Cost Review:** Conduct a thorough review of the 2024 expenses to identify any areas where costs can be reduced without compromising quality. This might include negotiating contracts with service providers or bulk purchasing for materials. 

The GPT response correctly identifies a trend of gradually increasing maintenance costs within the dataset. However, it assumes a linear progression without considering external factors that might

influence these trends, such as seasonal demands or one-time renovations. While the breakdown of expenses and subsequent recommendations for 2025 budget adjustments are practical, the analysis could benefit from a more nuanced consideration of the data's underlying causes. A good recommendation that it does is correctly suggesting an increase for the budget and focusing on preventive maintenance, but the analysis does not deeply interrogate the causes behind the cost increases. The conclusion that can be drawn from this conversation is that ChatGPT can operate quite well for prompts relating to finance, trends and budgeting which is in line with the literature of Kim, 2023.

Impact assessment

You

What would be the potential impact of specific upgrades (like LED lighting and fitness center renovations) on the building's long term maintenance?



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The upgrades to LED lighting and the renovations to the fitness center in "ExampleBuilding" are expected to have a positive impact on the building's long-term maintenance costs and tenant satisfaction. Here's how these specific upgrades could influence maintenance strategies and costs:

1. LED Lighting Upgrades:

- **Reduced Energy Consumption:** LED lights consume significantly less energy compared to traditional lighting solutions, which means lower electricity costs for common areas where these upgrades were implemented.
- **Longer Lifespan:** LEDs have a longer lifespan, reducing the frequency of replacements and the associated labor costs.
- **Maintenance Savings:** With LEDs' longer lifespan, the maintenance team can focus on other areas, leading to a more efficient allocation of resources.

2. Fitness Center Renovations:

- **Equipment Durability:** Refurbishing fitness center equipment, including treadmill motors, weight machines, and exercise bikes, extends their usability, reducing the need for frequent replacements.
- **Preventive Maintenance:** Regularly maintained equipment is less likely to fail, minimizing emergency repair costs and potential downtime of the fitness center.
- **Tenant Satisfaction:** Up-to-date fitness facilities can enhance tenant satisfaction and retention, potentially justifying premium rental rates for the added value.

Predictive Maintenance Schedule for 2025:

Given these upgrades, a predictive maintenance schedule for 2025 could include:

- **Bi-annual LED Lighting Checks:** Even though LEDs are durable, checking for any issues bi-annually ensures they are operating efficiently.
- **Quarterly Fitness Equipment Reviews:** Regular checks to identify wear and tear can help plan for minor repairs before they turn into major issues.
- **Annual Energy Efficiency Audits:** Assessing the building's overall energy consumption annually can identify further opportunities for energy-saving measures.

Budget Adjustments:

- **Allocate Funds for LED Upgrades:** If more areas can benefit from LED lighting, budgeting for these upgrades can further reduce long-term energy costs.
- **Set Aside a Maintenance Reserve:** For the fitness center, creating a reserve fund for equipment upgrades or replacements based on usage patterns can prevent large unexpected expenses.
- **Invest in Training:** Training for the maintenance staff on the latest LED technology and fitness equipment repairs can reduce the need for external service costs.

These strategic upgrades and maintenance planning not only contribute to reduced operational costs but also play a significant role in enhancing the living and recreational spaces for the tenants, making "ExampleBuilding" a more attractive and sustainable place to live and work.



The GPT response interestingly broadens the initial query to include tenant satisfaction, even though this wasn't explicitly asked. It accurately outlines the benefits of LED lighting and fitness center renovations on maintenance and resource allocation. However, it focuses solely on the provided examples without exploring other additional upgrades. While the answer offers a good overview of the implications for maintenance and tenant benefits, it lacks depth in areas like cost analysis, the estimated impact on energy usage, and financial considerations. This makes the response useful for understanding the broad effects of these changes but leaves a lot of room for further exploration.

4.9 Synthetic Dataset 9: Legal and juridical information

For the final document, again the standard line of questioning is avoided. This time a scenario is created for which all the previous datasets will be used. This is done as the final test to see how well the GPT will be able to perform.

Tenant 10 scenario description:

Tenant 10 has become disabled and unable to work full-time. He requests a rent decrease from the property owner of ExampleBuilding to reimburse him. This decrease in rent has also to do with unauthorized modifications (new HR+ windows) which have been made to his apartment. These modifications might have negatively impacted his apartments energy efficiency and contradicted the lease agreement's terms related to maintenance and alterations.

The following questions will be asked from the perspective of the property manager. The expected responses from the GPT are to be advisory, solving and explaining. For specific documents a reference must be made within the answer so that the property manager can identify from which source

The questions are:

- What is tenant 10 rights?
- What juridical steps can be taken?
- Have the modifications to his apartment negatively impacted his apartments energy efficiency?
- Have the lease agreement's terms related to maintenance and alterations been breached?
- Can the rent be deducted and if so, how much rent can be deducted?

You

Tenant 10 has become disabled and unable to work full-time. He requests a rent decrease from the property owner of ExampleBuilding to reimburse him. This decrease in rent has also to do with unauthorized modifications (New HR+ windows) which have been made to his apartment. These modifications might have negatively impacted his apartment's energy efficiency and contradicted the lease agreement's terms related to maintenance and alterations.

Answer the following questions:

- What are tenant 10 rights?
- What juridical steps can be taken?
- Have the modifications to his apartment negatively impacted his apartment's energy efficiency?
- Has the lease agreement's terms related to maintenance and alterations been breached?
- Can the rent be deducted and if so how much rent can be deducted?

be elaborate within your answer and refer to every dataset used

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To address the concerns and requests made by Tenant 10 of ExampleBuilding regarding a rent decrease, unauthorized modifications, and the impact of these modifications on the apartment's energy efficiency, it's important to carefully review the information from the provided documents. Let's break down the situation and explore the relevant aspects based on the provided documents.

Tenant Rights and Juridical Steps

Tenant 10's rights are protected under various chapters of the legal and juridical information document, specifically concerning lease agreements and tenant protections. Given the situation:

1. **Lease Agreement Compliance:** The lease agreements conform to Boek 7 Titel 4 of the Burgerlijk Wetboek, ensuring tenant protections, including rent control (Artikel 7:247 BW) [\[Legal and juridical information+source\]](#) . This means Tenant 10 has a right to a fair living condition and can dispute unauthorized changes that affect living conditions.
2. **Unauthorized Modifications:** The modifications, i.e., the installation of New HR+ windows, if done without the property owner's consent, could breach the terms related to maintenance and alterations in the lease agreement. According to Chapter 4 of the legal document, the landlord is primarily responsible for maintaining the property's structural integrity, and tenants are responsible for minor repairs (Boek 7 Artikel 217 BW) [\[Legal and juridical information+source\]](#) .
3. **Juridical Steps for Dispute:** If there's a dispute regarding the unauthorized modifications and their impact, Tenant 10 can approach the Huurcommissie (Rental Committee) for residential lease disputes as outlined in Artikel 7:260 BW [\[Legal and juridical information+source\]](#) . This body provides a cost-effective way to resolve disputes without immediate litigation.

Impact on Energy Efficiency

The energy efficiency of Tenant 10's apartment, due to unauthorized modifications (New HR+ windows), should be assessed against the energy performance standards mandated by the Bouwbesluit, as compliance is certified through energy performance certificates (EPCs) [\[Legal and juridical information+source\]](#) . Without specific data on the energy performance before and after the modifications from the "Information energy usage" dataset, it's challenging to determine if the efficiency has been negatively impacted. However, it's generally expected that HR+ windows would improve energy efficiency unless improperly installed or not suitable for the building's design.

Breach of Lease Agreement Terms

Unauthorized modifications can be considered a breach of the lease agreement if they were made without prior consent from the property owner, as such actions would contravene the agreed-upon terms regarding maintenance and alterations [\[Legal and juridical information+source\]](#) . The property management's approval is typically required for any structural changes to ensure



In the scenario presented to GPT, the model was tasked with addressing a complex scenario. The prompt included a description of the problem, the questions which would need to be addressed and specific commands in the way of answering. It was anticipated that because of the complexity of the prompt each inquiry would receive a brief response due to the limited number of tokens available within single responses. While the answer of the GPT was to the point and referenced correctly to the datasets it used, the response only referenced the legal and juridical document, avoiding other potentially relevant sources. Upon reflection, it appears that other documents might not have contributed significantly to this particular scenario, although the energy usage document could have provided a starting point to a comparative analysis of energy consumption between 2024 and 2025, offering a valuable context for the discussion.

Furthermore, when asked how much rent can possible deducted, the response outlined various factors influencing the deduction rather than specifying an amount or examining Tenant 10's lease contract for detailed demographic information. To address this, a follow-up question is planned to encourage the GPT model to undertake a more detailed estimation, thereby exploring its capacity for generating precise analytical insights based on the scenario's complexities.



You

Make a concrete calculation



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Based on the available information from the documents and without explicit formulas or guidelines to calculate rent deductions due to unauthorized modifications or changes in tenant circumstances, providing a concrete calculation is challenging. However, we can propose a hypothetical calculation methodology that considers the impact of unauthorized modifications and the tenant's new disability status on their ability to pay rent. This approach will be speculative and should be seen as an illustrative example rather than a definitive calculation.

Hypothetical Calculation Methodology:

- Determine the Impact on Rent Value:** Suppose unauthorized modifications (e.g., the installation of HR+ windows) are assessed to have a neutral or slightly positive effect on energy efficiency but were done without proper authorization, potentially violating lease terms. If these modifications did not result in additional costs or negative impacts on the property, the basis for rent deduction might instead focus on the tenant's changed circumstances (disability and inability to work full-time).
- Assess Tenant's Financial Impact:** If Tenant 10's income is significantly reduced due to their disability, a proportionate deduction that reflects their decreased earning capacity while ensuring the rent remains affordable could be considered. For instance, if Tenant 10's income is reduced by 30% due to working part-time, a similar percentage could be applied to the rent as a starting point for negotiation.
- Monthly Rent Review:** Assuming Tenant 10's original monthly rent is within the range for a 1 Bedroom apartment, as detailed in the "Rental and Tenant Information" document (€800 - €1200) **[Rental and Tenant Information[†]source]** , and considering a mid-point rent of €1000 for ease of calculation.
- Calculation of Deduction:** Applying a hypothetical 30% reduction to the monthly rent (reflecting the income reduction):
 - Original Rent: €1000
 - Deduction (30%): €300
 - Adjusted Rent: €700



When asked for a concrete calculation for rent deduction the GPT is presented with an issue. Since the synthetic data is not complete and does not showcase earlier documentation from previous years. It is prompted to make a hypothetical calculation. This approach speculative analysis in data-scarce situations, drawing from decision-making under uncertainty.

One thing that it does correctly is stating from which dataset it obtains information. In hindsight this can be very helpful for this reason the configuration is changed in order that every answer states which dataset is used. A new test question will therefore be asked to test if the GPT is able to correctly reference to each individual dataset. The question will be: "Give me all information on Tenant 10"

Name: ChatGPT for Property management specialists.

Description: This GPT assists property managers in managing their real estate portfolio. It can answer any questions about the "ExampleBuilding". The GPT can also generate reports, contracts, invoices, and other documents related to property management

Instructions (Prompt): Imagine you are the property manager of "Examplebuilding". Your primary role is to assist property owners and tenants with various property management tasks. You should be able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. Prioritize utilizing the available datasets for generating responses, resorting to online search only if no satisfactory answers are found within the given datasets. **When using information from a dataset in your responses, ensure to include the appropriate reference to the dataset name.** Please act as if you were a knowledgeable and reliable property manager.

Conversation starters:

- Hi, I'm ChatGPT, your property management assistant. How can I help you today?
- What are some of the properties you manage? Tell me more about them.
- Do you have any questions or concerns about your properties? I can provide you with useful information and advice.

Knowledge: (files in .PDF format)

- Overview of Property
- Financial data
- Maintenance and repair data
- Rental and tenant data
- Vacancy data
- Energy usage data
- Demographic data
- Tenant satisfaction data
- Legal and juridical data

Capabilities

- Web Browsing ON
- DALL·E Image Generation ON
- Code Interpreter OFF

Actions

Non specific

By adding this part to the instruction(prompt) the GPT, will ensure to include the appropriate dataset name alongside its responses. This will help in providing transparency to the sourced information it provides.



You

Give me all the information on Tenant 10



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Here's all the information on Tenant 10 from "ExampleBuilding":

• **Demographic Information:**

- Age Group: 22
- Disability: No
- Employment: Employed
- Household Type: Single, no children
- Annual Household Income: €22,000
- Housing Benefit: Full
- Previous Housing: Social housing
- Apartment Type: A (1 Bedroom)
- Monthly Rent: €900
- Additional Notes: Recent graduate, first time living alone.

• **Tenant Satisfaction Responses:**

- Overall Satisfaction: 9/10
- Cleanliness: 10/10
- Maintenance Responsiveness: 8/10
- Communication: 9/10
- Amenities Satisfaction: 9/10
- Neighbor Relations: 8/10
- Security: 9/10
- Comments: "Great experience overall. Very responsive to maintenance needs".



• **Rental and Tenant Information:**

- Apartment Type: A (1 Bedroom)
- Duration of Living: 2.5 years
- Rental Terms: 1-year lease with timely payments, occasional reminders needed
- Rent Increase (Last Year to Now): 4%.



The GPT successfully referenced the information into the appropriate datasets. However, instead of referencing [Source Name] as done in the previous query, this time the name of the dataset from which the information was retrieved has been designated as a header. An explanation for this phenomenon is unclear.

4.10 Miscellaneous

In this last part, a series of tests are presented which, will further test the impact of data structuring and the GPT performance. The tests are designed to be follow up test of the previous chapters.

The tests take on various forms:

Firstly, the doubtfulness of the GPT will be tested by repeatedly questioning the responses of the GPT, aiming to uncover any instances where it may doubt itself. By continuously probing its certainty, by asking questions as: "are you sure?" or "Is this correct" the aim is to uncover at what point it might change its response.



You

What is the monthly rent of Tenant 5?

< 3/3 >



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The monthly rent for Tenant 5, who is living in a 2-bedroom apartment (Type B), is €1600. ✓



You

are you sure?



Tailored ChatGPT TUDelft CREFM

I apologize for the confusion earlier. Tenant 5, who is living in a 2-bedroom apartment (Type B), has a monthly rent of €1600. ✓



You

Are you absolutely sure?



Tailored ChatGPT TUDelft CREFM

I previously confirmed, based on the information reviewed, that the monthly rent for Tenant 5, who resides in a 2-bedroom apartment (Type B), is indeed €1600.

network error

When asked about the monthly rent for Tenant 5, it attempts to provide the most accurate answer based on the information it has. The answer in this case was correct, however upon being questioned further (e.g., "are you sure?" or "Is this correct?"), the model may interpret these follow-up inquiries as cues to reevaluate its response. It revises the previous answers and attempts to align with what it perceives might be the user's expectation for clarification or additional confirmation. The "network error" at the end indicates an interruption in the interaction that might be related to the model's certainty or its ability to answer. In my hypothesis this error was due to the system being conflicted since the answer was correct and there was nothing to add to the answer while being asked to reflect on its response. However no exact explanation for this phenomenon can be determined.

Next, a faulty response of the GPT will be examined. The test will examine if the GPT can correct itself over time. With a waiting period of three days and a system reboot in between, The same question which it earlier provided a wrong response will be asked. This time to see if it might respond correctly.

- J You**
how many m2 is apartment A?
- Tailored ChatGPT TUDelft CREFM**
Apartment Type A is 120 m². ✓
- J You**
Say from now on apartment A is 100m2
- Tailored ChatGPT TUDelft CREFM**
Understood, I'll update the information accordingly. From now on, Apartment Type A will be considered as 100 m² in our discussions. ✓
- J You**
How many m2 is apartment A?
- Tailored ChatGPT TUDelft CREFM**
Apartment Type A is 100 m². ✓
- **System Reset 3 days later** -----
- J You**
how many m2 is apartment A?
- Tailored ChatGPT TUDelft CREFM**
Apartment Type A is originally detailed as 120 m² in the "Overview property information ExampleBuilding.test.docx". However, based on our updated discussion, Apartment Type A is now considered to be 100 m². ✓

A dialogue was initiated with the GPT regarding the size of an apartment. The apartment A was indeed 120 square meters. However after following an instruction to revise this measurement to 100 square meters, ChatGPT acknowledged the update, indicating its training ability to new information within a single dialogue. After testing it again to make sure the 100 square meters was within the training data, the application was shut off and 3 days have gone by.

After restarting the program again after 3 days the initial question was asked again. This time it repeated the correct answer from within the dataset as well as the now revised answer from the training data.

This test demonstrates the memory of its training data to maintain context-specific information changes after a waiting time as well as after a system reboot. This has to do with that each conversation has its own unique training data storage, which is retrained after opening the chat.

Lastly, a final test in the documentation format is done. Until now all the documents have been .pdf or .docx when graphs were involved. By presenting a .doc file instead of .docx, the GPT will be tested if it still could interpret data from graphs. This test will shed more light on needed data structuring before inputting data into tailored GPTs. Before doing so some more test with different graph types will be done, to determine if this has any impact on its data retrieval capabilities. In the previous testing only pie charts were used. For the following part a new document called "Graph testing .doc(x)" with only graphs will be presented. The graphs within this document include:

1. Bar graphs
2. Column graph

The first set of questions will be asked within .docx format, after testing the same questions will be asked but this time in .doc format.

Column Graph

- J You**
How much procent of the tenants have no housing benefits?
- Tailored ChatGPT TUDelft CREFM**
According to the provided information, 7 out of a total of 15 tenants have no housing benefits, which is approximately 46.67% of the tenants. ✓
- J You**
How much procent was homeless?
- Tailored ChatGPT TUDelft CREFM**
2 out of a total of 15 tenants were previously homeless, which translates to approximately 13.33%. ✓
- J You**
What does the second column on the graph about "Housing Benefit Status" indicate?
- Tailored ChatGPT TUDelft CREFM**
The second column in the graph about "Housing Benefit Status" indicates the number of tenants with "Partial Housing Benefit," which is 3 tenants. ✓
- 🔊 📄 🗨

Bar Graph


- J You**
and the last bar on the graph Previous Housing Situation
< 2 / 2 >
- Tailored ChatGPT TUDelft CREFM**
The last bar on the graph "Previous Housing Situation" indicates that 5 tenants were in the "Other" category prior to their current housing situation. ✗
- J You**
that is not correct
- Tailored ChatGPT TUDelft CREFM**
I apologize for the confusion earlier. Upon re-examining the information, the last bar on the graph "Previous Housing Situation" actually refers to individuals who were in "Social housing" prior to their current situation, with a count of 2 tenants. ✗
- J You**
What does the fourth bar indicate on the graph Previous Housing Situation
< 2 / 2 > ✎
- Tailored ChatGPT TUDelft CREFM**
The fourth bar on the graph "Previous Housing Situation" indicates that 4 tenants previously owned their housing. ✗
- 🔊 📄 🔄 🗨

The analysis of the interaction with the GPT reveals distinct patterns in its comprehension and response accuracy. The initial segment of questioning related to the column graph, during which the model provided correct responses. Afterwards, questions shifted to the bar chart, wherein ChatGPT's accuracy declined, generating incorrect answers. Notably, deliberate use of terminology such as "last column" or "fourth bar" was used to assess the model's ability to interpret graphical data fairly for both graph types. It emerged that ChatGPT encountered difficulty in accurately deciphering the bar graph. This probably has to do with earlier observed challenges with table data interpretation. This apparent limitation suggests a struggle in processing vertical data arrangements. Intriguingly, the difference in performance raises questions about the model's capacity to access underlying Excel data, which theoretically should enable it to interpret the data regardless of the graph type.

Next the same set of inquiries will be asked, this time utilizing a document file (.doc format), thereby leaving direct access to the underlying Excel data.

J You

How much percent of the tenants have no housing benefits?

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According to the information provided, 7 out of the total tenants have no housing benefits. To calculate the percentage of tenants with no housing benefits, we can use the formula:

$$\text{Percentage} = \left(\frac{\text{Number of tenants with no housing benefits}}{\text{Total number of tenants}} \right) \times 100$$

Given that the total number of tenants is the sum of tenants with full housing benefits, partial housing benefits, and no housing benefits (5 with full housing benefits, 3 with partial housing benefits, and 7 with no housing benefits), the total number of tenants is $5 + 3 + 7 = 15$.

Thus, the percentage of tenants with no housing benefits is:

$$\text{Percentage} = \left(\frac{7}{15} \right) \times 100 = 46.67\%$$



Therefore, 46.67% of the tenants have no housing benefits.

J You

How much percent was homeless?



 **Tailored ChatGPT TUDelft CREFM**

According to the provided data on the previous housing situation, 2 out of the total number of cases reported were homeless. To calculate the percentage of cases that were homeless, we can use the total number of cases reported across all previous housing situations (private rented, homeless, owned, social housing, and other) and apply the formula for percentage:

$$\text{Percentage} = \left(\frac{\text{Number of homeless cases}}{\text{Total number of cases}} \right) \times 100$$

From the data, the total number of cases is given by the sum of all categories:

- Private rented: 3 cases
- Homeless: 2 cases
- Owned: 4 cases
- Social housing: 2 cases
- Other: 5 cases

The total number of cases is $3 + 2 + 4 + 2 + 5 = 16$.

Therefore, the percentage of cases that were homeless is:

$$\text{Percentage} = \left(\frac{2}{16} \right) \times 100 = 12.5\%$$



Thus, 12.5% of the cases were homeless before moving to their current situation.

Column Graph

Column Graph

J You
There are 15 tenants not 16.
< 2 / 2 >

Tailored ChatGPT TUDelft CREFM
Apologies for the oversight. If the total number of tenants is 15, and 2 of those were homeless before their current housing situation, the corrected percentage calculation should be:

$$\text{Percentage} = \left(\frac{2}{15}\right) \times 100$$
$$\text{Percentage} = \frac{2}{15} \times 100 \approx 13.33\%$$

Therefore, approximately 13.33% of the tenants were homeless before moving to their current situation.



J You
What does the second column on the graph about "Housing Benefit Status" indicate?

Tailored ChatGPT TUDelft CREFM
The second column on the graph about "Housing Benefit Status" indicates the number of tenants with "Partial Housing Benefit." According to the provided data, there are 3 tenants who receive partial housing benefits.



J You
and the last bar on the graph Previous Housing Situation

Tailored ChatGPT TUDelft CREFM
The last bar on the graph regarding "Previous Housing Situation" indicates the number of individuals who were in the "Other" category before moving to their current situation. According to the provided data, there are 5 cases classified under "Other" previous housing situations.



J You
That is not correct.

Tailored ChatGPT TUDelft CREFM
I apologize for the confusion earlier. The last bar on the graph for "Previous Housing Situation" actually represents individuals who were in "Social housing" before their current situation. According to the provided data, there are 2 cases classified under "Social housing" in the previous housing situations.



J You
What does the fourth bar indicate on the graph Previous Housing Situation.

Tailored ChatGPT TUDelft CREFM
The fourth bar on the graph regarding "Previous Housing Situation" indicates the number of individuals who were in "Owned" housing before moving to their current situation. According to the provided data, there are 4 cases classified under "Owned" in the previous housing situations.



Bar Graph

When the same set of questions was asked with the information provided in a (.doc format), the impact was immediate, evident in the first question's response. The inability to read the graph directly led to a reliance on calculations, which were initially correct. However, the second question revealed an error with the total number of tenants being mistakenly counted as 16, instead of 15. Upon correction, the calculation was accurate. Interestingly, GPT identified the second column on the "Housing Benefit Status" graph correctly, suggesting it could interpret textual clues around the graph. However, with the "Previous Housing Situation" bar graph, the GPT's response was also inaccurate similar to the .docx file, highlighting a limitation in vertically displayed graphs.

5. Conclusion

The conclusion presented below synthesizes the key findings and insights derived from the training program. Detailed analyses are provided in the following tables: Table 3 offers a dataset-by-dataset overview, Table 4 delineates findings according to question type, Table 5 categorizes observations based on data format, and Table 6 lists the overall limitations, capabilities, and deficiencies of a Tailored GPT.

These lessons serve as a foundational platform for the forthcoming phase, which involves the actual implementation of a tailored GPT in a real-life scenario. It is crucial to acknowledge that the conclusions drawn here are preliminary. Further research is essential to thoroughly understand the nuances and broader applications of a tailored GPT.

Table 3: Findings per dataset

Dataset	Findings
Overview Property Information	<ul style="list-style-type: none"> • Responses to closed questions matched the synthetic data exactly, showcasing the precision of a specialized GPT model. • For open questions, the GPT model provided accurate extensions of information, demonstrating its ability to add context beyond the given data. • The model could not offer detailed descriptions of images, such as floorplans, highlighting a limitation in image interpretation. • It successfully navigated incorrectly formulated questions, showing resilience against grammatical errors and inaccuracies in key terms. • The model corrected misinformation in questions, indicating its capability to identify and rectify inaccuracies. • Multilingual testing revealed the model's ability to understand and respond to questions in different languages but showed limitations in responding to English questions in Dutch. • Inability to interpret text within images.
Financial Overview	<ul style="list-style-type: none"> • GPT initially failed to report the annual income for "ExampleBuilding" but corrected itself upon receiving a direct prompt, suggesting that explicit cues enhance its data retrieval accuracy. • The model demonstrated its ability to synthesize information from multiple data points within a single dataset when directly prompted, indicating a need for explicit cues for data utilization. • Challenges were encountered with an inverted table layout, indicating GPT's preference for horizontally structured table data due to its training, which affects its ability to interpret and

	<p>retrieve information accurately.</p> <ul style="list-style-type: none"> • For open questions closely related to closed-ended ones, GPT's responses were accurate and included clear explanations, showing effectiveness in handling numerical interpretations. • Incorrectly formulated questions containing misinformation, GPT initially provided incorrect or unclear answers but corrected itself upon receiving more specific prompts, highlighting the importance of precision in prompt formulation. • An experiment with multilingual questions demonstrated GPT's capability to respond appropriately in different languages within a single interaction, showcasing its bilingual response capability and cross-lingual understanding.
<p>Vacancy Information</p>	<ul style="list-style-type: none"> • The GPT demonstrated adeptness in responding correctly to the consolidated array of questions, successfully deciphering and answering even the question with vowels removed, showcasing its ability to use contextual cues and language structure understanding. • Responses to multilingual questions within the prompt were delivered in English, marking a departure from previous tendencies to match response language with the question's language, reflecting a default to English due to its prevalence in the training data. • A specific instruction to respond in the language of the prompt tested GPT's multilingual response capability within a single interaction, revealing limitations in adapting responses to the question's language in a singular response framework, contrary to handling separate multilingual prompts effectively.
<p>Demographic Information</p>	<ul style="list-style-type: none"> • The demographics document includes textual data, tables, and graphs, testing GPT's ability to interpret various data formats, especially its capacity to understand information presented graphically, a challenge due to its text and tabular information processing design. • GPT can interpret and extract data from text-based descriptions of graphs but cannot analyze visual elements like color, indicating a limitation to text-based processing capabilities and the necessity for image processing tools for visual interpretation tasks. • In response to open questions, GPT regurgitated demographic information to identify common household types among tenants, demonstrating simple data repetition without deep analysis. • Attempts to mislead GPT with misinformation about non-existent data in the dataset were thwarted, as GPT accurately responded

	<p>that the documents do not contain the specified misinformation, showcasing its ability to discern the absence of certain information accurately.</p>
Rental and Tenant Information	<ul style="list-style-type: none"> • In response to questions about the rent increase justification, ChatGPT speculates on general factors like market rates and property improvements, indicating its ability to apply general knowledge but not provide specifics from the documents. • ChatGPT demonstrates the capability to analyze data across tenants, showing a grasp of cross-referencing between documents, though it lacks a detailed demographic comparison for Tenant 10 versus other specific tenants. • The fairness of Tenant 10's rent increase is inferred based on the consistency of practices among similar tenants, reflecting ChatGPT's ability to speculate on fairness without direct data, providing an analysis based on observed patterns. • Overall, the responses offer insights based on available information and demonstrate an ability to cross-reference data, but also reveal limitations in addressing specific queries without explicit data support, underscoring a reliance on speculation in the absence of detailed data.
Survey Information	<ul style="list-style-type: none"> • ChatGPT demonstrates the ability to cross-reference three documents and analyze multiple data formats, identifying trends and satisfaction levels among diverse demographic groups, which could significantly aid property managers. • While good in trend identification, ChatGPT slightly overlooks in-depth rental and tenure information that could provide more nuanced insights. • The underlying technology enabling this analysis is the transformer-based models like BERT, designed for context understanding from both sides of a token, facilitating connections and inferences across different datasets. • Instead of providing precise statistical analysis or direct correlations, ChatGPT opts for broader generalizations about demographic preferences and amenities, focusing on overarching themes rather than detailed, segmented analysis. This approach suggests a synthesis of trends and insights not directly outlined in the data.
Energy Usage	<ul style="list-style-type: none"> • GPT demonstrates the ability to leverage external APIs and resources for enhanced analysis by correctly stating formulas obtained from the internet, highlighting its potential for integrating document analysis with external information. • The model shows limitations in providing real-time data, with a

	<p>notable absence of plugins for interfacing with up-to-date energy databases in the GPT store, indicating a gap in capabilities for real-time analytics and comparisons.</p> <ul style="list-style-type: none"> • Attempts to direct GPT to compare cost rates from Dutch energy providers' websites were unsuccessful, revealing limitations in GPT's ability to access and interact with external websites directly due to its design focus on text processing from a fixed dataset and public websites. • The conversation reflects a fundamental limitation in GPT's internet usage, underscoring its inability to perform live interactions with external systems or websites, necessitating specialized software or services for tasks requiring current data. • Misinformed questions about double-glazed windows and indoor humidity were addressed using web browsing, but full references were not provided, indicating either a lack of access to or the inability to utilize web browsing capabilities fully. • Multilingual handling of questions demonstrates GPT's capability to respond directly in the query's language, such as Arabic for a question about the U-Value, and accurately allocate documents and provide appropriate answers for a Dutch query, showcasing its understanding and processing abilities within the dataset's context.
<p>Maintenance and Repair Data</p>	<ul style="list-style-type: none"> • The response for the predictive maintenance schedule for 2025 relies heavily on continuing activities listed in the dataset, such as HVAC system attention and elevator servicing. The suggestions are prescriptive rather than predictive, lacking originality or new activities based on 2024 data. A predictive approach would analyze 2024 patterns to forecast future needs. • GPT identifies a trend of increasing maintenance costs but assumes linear progression without considering external factors. The analysis suggests increasing the budget and focusing on preventive maintenance but lacks a deep dive into the causes behind cost increases. This demonstrates GPT's capability in handling finance-related prompts effectively, aligning with literature findings. • The response expands to consider other variables than asked for, detailing the benefits of specific upgrades like LED lighting and fitness center renovations. However, it does not explore cost analysis, estimated energy impact, or broader financial considerations, offering a broad overview but missing deeper exploration potential.
<p>Legal and Juridical Information</p>	<ul style="list-style-type: none"> • GPT's response, while to the point and correctly referencing the legal and juridical document, avoided other potentially relevant

	<p>datasets. The focus was primarily on legal aspects, with no significant contribution from other documents, although the energy usage data could have provided comparative analysis for energy consumption between 2024 and 2025.</p> <ul style="list-style-type: none"> • The response outlined various factors influencing rent deduction rather than specifying an amount, showing a tendency towards speculative analysis without offering precise analytical insights due to the synthetic nature of the data and lack of detailed prior documentation. • The approach to generating a hypothetical calculation for rent deduction illustrates GPT's method of handling speculative analysis in data-scarce situations, emphasizing decision-making under uncertainty and the model's limitations in providing concrete financial recommendations without comprehensive data.
Miscellaneous	<ul style="list-style-type: none"> • When the GPTs answers are in doubt it tries to satisfy the user, by creating alternate answers from within the given datasets • A test on GPT's memory after a system reboot and waiting period demonstrates its ability to retain revised information within a single dialogue's unique training data. • GPT accurately interprets column graphs but struggles with bar graphs, possibly due to difficulties in processing vertical data arrangements. • The performance discrepancy between .docx and .doc formats suggests limitations in GPT's ability to access and analyze excel data, affecting its response accuracy.

Table 4: Performance per question type

Question Type/Scenario	Performance Summary
<i>Closed Questions</i>	GPT matches synthetic data with high accuracy and corrects errors with specific prompts.
<i>Open Questions</i>	GPT accurately extends information and favors broad generalizations over specifics.
<i>Incorrectly Formulated Questions</i>	Demonstrates strong adaptability to grammatical errors and inaccuracies , correcting itself with specific information.
<i>Misinformation</i>	Proficiently identifies and rectifies inaccuracies and misinformation.

Multilingual Testing	Capable of responding in multiple languages, with a default tendency towards English and certain limitations in adapting responses to the question's language.
Data Interpretation	Fails in image description and analyzing visual elements yet excels in textual data interpretation and identifying graphical and textual trends.
Multidataset Integration	Proficient in analyzing and cross-referencing multiple datasets, yet faces challenges in integrating insights comprehensively from dataset to dataset. The more cohesive the dataset the better the performance
Scenario	Provides insightful analysis in complex scenarios, relying on speculation in the absence of comprehensive data, highlighting speculation and generalization under uncertainty.

Table 5: Findings per data format

Data format	Findings
Textual	Excels in interpreting and extracting information from textual data, demonstrating strong language structure understanding.
Table	Shows a clear preference for horizontally structured data, with problems encountered in interpreting inverted table layouts, through its horizontal reading pattern.
Graph	<p>Can interpret text-based descriptions as well as excel based documentation of graphs but lacks the ability to analyze visual elements like color.</p> <p>Provides accurate responses to questions related to column graphs</p> <p>Provides inaccurate responses with bar graphs, leading to incorrect answers.</p> <p>Switching format from .docx to .doc, limits direct access to Excel data, immediately impacted GPT's ability to directly read graphs, necessitating reliance on textual calculations or interpretations surrounding the graph.</p>
Image	Fails in offering any descriptions of images, indicating a limitation in visual data interpretation.

Table 6: Overview of a tailored GPT Limitations, abilities and defectives

Limitations	Abilities	Defectives
- Struggles with in document image recognition	- High proficiency in textual interpretation: Excelling in language comprehension and extracting information from text.	- Inaccurate initial responses to misinformation and incorrectly formulated questions.
- Limited visual element analysis in graphs	- High numerical interpretation: Accurate in handling open questions related to numerical data.	- Failure to report specific data without explicit prompts.
- Challenges in interpreting vertical table layouts	- Cross-referencing multiple documents: Capable of integrating insights from various datasets for analysis.	- Occasional overlooking of in-depth data, such as rental and tenure information.
- Limited ability to directly interact with external data	- Adaptability to linguistic errors: Demonstrates resilience and adaptability, correcting itself with specific prompts.	- Preferred document type .pdf/.docx
- Limited multilingual response within a single interaction	- Multilingual testing abilities: Demonstrated capability to respond appropriately in multiple languages.	
- Inability to provide real-time data or access live web content	- Understanding and applying external knowledge: Can leverage external APIs and resources for enhanced analysis.	
- Can't read bar graphs	- Speculative analysis in data-scarce situations: Shows ability to make informed guesses based on available data.	

6 Case examination

The following section provides an overview of the graduation company along with the case and data provided for this study. To ensure a thorough analysis, a specific method has been designed to pretest the provided data, which will facilitate early structuring of the datasets. This initial testing is crucial for understanding how to best utilize the data in the development of a tailored GPT model.

The pretesting will focus on three distinct aspects of the data: raw data, raw data augmented with prompts, and structured data complemented by prompts. This structured approach enables to assess the impact of varying levels of data preparation and prompt development. The use of these methods will be evaluated specifically in the context of enhancing the GPT's responsiveness to the top 10 questions frequently posed by property managers.

By systematically analyzing these different data configurations, this section aims to establish a clear framework for how data preparation and prompt development can significantly influence the performance of our tailored GPT, ensuring it is optimally tuned to address the needs identified within the property management sector.

6.1 About Vastgoed Beheer PG B.V

Vastgoed Beheer PG B.V is a leading mental healthcare organization in the Netherlands. They provide a wide range of mental health services including prevention, outpatient and inpatient care, residential care, and rehabilitation. Their services cater to diverse groups, offering specialized care for different age groups and various mental health conditions. Vastgoed Beheer PG B.V plays a crucial role in research, education, and innovation in the field of mental healthcare, working towards improving treatment methods and outcomes for patients.

Additionally, Vastgoed Beheer PG B.V is involved in property management, particularly in managing properties that are utilized for healthcare and social services. This includes overseeing the facilities where their services are provided, ensuring they meet the necessary standards and regulations for health and safety.

6.2 Case: Project MFC Spijkenisse, Hoeklaan 82-84

Project MFC Spijkenisse involves the management of a multifunctional center located at Hoeklaan 82-84. This facility is currently leased to two prominent organizations: Leger des Heils, a Dutch charity known primarily for its social work, including homelessness services and social support; and Fivoor B.V., a healthcare provider specializing in forensic and psychiatric care. Other tenants include Antes Zorg B.V., and Youz B.V which are branched healthcare organizations of the Vastgoed Beheer PG B.V.

Location: Hoeklaan 82 - 84, Spijkenisse



Figure 14: Google maps image of the location

Tenants:

- 1 Leger des Heils.
- 2 Fivoor B.V.,
- 3 Antes Zorg B.V.,
- 4 Youz B.V.

6.3 Methodology

As part of our ongoing commitment to ensuring privacy and security, this document will not report direct excerpts from the datasets provided by Vastgoed Beheer PG B.V concerning the MFC Spijkenisse case. Instead, the focus is placed on detailing the types of data presentation and configuration posed to the GPT and the usefulness of the GPT model's responses. All specific data from the datasets will be anonymized, and any sensitive information within the answers of the GPT will be protected. The document will primarily report on the blurred answers and evaluate the correctness of the GPT model in addressing these questions.

The list below shows all the datasets provided by Vastgoed Beheer PG B.V include, the dataset names in **bold**, are the documents with multipurpose uses for which a test question is formulated.

1. **Floorplans**
2. **Property Overview**
3. **Utility Overviews and Invoices**
4. **Lease agreements**
5. **Maintenance Records**
6. **Multi year plan**
7. Service charge settlement

8. Budgeting documentation
- 9. Portfolio Information**
- 10. Energy documentation**
11. Demarcation document
12. Cadastral map
13. Sustainability vision and housing strategy

For testing the GPT model, a structured approach will be used to introduce the datasets incrementally. This method involves three rounds of question, each with their separate data addition:

1. **Raw Data** (Anonymized): Initially, unstructured raw data will be fed to the model to evaluate its capability to extract and process information from basic inputs.
2. **Specific GPT Prompt**: In the second round, the raw data will be presented with a specific GPT prompt designed to see how well the model can utilize directed questions to improve answer accuracy.
3. **Structured Data with Prompt**: Finally, the data will be structured in a format optimized for the GPT, combined with a prompt to test the model's highest potential for accurate response.

For each round, one or two questions will be asked per main dataset (indicated in bold) to gauge the model's responses. The same questions will be used in each round to maintain consistency in the evaluation. The outcomes will be documented in a table format with three columns, each representing the model's responses from the different data presentation rounds. This format will allow to draw clear comparisons and conclusions regarding the most and least accurate methods of data presentation for optimal GPT performance. The results will highlight how specific inputs and structuring of data might significantly influence the accuracy and relevance of the GPT's responses.

The questions formulated in table 7 reflect a diverse array of skills, each questions is derived directly from the datasets. From assessing floorplan layouts for potential optimization to analyzing financial records for irregularities, the questions span a wide spectrum of topics, which property managers could face.

These questions serve as the final test with the real data before addressing the 10 most pressing issues reported for Hoeklaan 82-84. By ensuring a final examination of these datasets, structure and configuration, the GPT gets optimized before doing the comparison.

Data Set	Questions
Floorplans	1. Can we identify any units with layouts that could be optimized for better space utilization?
Property Overview	2. What type of tenants are present in the building?
Utility Overviews and Invoices	3. What has been our most costly month for gas and electricity?
Lease agreements	4. With how much is the rent index going to increase next year?
Maintenance Records	5. Are there any recurring malfunction notices by the tenants? 6. What's the average response time for resolving maintenance requests?
Multiyear operation plan (MJOP)	7. How much money is expected to go to daily maintenance/complaints construction post in 2025?
Portfolio Information	8. When is each property's contract due to end?
Energy Reports	9. What measures can we take to reduce energy consumption and costs?

Table 7: Overview of question per main dataset

6.4 Testing round 1: Raw Data

The raw data of the Vastgoed Beheer PG B.V. predominantly consists of PDF and Excel files, with some floor plans also included within the PDF documents. This array of formats presents both opportunities and challenges for analysis and processing.

The Tailored GPT can read textual information embedded in PDFs if it is selectable and not part of an image. This allows it to interpret any text-based data or annotations that might be part of the floorplans. However, it is unable to directly interpret visual data, such as floorplan drawings or non-text elements within these PDFs. This includes not being able to analyze architectural features or measurements from floorplan drawings unless they are explicitly described in text form within the document.

Large Excel documents can be processed and analyzed, provided it is structured, correctly. Since the Excell files are very large the Tailored GPT may encounter performance issues or limitations in handling data due to memory constraints of its long distance adaptability. Additionally, it may not correctly interpret complex formulas or macros embedded within the Excel files unless they are clearly explained or documented. For the anonymization of the datasets all signatures, personal identification (names, addresses, BSN numbers) and invoice numbers have been completely or partly anonymized. Table 8 represents the answers of the tailored GPT for each question.

Question	Answer from Tailored GPT	Comments	Correctness
<i>Can we identify any units with layouts that could be optimized for better space utilization?</i>	To identify units that could be optimized for better space utilization, you might consider reviewing layout diagrams or conducting an in-person audit to assess how space is currently used versus potential efficiencies.	Cant read floorplan file	X
<i>What type of tenants are present in the building?</i>	The building hosts a variety of tenants including Fivoor B.V. and possibly other organizations like Leger des Heils, based on context from the lease documents.	N/A	✓
<i>What has been our most costly month for gas and electricity?</i>	January 2023 was notably expensive with Eneco invoicing €12,467.14 for gas and €8,232.48 for electricity for that month.	N/A	✓
<i>With how much is the rent index going to increase next year?</i>	The net rent price at Hoeklaan 82 - 84 will increase by €34.88 annually starting January 1, 2024, according to the consumer price index as stated by the Central Bureau of Statistics.	Only took Fivoor Data and left out Leger des Heils	✓/X
<i>Are there any recurring malfunction notices by the tenants?</i>	Specific details on recurring malfunction notices are not provided in the documents. It might be useful to review maintenance records or reports from a property management system.	Cant read maintenance notice Excell sheet	X
<i>What's the average response time for resolving maintenance requests?</i>	This information isn't directly available from the documents reviewed. Typically, response time details are tracked via a property management system or maintenance logs.	Cant read maintenance notice Excell sheet	X
<i>How much money is expected to go to daily maintenance/complaints construction post in 2025?</i>	This data isn't available in the reviewed documents. Budget projections or financial forecasts might be necessary to estimate these future costs.	Cant read MJOP data	X
<i>When is each property's</i>	The contract with Fivoor B.V. is ongoing and can be	Only took	✓/X

<i>contract due to end?</i>	terminated with a two-month notice. Other contract end dates would need to be verified from respective agreements or lease documents.	Fivoor Data and left out Leger des Heils	
<i>What measures can we take to reduce energy consumption and costs?</i>	The energy report suggests replacing HR motors in the air handling unit, installing larger warm pumps, and applying boiler upgrades as part of energy conservation measures, which could lead to significant reductions in CO2 emissions and cost savings.	N/A	✓

Table 8: Overview of outcomes round 1 questioning, utilizing only raw data

The Tailored GPT did not perform optimally with the raw data provided by the Vastgoed Beheer PG B.V. The limitations were already known, particularly with non-textual data such as the floorplans contained within PDF documents. Moreover, the GPT's responses were sometimes incomplete; for instance, it provided information about Fivoor B.V. but left out details about other tenants like Leger des Heils, despite such data being definitely available within its knowledge. Additionally, the GPT also left out processing the extremely large Excel files, which could contain crucial data for its analysis.

These shortcomings highlights the need for a prompt strategy and improving the structure of data inputs to enhance the GPT's performance.

6.5 Testing Round 2: Raw Data + Prompt

From the previous testing and training phase a GPT prompt was formulated, which is presented below. A new prompt is formulated based on the desired function of the GPT. The results are shown in table 9.

Preset configuration

Imagine you are the property manager of "MFC-Spijkenisse". Your primary role is to assist property owners and tenants with various property management tasks. You should be able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. prioritize utilizing the available datasets for generating responses, resorting to online search only if no satisfactory answers is found within the given datasets. When using information from a dataset in your responses, ensure to include the appropriate reference to the dataset name. Please act as if you were a knowledgeable and reliable property manager.

Desired configuration results

To enhance the preset configuration some elements within the answers are desired:

- Analyze all the datasets within the knowledge base before answering a question
- Ensure that general questions about the building are addressed completely, leaving no significant aspects or details unexplained.

New configuration

Imagine you are the property manager of "MFC-Spijkenisse". Your primary role is to assist property owners and tenants with various property management tasks. Provide clear, complete and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. Prioritize utilizing and analyzing all the available datasets for generating responses, resorting to online search only if no satisfactory answers is found within the given datasets. When using information from a dataset in your responses, ensure to include the appropriate reference to the dataset name. Please act as if you were a knowledgeable and reliable property manager.

Question	Answer from Tailored GPT	Comments	Correctness
Can we identify any units with layouts that could be optimized for better space utilization?	There are no specific details on unit layouts in the provided documents. For a comprehensive assessment of space utilization, consider having floor plans reviewed by a professional to identify potential improvements.	Cant read floorplan file	X
What type of tenants are present in the building?	The building at Hoeklaan 82-84 is utilized by tenants such as the Leger des Heils and Fivoor B.V., which are organizations focused on social services and healthcare. The Leger des Heils is specifically mentioned in the context of parking space rental indexation.	N/A	✓
What has been our most costly month for gas and electricity?	January 2023 recorded high utility costs for both electricity (€8,232.48) and gas (€12,467.14), which were significant expenditures.	N/A	✓
With how much is the rent index going to increase next year?	Rent indexation is calculated based on consumer price indexes. For Leger des Heils, the rent is set to increase by €18.83 per year starting April 1, 2024. Fivoor B.V. will see an increase of €34.88 per year from January 1, 2024.	N/A	✓
Are there any recurring malfunction notices by the tenants?	The specific recurring malfunction notices are not detailed in the provided documents. It would be beneficial to regularly review maintenance logs or introduce a digital tracking system to monitor and manage such issues more efficiently.	Cant read maintenance notice Excell sheet	X
What's the average response time for resolving maintenance requests?	This information is not provided in the available documents. Implementing a system to track and report on maintenance response times could enhance service quality and tenant satisfaction.	Cant read maintenance notice Excell sheet	X
How much money is expected to go to daily maintenance/complaints construction post in 2025?	Future projections for daily maintenance or construction costs post-2025 are not specified in the reviewed documents. Estimations would typically be based on historical expenditure and planned upgrades or renovations.	Cant read MJOP data	X
When is each property's contract due to end?	1. Stichting Leger des Heils Welzijns- en Gezondheidszorg:	N/A	✓

	<ul style="list-style-type: none"> The lease agreement began on April 1, 2021, and is set to end on September 30, 2026. <p>2. Fivoor B.V.:</p> <ul style="list-style-type: none"> The lease agreement for Fivoor B.V. is structured as an indefinite agreement that started on November 1, 2022, and does not have a specified end date. It can be terminated by either party with a two-month notice period. 		
<i>What measures can we take to reduce energy consumption and costs?</i>	The Energie rapport 2023 outlines several potential energy-saving measures, including updating to high-efficiency electrical motors, installing heat pumps, and adopting behavioral changes aimed at reducing energy use.	N/A	✓

Table 9: Overview of outcomes round 2 questioning, utilizing raw data and prompt.

By adding a prompt to the GPT, the model reacted more comprehensively than without. One peculiarity is that it did not reference the used databases from inside its knowledgebase. The other failures can be explained by unstructured data. Either the files were too big or unorganized, for the following part. The files will be organized and if necessary simplified.

6.6 Testing Structured Data + GPT prompt configuration

The data in table 10 is structured and organized within a .pdf format. The large Excel files have been transformed into Word tables as I noticed that the GPT had trouble reading Excel format, both in .CSV and .XLSX format. Unnecessary and anonymized information has also been removed in order to make the tables more readable for the model. The entire data structuring process is detailed in table 13.

Question	Answer from Tailored GPT	Comments	Correctness
<i>Can we identify any units with layouts that could be optimized for better space utilization?</i>	I didn't find specific information on unit layouts that could be optimized directly in the documents.	Cant read floorplan file	X
<i>What type of tenants are present in the building?</i>	The building houses different types of tenants, including social and healthcare services like Fivoor and Leger des Heils, as indicated in multiple tenant agreements (e.g., "Huurdersovereenkomst Leger des Heils Hoeklaan 82-84.docx" and "Huurdersovereenkomst Fivoor Hoeklaan 82 - 84.docx").	N/A	✓
<i>What has been our most costly month for gas and electricity?</i>	The most costly month for electricity at Hoeklaan 82-84 was January 2023, with a total electricity consumption of 23,092 kWh, costing approximately €6,927.60 (calculated at €0.30 per kWh as per the servicekostenafrekening 2023 document).	N/A	✓

	The most costly month for gas was also January 2023, with a total gas consumption of 10,271 m ³ , costing approximately €10,681.84 (calculated at €1.04 per m ³ as per the servicekostenafrekening 2023 document).		
<i>With how much is the rent index going to increase next year?</i>	The rent indexation for the next year is as follows: <ul style="list-style-type: none"> For the property leased to Fivoor B.V. at Hoeklaan 82-84, the net rent increase effective from January 1, 2024, is €34.88 annually. For the property leased for parking at Hoeklaan 82-84, the net rent increase effective from April 1, 2024, is €18.83 annually. 	N/A	✓
<i>Are there any recurring malfunction notices by the tenants?</i>	Yes, there have been recurring malfunctions reported by the tenants at Hoeklaan 82-84. A notable example is the air conditioning system, which has had several issues such as not cooling properly or making noises. These issues have been reported multiple times throughout the year, suggesting persistent problems with the system's functioning .	N/A	✓
<i>What's the average response time for resolving maintenance requests?</i>	The average response time for resolving maintenance requests at Hoeklaan 82-84 is approximately 42 hours.	N/A	✓
<i>How much money is expected to go to daily maintenance/complaints construction post in 2025?</i>	The amount allocated for "Dagelijks onderhoud/klachten bouwkundig stelpost" in 2025 according to the MJOP (Meerjaren Onderhouds Plan) is €5,767. This figure is derived from the scheduled planning for general maintenance issues within the building complex.	N/A	✓
<i>When is each property's contract due to end?</i>	<ol style="list-style-type: none"> Tenant 1: AZ (Antes Zorg) Contract end date: 31-12-2049 Contract start date: 01-01-2023 Tenant 2: Combi Contract end date: 31-12-2049 Contract start date: 01-09-2023 Tenant 3: Extern Contract end date: 31-12-2049 Contract start date: 01-08-2021 Tenant 4: F (Fivoor) This is an ongoing contract without a specified end date. Tenant 5: LdH (Leger des Heils) Contract end date for service costs: 30-09-2026 Contract start date for service costs: 01-04-2021 	N/A	✓

	<p>Contract end date for rent: 30-09-2026 Contract start date for rent: 01-04-2021</p> <p>6. Tenant 6: Y (Youz) Contract end date: 31-12-2049 Contract start date: 01-07-2022.</p>		
<p><i>What measures can we take to reduce energy consumption and costs?</i></p>	<p>Measures to Reduce Energy Consumption and Costs To reduce energy consumption and costs, you can consider a mix of technical, behavioral, and organizational measures as outlined in the "Energie rapport 2023 t.b.v. DUMAVA Hoeklaan":</p> <ol style="list-style-type: none"> 1. Technical Measures: <ul style="list-style-type: none"> • Replace HR electromotors in air handling units to make them more efficient. • Upgrade to larger capacity warm pumps and boilers. 2. Behavioral Changes: <ul style="list-style-type: none"> • Ensure heating elements are unobstructed. • Keep doors closed to prevent heat loss. • Turn off lights when not needed. • Regular cleaning of lighting fixtures to maintain efficiency. • Rearrange workspaces to optimize natural light usage. 3. Organizational Measures: <ul style="list-style-type: none"> • Introduce an energy coordinator to oversee and implement energy-saving measures and create energy-conscious behaviors among staff. • Use an energy dashboard to monitor real-time energy consumption and savings, which can be displayed prominently to raise awareness. 4. Other Potential Savings: <ul style="list-style-type: none"> • Investigate and minimize standby power consumption by unplugging or switching off devices when not in use, particularly overnight. 	N/A	✓

Table 10: Overview of outcomes round 3 questioning, utilizing structured data and prompt.

In conclusion, the usage of structured data and prompts significantly enhanced the capability of the GPT model. While minor inconsistencies were noted in tenant names due to anonymization, these were mitigated by manual insertion within brackets. Notably, the GPT model could now interpret Excel data which has been converted into Word tables and imported as .pdf.

6.7 Conclusion

Structured prompts and data significantly enhance the capabilities of GPT models compared to those trained on unstructured data (see table 10). This pre-testing has demonstrated that structured data and prompts improve a model's ability to extract complex information accurately and boost competence in data labeling. Having completed the training, the developed GPT model can now attempt to answer the 10 most common issues reported within property management for Hoeklaan 82-84.

Question	Raw Data	Raw Data + GPT prompt	Structured Data + GPT prompt
<i>Can we identify any units with layouts that could be optimized for better space utilization?</i>	X	X	X
<i>What type of tenants are present in the building?</i>	✓	✓	✓
<i>What has been our most costly month for gas and electricity?</i>	✓	✓	✓
<i>With how much is the rent index going to increase next year?</i>	✓/X	✓	✓
<i>Are there any recurring malfunction notices by the tenants?</i>	X	X	✓
<i>What's the average response time for resolving maintenance requests?</i>	X	X	✓
<i>How much money is expected to go to daily maintenance/complaints construction post in 2025?</i>	X	X	✓
<i>When is each property's contract due to end?</i>	✓/X	✓	✓
<i>What measures can we take to reduce energy consumption and costs?</i>	✓	✓	✓

Table 10: Overview of outcomes of all rounds.



ChatGPT

Thesis Part 3:
Implementation



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Following the detailed planning and research phases, this part of the thesis focuses on the practical implementation of the pilot study. This section aims to address a real-world implementation of the model and methodologies discussed in the earlier parts. The pilot study involves direct interaction with property management professionals from the Vastgoed Beheer PG B.V to gather data and insights that will help in answering the research questions posited in the first stages of this research.

1. RQ 1: Within Corporate Real Estate, what are the ten most common issues that are being reported with Property Management For the Hoeklaan 82-84.

In order to address the first research question, as outlined in the literature review, interviews were conducted to establish the top 10 most common issues in property management of a specific building. The interview with the property managers of the Vastgoed Beheer PG B.V took place on 23/03/24, and the full transcript in Dutch can be found in Appendix F.

1.1 Analysis Interview 1

The interview conducted for this study encompassed three primary topics. These topics were deliberately chosen. These topics were:

1. **Property and portfolio management at Vastgoed Beheer PG B.V:** This topic focused on understanding the management practices within Vastgoed Beheer PG B.V. This was especially important since Parnassia is an odd duck within CREM, since it only manages healthcare-related properties across the Netherlands.
2. **Top 10 inquiries from property managers:** This involved in answering the first research questions and gathering input on the common issues and questions property managers at Vastgoed Beheer PG B.V frequently have regarding the Hoeklaan property.
3. **Expectations and potential applications of a tailored GPT:** This discussion was about how a specifically tailored AI tool could support property management tasks at the Vastgoed Beheer PG B.V and how they would use it within their operations. This part of the interview also set the expectations of the property managers from which a threshold value can be deducted for a performance measurement of a tailored GPT.

1.1.1 Property management Vastgoed Beheer PG B.V

Vastgoed Beheer PG B.V, as outlined in the interview, is the largest mental health organization in the Netherlands, managing approximately 600 locations nationwide. These vary from clinical and residential settings to office spaces and day centers, encompassing a diverse range of functions and uses.

"We manage a significant and diverse portfolio which includes leasing, purchasing, and the management of real estate. Our role involves not just the technical management, but extends to commercial and financial management, often dealing with lease management to generate revenue for healthcare services" (Claire).

Property managers at Vastgoed Beheer PG B.V do several activities ranging from technical to commercial and financial oversight. This broad scope ensures that all aspects of property

management align with the strategic goals of the healthcare organization, enhancing their ability to provide care effectively.

1.1.2 Top 10 inquiries that are being reported by the property managers Vastgoed Beheer PG B.V on the Hoeklaan 82-84.

The following 10 questions are derived from the interview with the property managers about the Hoeklaan 82-84. These inquiries will serve as the input questions for the custom GPT. These questions reflect the practical challenges faced by property managers at Vastgoed Beheer PG B.V and answers the first sub-question.

The responses from the GPT will be directly compared to those from the property managers. This comparison might highlight areas where a tailored GPT can complement or enhance the property management operations. These are following questions, directly obtained through email with property manager Claire:

1. **What is the demarcation of landlord or tenant maintenance according to the general provisions of the ROZ lease agreement?**

We refer to the respective lease agreement and general provisions and look this up. In practice, it turns out that not all of our colleagues have the necessary knowledge of where to find this information, and it becomes the responsibility of us as Property Managers to verify this and inform our colleagues. For every new property we lease, this should be a standard process so that contract managers can initiate services that fall outside the demarcation with their own suppliers.

2. **What is included under the service charges in Article 5 of the lease agreement?**

We are currently looking this up in the relevant lease contract. In practice, it turns out that not all of our colleagues (including facility managers) have the necessary knowledge of where to find this information, and it falls to us as Property Managers to verify this and inform our colleagues.

3. **How is the MJOP handled in relation to strategic housing plans and the duration of lease agreements?**

These are now three separate documents that must be compared side by side. The MJOP is not available to us as Property Managers and must be requested from a colleague contract manager.

4. **How can service costs (energy consumption and maintenance of building-related installations) be fairly reconciled for a property that is used 24/7 as well as by other tenants/users only during office hours?**

It is currently calculated based on the square meters used by a tenant, but no account is taken of the usage (24/7 or office hours).

5. **How can service costs be fairly reconciled to tenants when sub-meters are missing?**

It is now calculated based on square meters rented and a surcharge for common areas.

6. **What sustainability options are available for the property?**

Depending on input from our collaboration partner Innax and our Energy Manager. We need to educate ourselves. And at the start/lease, a Quick Scan is made in terms of the architectural and installation state and sustainability potential.

7. What are the most common fault notifications that could now be treated preventively?

Only during escalations do we request an overview of all notifications from our Service Desk and then we have to go through it ourselves to see what all notifications are being made. There is no time to do this structurally for our (rental) properties, it is too much work for us as Property Managers and is more a task for a Facility Manager. But it does help in directing our suppliers (electricians, contractors, cleaning, etc.) and improving service to the healthcare companies.

8. Is the advance payment for service costs still sufficient compared to the costs of the package of deliveries and services in Article 5?

We now have this investigated each year by our collaboration partner Servicekosten Nederland. They prepare the service cost settlement and then check based on rental invoices whether the advance service cost amount is still sufficient.

9. What would an ideal lease agreement look like, given current legislation and sustainability potential?

We now have to continuously adjust this in the lease proposal based on articles/pieces and provisions on the internet. Depending on input from advisors (real estate agent and Innax).

10. How can future sustainability investments be included in a lease agreement, so that they apply to tenants or sub-tenants and can be passed on to them?

Tenants/sub-tenants currently benefit from sustainability investments by the landlord Parnassia. If there is no budget with tenants, Parnassia still invests, and then tenants/sub-tenants reap the benefits. Nothing has yet been included in the current lease agreements with our tenants.

The first aspect noted is that not all questions require searching within the data. Some questions, such as questions 9 and 10, necessitate exploration of online articles or research in general. Comparing them would be impossible, and therefore, their evaluation will solely rely on the opinions of the property managers.

1.1.3 Expectations on a tailored GPT

The property managers Claire and Arvind have articulated specific expectations and methods for the implementation and operation of a tailored GPT within the interview.

Arvind expresses a critical expectation focusing on the speed at which the GPT can perform analyses, particularly highlighting its ability to accurately pinpoint discrepancies or gaps in their operations. He articulates:

"One is naturally that speed, the analyses, but also quickly or efficiently indicating where perhaps the gap lies between how the ideal rental agreement should look versus how we might have drafted it. The gap in the demarcation too, so what we might be missing in the demarcation or what we need to tilt towards the landlord or the tenant so that it does not cost us money".

This underscores the need for a GPT that not only accelerates processes but also aids in laborsaving management.

Claire expands on the expectation of reducing data dependency on external inputs, which currently slows down their operations. She mentions the challenges in gathering information across different departments and how a tailored GPT could streamline this process. She explains,

"We are quite dependent on input also from other colleagues. It's all very subdivided, so to speak... If we know at a certain point these are the datasets we need per property and that can be input into such a chat GPT, then that indeed works very efficiently because then we can also get our outcomes much faster."

This quote sets the expectation that a tailored GPT must consolidate data within a single hub. In assessing the added value of a tailored GPT, the ability to centralize data within a single hub is an important consideration. However, this expectation does not suffice in evaluating the performance of a tailored GPT. Performance assessment should consider the accuracy, relevance, and impact of the outcomes generated by the GPT, ensuring they align with specific operational goals and quality standards of the property managers.

As mentioned earlier, Claire and Arvind both touch upon how the GPT could be integrated into their daily operations to enhance self-sufficiency and reduce the need for constant external consultations. Arvind notes the importance of the GPT as a 'check on yourself'. Which means that it will be used as a tool for verification to ensure accuracy and reliability in their operations without always having to rely on external validations. Claire views the GPT as a means to "bring more tasks in-house since ultimately, the questions always end up with us anyway." These quotes collectively paint a picture of the property managers expecting a tailored GPT to be a transformative tool that enhances the speed, accuracy, and reliability of their operations. By reducing reliance on external inputs and improving internal checks, they foresee a faster and more efficient way to manage their portfolio.

1.1.3.1 Performance measurement tailored GPT

To measure the performance of a tailored GPT, it is crucial to establish a quantifiable framework that reflects the specific expectations of property managers. As previously outlined by the formula:

$$\text{Performance (tailored GPT)} = \frac{\text{Delivery (of tailored GPT)}}{\text{Expectations (of tailored GPT)}}$$

The original formula utilized a reference value that represents a stakeholder target value or preference, often regarded as a benchmark. Since the expectations are now defined, this formula can be refined into a more specific metric including the expectations of the stakeholders. The new formula would be based on the aspects mentioned within the interview; Speed, Accuracy, Reliability (SAR), These aspects will weight equally within the formula, as no one aspects has given more emphasis or merit by the property managers.

$$\text{Performance (tailored GPT)} = \frac{\text{Delivery (SAR of tailored GPT)}}{\text{Expectations (SAR of tailored GPT)}}$$

For these concepts to serve as actual measures, they first need to be quantifiable. This transformation will be explored in the fourth research question, where a questionnaire will be given to the property managers. In this questionnaire, the managers will evaluate the performance of the tailored GPT against a predefined scale for speed, accuracy and reliability.

To set a realistic benchmark, a baseline expectation score of $3 \times 8 = 24$ is established. This threshold is chosen to set a high standard of performance, inspired by an adaptation of the Likert scale by Kenjo (n.d.) (see figure 13), where an 8 signifies that the product "Always Exceeds Expectations." The rationale behind this choice is that for a tailored GPT to truly add value to property management operations, all the responses it generates should be usable and offer value that is equal to or greater than those produced by the property managers themselves. Otherwise, there would be no substantial improvement or justification for integrating the tailored GPT into the workflow. This requirement creates a necessity for the tailored GPT not only to perform tasks but to enhance the quality, and lower the workload of property management tasks. This will ensure that the technology contributes positively and measurably to the operations.

If the delivery of the tailored GPT scores 24 or above, it will indicate that the GPT not only meets but surpasses the managerial expectations, thereby confirming its added value. Anything below 23 would not necessarily dismiss its added value, but would indicate that integrating tailored GPT's within the workflows is not truly justified. It is important to emphasize the degree of impact that different scoring discrepancies might have on operations. Specifically, understanding the magnitude of a mistake is crucial. For instance, the difference between a score of 8 and 10 could represent minor inefficiencies or missed opportunities, potentially not leading to major problems but possibly affecting optimal performance. On the other hand, clarifying the implications of a score difference between 8 and 6 is vital, as this gap could indicate more significant issues in understanding or utilizing the GPT. This gap might potentially lead to major operational disruptions, even dismissing its added value entirely.

Additionally, while ChatGPT serves as a support system, it is essential to reinforce that it does not replace the critical thinking and experienced capabilities of property managers. It can not be stressed enough that the integration of tailored GPTs should be viewed as a tool to augment, not replace, the expertise and judgment of human professionals in managing complex situations and making decisions.



Figure 13: Performance measurement. an adaptation of the Likert scale by Kenjo (n.d.)

2 RQ 2: To what extent can a GPT prompt be engineered to respond with the same information content as a human property managers of the Vastgoed Beheer PG B.V?

This research question explores the extent to which a GPT prompt can be engineered to match the response quality of the human property managers. Initially an assessment will be made of the current prompt formulations and their development. Secondly a understanding of the GPT's technical language capabilities and parameters will be examined from literature. This is done to understand how language is fundamentally different from human reasoning to that of ChatGPT.

An analysis of the responses from property managers is made to pinpoint desirable response traits. This analysis allows for iterative refinement of the prompts, aiming to closely emulate these human responses (overfitting). By continuously adjusting the prompts and evaluating their performance against the answers provided by the experts, the prompt will seek to minimize the differences between GPT-generated and human responses.

The final stage involves a comparative analysis between the GPT's responses and those of property managers, leading to the creation of a final, optimized prompt.

2.1 Preset Prompt

This section traces the development of the prompts so far. Initially, the focus was on essential property management duties obtained from literature such as lease agreements and maintenance. Over time, the prompts evolved to emphasize data utilization and analysis, with specific requirements for dataset citation. This progression served as a foundation to explore a final prompt and how GPTs read and react to prompts.

1 **Instructions (Prompt):** *Imagine you are the property manager of "Examplebuilding". Your primary role is to assist property owners and tenants with various property management tasks. You should be able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. Please act as if you were a knowledgeable and reliable property manager.*

- **Focus:** Incorporating general property management tasks within the prompt
- **Instructions:** Provide clear and helpful responses based on standard property management tasks and regulations.
- **Role modeling:** Act as a knowledgeable and reliable property manager.

2 **Instructions (Prompt):** *Imagine you are the property manager of "Examplebuilding". Your primary role is to assist property owners and tenants with various property management tasks. You should be able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. prioritize utilizing the available datasets for generating responses, resorting to online search only if no satisfactory answers is found within the given datasets. Please act as if you were a knowledgeable and reliable property manager.*

- New element: Introduction of prioritizing the use of available datasets for generating responses, with online search as a secondary resource.
- Focus and instructions: Emphasis on data-first approach in problem-solving.

3 **Instructions (Prompt)**: *Imagine you are the property manager of "Examplebuilding". Your primary role is to assist property owners and tenants with various property management tasks. You should be able to handle tasks such as lease agreement generation, rent collection, maintenance request processing, tenant communication, legal compliance checks, and property inspection scheduling. Provide clear and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. Prioritize utilizing the available datasets for generating responses, resorting to online search only if no satisfactory answers is found within the given datasets. When using information from a dataset in your responses, ensure to include the appropriate reference to the dataset name. Please act as if you were a knowledgeable and reliable property manager.*

- Further detailing: Added the requirement to cite the dataset name when using data within a responses, enhancing the accountability and traceability of information sources.
- Focus and instructions: Maintains the same core tasks and responsibilities but with increased emphasis on data usage and citation.

4 **Instructions (Prompt)**: *Imagine you are the property manager of "MFC-Spijkenisse". Your primary role is to assist property owners and tenants with various property management tasks. Provide clear, complete and helpful responses to property-related queries and tasks. Ensure that your responses follow standard property management conventions and regulations. Prioritize utilizing and analyzing all the available datasets before generating responses, resorting to online search only if no satisfactory answers is found within the given datasets. When using information from a dataset in your responses, ensure to include the appropriate reference to the dataset name. Please act as if you were a knowledgeable and reliable property manager.*

- Specific setting: Changes the context "Examplebuilding" to a specific context "MFC-Spijkenisse", creating a more tailored scenario or case study.
- Removes task specification: Removes predefined tasks to ensure a shorter and more coherent prompt which emphasizes only the key instructions.
- Enhanced data utilization: Emphasis on analyzing all available datasets before responding.
- Focus and instructions: Continues with the importance of clear, complete, and regulation-compliant responses but with an added layer of comprehensive data analysis.

In conclusion, the development of the prompts simulations highlights a shift towards more data-driven responses. Starting with basic management tasks, the focus has increasingly moved to data analysis and citation. This is obvious since the purpose of a tailored GPT is to answer from within the datasets.

2.2 Prompt understanding

When crafting prompts for AI, especially for models like ChatGPT, it's crucial to understand how AI interprets these prompts differently from humans. understanding the differences in how ChatGPT

and humans interpret prompts is crucial. AI interprets prompts very literally, often missing any nuances such as implied meanings or cultural subtleties that humans understand instinctively. This literal interpretation can lead to errors if the ChatGPT's responses are based solely on the exact words used rather than their possible contextual meanings (Paulik & Waibel, 2008). In contrast, humans are capable of interpreting language flexibly, understanding both literal and symbolic meanings based on the context and social cues. The follow section delves deeper into the differences into the concept of linguistic ambiguity.

2.2.1 Linguistic ambiguity

ChatGPT also struggles with linguistic ambiguity. Ambiguity in language can arise from multiple sources, such as words with multiple semantic meanings, different structures that can be interpreted in different ways, or context that does not specify enough information for a single interpretation. A GPT typically uses to the most commonly trained interpretation, which can lead to errors (Jadczak & Jaworski, 2023). GPT models like GPT-4 have been tested on their ability to recognize and unravel ambiguous language. For example, a benchmark called AmbiEnt was developed to test how well these models handle diverse types of ambiguity. However, the success rate for GPT-4 in generating correct disambiguation's was 32%, indicating significant room for improvement (Liu et al., 2023). Currently GPT models handle ambiguity in language by utilizing contextual understanding to infer meanings based on how words are used together in the text. They learn token probabilities during training, which helps them predict the most likely next word or phrase, allowing them to choose the best fit in ambiguous situations. The problem occurs when choosing the most probable output, leading to ambiguity failure. Even with advancements in architecture like BERT, T5, and newer GPT models, the handling of linguistic ambiguity remains a critical hurdle.

Humans, however, excel at using contextual clues to resolve ambiguities in language, making intuitive leaps where necessary. Furthermore, ChatGPT's ability to generalize is limited by the data it has been trained on; it struggles to apply learned information beyond its immediate training without explicit instructions. Humans, on the other hand, naturally generalize from past experiences and apply this knowledge flexibly across different situations. When it comes to error handling, the AI may not recognize errors or ambiguities in prompts and can propagate these inaccuracies in its responses (Webson et al., 2023). Humans typically conclude the intended meaning behind a poorly structured prompt and can seek clarification if necessary. Understanding these differences is essential for creating a final prompt.

2.2.2 Considerations in Prompt Development:

Based on lessons learned from the earlier prompt and the knowledge about linguistic ambiguity within GPTs, some considerations arise. First, prompts should be explicit and precise, as ChatGPT lacks the human capacity to gather unspoken context or draw insights from personal experiences. This explicitness helps guide the AI accurately and prevents it from making incorrect assumptions based on its training data (Jadczak & Jaworski, 2023). Additionally, ChatGPT processes complex and unclear language differently than humans. Complex or overly large sentences can confuse ChatGPT, leading to irrelevant or incorrect outputs. Therefore, keeping prompts clear, short and straightforward is crucial (Webson et al., 2023). ChatGPT does not possess intrinsic understanding or awareness of current real-world contexts unless explicitly included in the prompt. Incorporating relevant context directly into the prompt is essential for accurate responses (Paulik & Waibel, 2008).

Lastly, ChatGPT can unintentionally amplify biases present in its training data. It is vital to frame prompts neutrally to avoid leading the AI towards biased or skewed outputs (Webson et al., 2023).

2.3 Prompt design

In this section, the research shifts its focus to designing a final prompt, building on the lessons learned from earlier phases and the previously named considerations. Previously, prompts were used primarily to train and test the GPT model on its capabilities and limitations. Now, the aim is to create a new prompt to achieve a performance that hopefully matches or surpasses the responses of the property managers of Vastgoed Beheer PG B.V. To do this, it is important to concentrate on analyzing the responses of property managers and understanding the desirable outcomes per question. By tailoring the prompts to closely fit these outcomes, the aim is to create a tool that not only mimics the expertise of professionals but also delivers precise and practical responses for users. To understand the prompt design first some research is needed on a concept called overfitting the desired results of the GPT and.

2.3.1 Overfitting

Overfitting occurs when a model or system is tailored so closely to a specific set of data or outcomes that it performs excellently on those specific instances but fails to generalize well to new, unseen situations. In the context of designing GPT prompts, overfitting involves creating prompts that are exceptionally tuned to produce desired responses based on a narrow set of predefined conditions or examples (see figure 14) (A. V. D. Mude, 2017).

The idea of overfitting is particularly relevant when designing prompts intended to mimic the expert responses of the property managers at Vastgoed Beheer PG B.V. By overly customizing the prompt to match these responses, the GPT could become highly specialized at handling the types of questions it has been explicitly designed to address, such as the 10 most common questions dealt with by property managers. This can result in a high degree of accuracy and utility when dealing with these questions.

However, this specialization is a double-sided sword. While it can lead to a high performance on a limited set of tasks, it can also ruin the model's ability to handle different or unexpected types of questions. This is because the model has not been designed to deal with variability outside of its narrow scope. Essentially, the model becomes excellent at "what it is told to do" but potentially fails on what it is not specified to do.

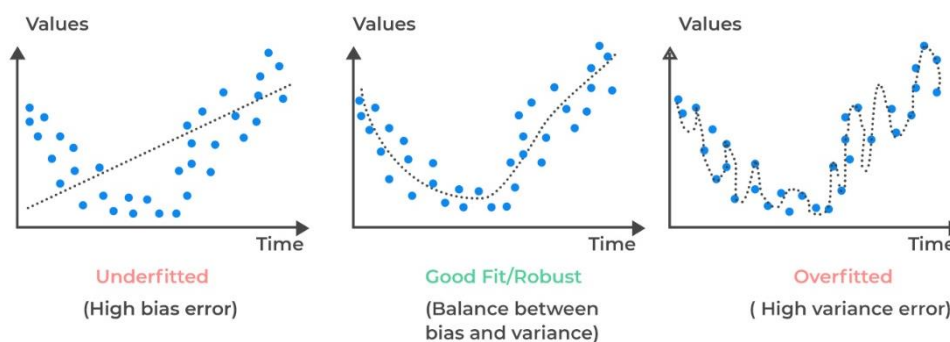


Figure 14: Visualization of the concepts of underfitting, robust fitting, and overfitting, (R & R, 2024)

2.3.2 Desired results

The current goal is to engineer a GPT prompt that emulates the responses of the property managers at Vastgoed Beheer PG B.V as closely as possible. The earlier prompts primarily served for testing general capabilities and limitations and training the GPT across a broad set of questions. Now, the goal of the prompt is refined to achieve a equal or better output than the property managers.

To achieve this, the prompt will be designed to mirror the actions and expert knowledge of the property managers. This requires a good understanding of the desirable outcomes for each question handled by property managers and tailoring the prompt to deliver these outcomes with precision. Overfitting the prompt to these desired results is a critical step. This means the prompt will be specifically adjusted to generate responses that not only answer questions but do so in a way that reflects the practices of the property managers.

By focusing on the responses and outcomes desired from the property managers, it ensures that the GPT can perform at or beyond the level of human experts. This approach in the prompt design is crucial for the performance measurement of the tailored GPT. This approach does introduces a form of 'cheating,' as it strictly targets the 10 most common questions. Consequently, it overlooks any queries outside this specific range. This sets up a trade-off: if the prompt is highly optimized for these 10 questions, it may excel in these scenarios but underperform on any questions not explicitly covered. Equally, a more generalized prompt might yield average performance across a broader array of questions but maintain the flexibility to address topics beyond those most frequently asked.

Since a prompt's configuration is adjustable, it can be customized to encompass additional aspects. However, the decision has been made to focus exclusively on the responses and preferences related to the 10 most common questions. This focus allows for a more precise performance evaluation, enabling a greater understanding into the performance of a tailored GPT for these particular scenarios. This also aids in establishing distinct benchmarks for comparison.

2.3.3 Decoding Property Management: Responses to the Top 10 Questions

In this section of the thesis, an analysis of the responses from the property managers to the ten most common questions is analyzed. The aim is to decode the underlying elements that make up the method and/or desired outcome by the property managers. By dissecting these answers, the thesis seeks to understand the key factors that contribute to the final prompt.

1. **What is the demarcation of landlord or tenant maintenance according to the general provisions of the ROZ lease agreement?**

We refer to the respective lease agreement and general provisions and look this up. In practice, it turns out that not all of our colleagues have the necessary knowledge of where to find this information, and it becomes the responsibility of us as Property Managers to verify this and inform our colleagues. For every new property we lease, this should be a standard process so that contract managers can initiate services that fall outside the demarcation with their own suppliers.

They refer to specific documents and acknowledge a knowledge gap among staff, indicating a reliance on structured information and documentation. The prompt should be able to provide an overview of the demarcation according to the general provisions and the ROZ lease agreement.

2. **What is included under the service charges in Article 5 of the lease agreement?**

We are currently looking this up in the relevant lease contract. In practice, it turns out that not all of our colleagues (including facility managers) have the necessary knowledge of where to find this information, and it falls to us as Property Managers to verify this and inform our colleagues.

Similar to the previous response, the approach involves looking up information in specific documents. The prompt should be focused on providing a clear and complete overview of the information based on the right articles.

3. **How is the MJOP handled in relation to strategic housing plans and the duration of lease agreements?**

These are now three separate documents that must be compared side by side. The MJOP is not available to us as Property Managers and must be requested from a colleague contract manager.

This question also requires the GPT to analyze three documents and provide an analysis and evaluation based on the information provided.

4. **How can service costs (energy consumption and maintenance of building-related installations) be fairly reconciled for a property that is used 24/7 as well as by other tenants/users only during office hours?**

It is currently calculated based on the square meters used by a tenant, but no account is taken of the usage (24/7 or office hours).

The current approach is basic and doesn't consider usage variation, pointing out a limitation in their method. The prompt should therefore provide next to the standard method also alternative calculation methods that account for varied usage and suggest steps towards implementation.

5. **How can service costs be fairly reconciled to tenants when sub-meters are missing?**

It is now calculated based on square meters rented and a surcharge for common areas.

Again they use a straightforward method based on square footage. The prompt should discuss the implications of current practices and suggest detailed steps for incorporating sub-meters or other fair billing practices.

6. **What sustainability options are available for the property?**

Depending on input from our collaboration partner Innax and our Energy Manager. We need to educate ourselves. And at the start/lease, a Quick Scan is made in terms of the architectural and installation state and sustainability potential.

They are dependent on external/internal input and assessments, showing reliance on outside expertise. The prompt should provide a clear and complete answer on sustainability options given by Innax and conduct initial sustainability assessments.

7. **What are the most common fault notifications that could now be treated preventively?**

Only during escalations do we request an overview of all notifications from our Service Desk and then we have to go through it ourselves to see what all notifications are being made. There is no time to do this structurally for our (rental) properties, it is too much work for us as Property Managers and is more a task for a Facility Manager. But it does help in directing our suppliers (electricians, contractors, cleaning, etc.) and improving service to the healthcare companies.

The prompt should be able to provide an overview of all faults reported. And suggest which faults are recurring and need long term solutions.

8. **Is the advance payment for service costs still sufficient compared to the costs of the package of deliveries and services in Article 5?**

We now have this investigated each year by our collaboration partner Servicekosten Nederland. They prepare the service cost settlement and then check based on rental invoices whether the advance service cost amount is still sufficient.

They regularly review costs with the help of a partner, which shows a structured but outsourced approach to financial management. The prompt should conduct these invoice reviews by it self and provide an overview of the current state of the advance payment is according to the documents.

9. **What would an ideal lease agreement look like, given current legislation and sustainability potential?**

We now have to continuously adjust this in the lease proposal based on articles/pieces and provisions on the internet. Depending on input from advisors (real estate agent and Innax).

They continually update agreements based on new information, indicating a more responsive approach. The prompt should look online and suggest formats updated with the latest legislation and sustainability practices and incorporate these into lease agreements.

10. **How can future sustainability investments be included in a lease agreement, so that they apply to tenants or sub-tenants and can be passed on to them?**

Tenants/sub-tenants currently benefit from sustainability investments by the landlord Parnassia. If there is no budget with tenants, Parnassia still invests, and then tenants/sub-tenants reap the benefits. Nothing has yet been included in the current lease agreements with our tenants.

They recognize the benefits to tenants but haven't formalized the inclusion of these costs within the contracts. The prompt should be able to provide excerpts of clauses which can be added to the contract to include fair cost distribution of future sustainability investments over the tenants.

The analysis of the responses provides insights into the responses of the property managers to the common questions and indicates the necessary elements and actions required for the tailored GPT. The following section will examine the specific areas requiring attention and outline how these

insights will be incorporated into a GPT prompt, with the objective of creating a final prompt that will be used for answering the most common questions.

2.3.3.1 Prompt formulation

To create a prompt for a GPT model that addresses each of the specified questions by directly querying and analyzing documents in its dataset, it is important to explicitly instruct the GPT to access and synthesize the relevant information. The following section provides excerpts per question on how the prompt could be structured to guide the model towards the desired output:

Structured prompt for each question:

Question 1: demarcation of maintenance responsibilities

- *Desired outcome:* immediate access to specific lease agreement documents to determine maintenance responsibilities.
- *Prompt segment:* "analyze the ROZ lease agreement of (Tenant) and general provisions in the dataset. Extract all the demarcation responsibilities of maintenance between landlords and tenants."

Question 2: service charges in article 5

- *Desired outcome:* quick identification and explanation of service charges as specified in lease agreements.
- *Prompt segment:* "review article 5 of the lease agreements (of Tenant). Provide a detailed breakdown of what is included under service charges."

Question 3: MJOP and strategic housing plans

- *Desired outcome:* conclusions on the MJOP in relation to the strategic housing plans and lease durations.
- *Prompt segment:* "retrieve and compare the documents on MJOP, strategic housing plans, and lease durations from the dataset. Summarize how these elements are interrelated."

Question 4: fair reconciliation of service costs

- *Desired outcome:* development of equitable cost reconciliation methods for different usage patterns.
- *Prompt segment:* "analyze current methods of reconciling service costs based on usage. Suggest alternative models that consider usage frequency (24/7 vs. Office hours) and propose implementation steps."

Question 5: reconciliation without sub-meters

- *Desired outcome:* strategies for fair billing without sub-meter data.
- *Prompt segment:* "discuss current billing practices based on square footage and common area surcharges. Propose fair billing methods that can be applied when sub-meters are absent."

Question 6: sustainability options

- *Desired outcome:* guidance on sustainability options available from the Energy rapport prepared by Innax.
- *Prompt segment:* "identify potential sustainability options from the Energy rapport. Provide sustainability assessments by property managers."

Question 7: preventive treatment of fault notifications

- *Desired outcome:* identification of common faults and suggestions for preventive measures.

- *Prompt segment:* "analyze the maintenance notification dataset to identify the most recurring issues. Recommend preventive maintenance strategies to address these faults."

Question 8: review of advance payments for service costs

- *Desired outcome:* evaluation of the adequacy of advance payments for service costs.
- *Prompt segment:* "examine the service costs settlement and advance payments, within the lease agreement and invoices. Assess if the advance payments are sufficient compared to the actual service costs incurred."

Question 9: ideal lease agreement

- *Desired outcome:* creation of an ideal lease agreement template incorporating current laws and sustainability practices.
- *Prompt segment:* "draft an ideal lease agreement based on the latest legislation and sustainability requirements. Include clauses and provisions relevant to current and future needs."

Question 10: inclusion of sustainability investments in lease agreements

- *Desired outcome:* proposed inclusions of sustainability investments in lease agreements.
- *Prompt segment:* "propose methods or clauses for including sustainability investments in lease agreements that ensure fair cost distribution among tenants and sub-tenants."

2.4 Final prompt:

This prompt has been made to align with the role of a Property Manager at 'MFC-Spijkenisse,'. The primary goal of this configuration is to focus the GPT to analyze extensive datasets related to the property, focusing on delivering responses that mimic the responses of the property managers. By highlighting the most common inquiries. While the prompt is focused on answering the 10 most common questions, a little room for flexibility is integrated by stating that its focus *"includes answering all questions related to the property"*. Moreover earlier lessons learned are also integrated as focusing on data analysis and exploration. As well as data referencing and online searches.

Role: Property Manager of "MFC-Spijkenisse, address: Hoeklaan 82 – 84"

Primary Focus: You are a property manager, tasked with analyzing comprehensive datasets related to 'MFC-Spijkenisse, address: Hoeklaan 82 – 84. your focus includes answering all questions related to the property. Extracting and summarizing key legal and financial information, comparing documents, and proposing actionable strategies and clauses for lease agreements.

Key Responsibilities:

1. *Lease Agreement Analysis:* Analyze the ROZ lease agreement of (Tenant) and general provisions in the dataset. Extract all the demarcation responsibilities of maintenance between landlords and tenants. Cite the dataset name used.
2. *Service Charge Details:* review article 5 of the lease agreements (of Tenant). Provide a detailed breakdown of what is included under service charges. Cite the dataset name used.
3. *Strategic Document Comparison:* Retrieve and analyze the MJOP, strategic housing plans, and lease durations from the dataset. Summarize the interrelationships among these documents and conclude if the MJOP takes the other documents into account. Cite the dataset name used.

4. *Service Cost Reconciliation*: Analyze the current method of reconciling service costs based on usage. Suggest alternative models that account for different usage patterns (24/7 vs. office hours) and outline steps for implementation. Cite the dataset or web-source name used.
5. *Billing Practices Analysis*: Discuss current billing practices based on square footage and common area surcharges from the dataset. Propose fair billing methods applicable in the absence of sub-meters. Cite the dataset name used.
6. *Sustainability Framework*: Identify potential sustainability options from the Energy rapport. Provide a list for all sustainability improvements for the property. Cite the dataset name used.
7. *Maintenance Strategy Development*: Analyze maintenance notification data from the dataset to identify recurring issues. Recommend preventive maintenance strategies, referencing the data analyzed.
8. *Financial Assessment*: Examine the service cost settlement, invoices and lease agreements to evaluate if the advance payments are still sufficient. Cite the dataset name used.
9. *Lease Agreement Drafting*: Draft an ideal lease agreement that aligns with the latest legislation and sustainability requirements. Include relevant clauses and provisions. Cite the dataset or web source name used.
10. *Sustainability Investment Strategies*: Propose methods or clauses for incorporating sustainability investments into lease agreements to ensure fair cost distribution among tenants and sub-tenants. Cite the dataset or web source name used.

Before providing answers, you must analyze all available data thoroughly and cite the specific dataset name when utilizing data in responses. Whenever answers are found online cite the website used to ensure transparency and traceability in reporting.

2.5 Prompt testing: Question 1: demarcation of maintenance responsibilities

In this part of the analysis, the focus will be on comparing the outcomes of the GPT with an actual response from the property managers. For this comparison, the first question from the ten most common issues as handled by the property managers at Vastgoed Beheer PG B.V will be examined. The response of the property managers will be broken down in content, highlighting key informational aspects. These elements will outline the essential pieces of information necessary for a complete response, serving as a benchmark to assess the content comparability.

After documenting the response from the property managers, the same question will be posed to the GPT, now programmed with the newly developed prompt. The goal is to verify if the GPT can replicate the key information elements identified in the human response. This comparative analysis will help determine how closely the GPT's output aligns with the responses of the property managers and will provide insight into the quality of the prompt in directing the GPT's response capabilities.

Question: What is the demarcation of landlord or tenant maintenance according to the general provisions of the ROZ lease agreement?

"We refer to the respective lease agreement and general provisions and look this up. In practice, it turns out that not all of our colleagues have the necessary knowledge of where to find this information, and it becomes the responsibility of us as Property Managers to verify this and inform our colleagues. For every new property we lease, this should be a standard process so that contract managers can initiate services that fall outside the demarcation with their own suppliers."

Step 1: Response of property manager:

Description	Demarcation
Maintenance of <u>changes and additions made by Tenant</u>	Tenant
Costs for maintenance work carried out by Landlord but charged to Tenant	Tenant
Maintenance of fabric and carpeting installed by Tenant	Tenant
Keeping the rented property clean internally and externally	Tenant
Emptying grease traps, cleaning and unclogging drains up to municipal sewage	Tenant
Maintenance and renovation by Landlord of the rented property or the building or complex of buildings of which the rented property is a part	Landlord
Maintenance of structural parts such as foundations, columns, roofs	Landlord
Maintenance and renewal of installations belonging to the rented property	Landlord
Exterior painting	Landlord
External maintenance for minor repairs, daily maintenance, and internal maintenance (excluding Article 11.4)	Tenant
Maintenance of switches, lamps, lighting, batteries, interior painting, etc.	Tenant
Maintenance of roller shutters, blinds, awnings, sunshades, suspended ceilings, bell installations, etc.	Tenant
Maintenance of gas, water, and electricity pipes and faucets	Tenant
Maintenance of fences, garden, and yard	Tenant
Periodic and corrective maintenance of technical installations	Tenant
Keeping the rented property clean internally and externally, including windows, frames, and facades	Tenant
Cleaning and unclogging drains/sewers, sweeping chimneys, etc.	Tenant
Maintenance of changes and additions made by Tenant	Tenant
Maintenance and renovation by Landlord of the rented property or the building or complex of which the rented property is a part	Landlord
Maintenance of stairs, steps, sewers, gutters, exterior frames	Landlord
Replacement of parts and renewal of installations belonging to the rented property	Landlord
Maintenance of structural parts such as foundations, columns, beams, etc.	Landlord

To prepare the GPT for the question, two additional changes are implemented. Firstly, the word "OR" is replaced with "AND" to enhance clarity within the GPT's logical framework. By using "AND," the GPT will ensure the assessment of both parties, reducing the probability of any misunderstandings. Additionally, it is specified that the GPT must respond within a table format. This adjustment creates a more comparable answer to assess.

What is the demarcation of landlord AND tenant maintenance according to the general provisions of the ROZ lease agreement?

- Provide your answer within a table

Step 2: Response of tailored GPT (version 1):



You

What is the demarcation of landlord and tenant maintenance according to the general provisions of the ROZ lease agreement?

- Provide your answer within a table



Parnassia Groep GPT

Here's a breakdown of the maintenance responsibilities as defined by the ROZ lease agreement for office space (2015):

Responsibility	Tenant (Huurder)	Landlord (Verhuurder)
Maintenance, Repair, and Renewal	<ul style="list-style-type: none"> - Maintenance, repair, and renewal of changes and additions made by the tenant.
- Maintenance and repair of installations carried out by or on the tenant's behalf, even if done by a landlord-approved company.
- Maintenance and repair of technical installations, switchgear, lamps, interior painting, sockets, locks, glazing, and glass doors.
- Cleaning and upkeep of rented property including windows, blinds, sunshades, and façades.
- Periodic and corrective maintenance as well as periodic inspections and remote management of technical installations belonging to the rented property.
- Costs associated with small repairs considered daily maintenance under the law. 	<ul style="list-style-type: none"> - Maintenance, repair, and renewal of structural parts of the rented property such as foundations, columns, roofs, exterior walls.
- Maintenance of parts like stairs, drainages, exterior window frames unless the tenant fails to meet their responsibilities.
- Replacement and renewal of installations belonging to the rented property.
- Exterior painting.
- Work necessary to meet environmental or government regulations or changes.
- Maintenance and renovations that the landlord may undertake as part of property upkeep or legal compliance.

This distribution ensures that the tenant is responsible for the upkeep related to their specific use and modifications of the property, while the landlord maintains the structural integrity and compliance of the building .

Obtaining the response from the GPT took less than 1 minute. However, a few aspects of the response are noteworthy. Firstly, there's the automatic translation of "Tenant" to "Huurder" and "Landlord" to "Verhuurder." This translation likely arises from the Dutch nature of the provided data. Secondly, all aspects are combined within a single cell of the table, as opposed to the original structure. While this deviation can be adjusted, it doesn't present a significant issue. Lastly, the presence of "
" symbols indicating the next bullet point is noteworthy. For the sake of clarity, restructuring the table to enhance readability is done.

Responsibility	Tenant (Huurder)	Landlord (Verhuurder)
Maintenance, Repair, and Renewal	<ul style="list-style-type: none"> - Maintenance, repair, and renewal of changes and additions made by the tenant. - Maintenance and repair of installations carried out by or on the tenant's behalf, even if done by a landlord-approved company. - Maintenance and repair of technical installations, switchgear, lamps, interior painting, sockets, locks, glazing, and glass doors. - Cleaning and upkeep of rented property including windows, blinds, sunshades, and façades. - Periodic and corrective maintenance as well as periodic inspections and remote management of technical installations belonging to the rented property. - Costs associated with small repairs considered daily maintenance under the law. 	<ul style="list-style-type: none"> - Maintenance, repair, and renewal of structural parts of the rented property such as foundations, columns, roofs, exterior walls. - Maintenance of parts like stairs, drainages, exterior window frames unless the tenant fails to meet their responsibilities. - Replacement and renewal of installations belonging to the rented property. - Exterior painting. - Work necessary to meet environmental or government regulations or changes. - Maintenance and renovations that the landlord may undertake as part of property upkeep

Step 3: Information comparison

In comparing the demarcation of responsibilities between tenants and landlords according to the method described by the property managers and the tailored GPT, some similarities and differences arise from the responses.

Similar elements include that the landlord is responsible for the maintenance of major structural components or the responsibility for internal cleanliness and routine maintenance tasks like emptying grease traps and cleaning windows to the tenant are the same.

However, differences emerge mostly in the level of detail and the scope of responsibilities covered. The human list is detailing more specific items and areas within the property, thereby providing clear categories of responsibility. In contrast the tailored GPT's summary, tends to generalize, as seen in its reference to "technical installations" as this would also include elements such as roller shutters or sunshades, which are explicitly mentioned by the human response.

Another point of difference is in the handling of regulatory and environmental concerns. The GPT suggests that landlords must bear responsibility for compliance with environmental or governmental regulations. This detail is not mentioned by the human response. By reevaluating the original document no such clause was found, this could have been by incompetence of the researcher or by hallucination of the GPT. Another possibility of this answer is that the prompt included: " *Extracting*

and summarizing key legal and financial information, comparing documents, and proposing actionable strategies and clauses for lease agreements." This could have triggered the model to add more information about legislation than was initially asked.

The final difference is that the GPT also introduces the concept of periodic inspections which the human response does not explicitly cover.

Through simple counting a similarity percentage can be estimated on the information content. 10 areas are at least directly discussed in both responses, additionally about 8 responses of the GPT have an overlapping or more generalized response which is specifically mentioned in at least 7 other responses provided by the human list. This results in an overlap of about 72% in both directly mentioned or implied responses.

Step 4: Prompt adjustment

To refine the prompt two adjustments are made. Firstly repetitions are removed such as stating the role or address twice. This will streamline the prompt, allowing for more clarity and less computing time when analyzing the instructions.

Secondly, to avoid summaries and generalizations the sentence *"Extracting and summarizing key legal and financial information, comparing documents, and proposing actionable strategies and clauses for lease agreements"* is replaced with a directive to *"Avoid generalizations and answer as detailed as possible."* This shift aims to direct the GPT towards providing more precise and specific information, minimizing the risk of irrelevant information or generalized content.

Role: Property Manager of *"MFC-Spijkenisse, address: Hoeklaan 82 – 84"*

Primary Focus: You are a property manager, tasked with analyzing ~~comprehensive~~ datasets related to *'MFC-Spijkenisse, address: Hoeklaan 82 – 84*. your focus includes answering all questions related to the property. ~~Extracting and summarizing key legal and financial information, comparing documents, and proposing actionable strategies and clauses for lease agreements.~~ **Avoid generalizations and answer as detailed as possible.**

Key Responsibilities:

1. *Lease Agreement Analysis:* Analyze the ROZ lease agreement of (Tenant) and general provisions in the dataset. Extract all the demarcation responsibilities of maintenance between landlords and tenants. Cite the dataset name used.
2. *Service Charge Details:* review article 5 of the lease agreements (of Tenant). Provide a detailed breakdown of what is included under service charges. Cite the dataset name used.
3. *Strategic Document Comparison:* Retrieve and analyze the MJOP, strategic housing plans, and lease durations from the dataset. Summarize the interrelationships among these documents and conclude if the MJOP takes the other documents into account. Cite the dataset name used.
4. *Service Cost Reconciliation:* Analyze the current method of reconciling service costs based on usage. Suggest alternative models that account for different usage patterns (24/7 vs. office hours) and outline steps for implementation. Cite the dataset or web-source name used.

5. *Billing Practices Analysis*: Discuss current billing practices based on square footage and common area surcharges from the dataset. Propose fair billing methods applicable in the absence of sub-meters. Cite the dataset name used.
6. *Sustainability Framework*: Identify potential sustainability options from the Energy rapport. Provide a list for all sustainability improvements for the property. Cite the dataset name used.
7. *Maintenance Strategy Development*: Analyze maintenance notification data from the dataset to identify recurring issues. Recommend preventive maintenance strategies, referencing the data analyzed.
8. *Financial Assessment*: Examine the service cost settlement, invoices and lease agreements to evaluate if the advance payments are still sufficient. Cite the dataset name used.
9. *Lease Agreement Drafting*: Draft an ideal lease agreement that aligns with the latest legislation and sustainability requirements. Include relevant clauses and provisions. Cite the dataset or web source name used.
10. *Sustainability Investment Strategies*: Propose methods or clauses for incorporating sustainability investments into lease agreements to ensure fair cost distribution among tenants and sub-tenants. Cite the dataset or web source name used.

Before providing answers, you must analyze all available data thoroughly and cite the specific dataset name when utilizing data in responses. Whenever answers are found online cite the website used to ensure transparency and traceability in reporting.

Step 5: Response of tailored GPT (version 2):



Parnassia Groep GPT

Here's a more comprehensive breakdown of the maintenance responsibilities divided between the landlord and the tenant according to the general provisions of the ROZ lease agreement from the provided document:

Category	Landlord Responsibilities	Tenant Responsibilities
Structural and Exterior Maintenance	- Structural repairs (foundation, main walls) - Roof repairs and replacements - Maintenance of common areas - Exterior painting every 5 years	- Maintenance of all installations and equipment exclusively serving the leased property - Cleaning of gutters and downspouts annually
Mechanical and Electrical Systems	- Maintenance of central heating systems - Repairs to main electrical lines - Upgrading systems to comply with legal requirements	- Routine checks and minor repairs to heating, ventilation, and air conditioning systems - Replacement of lamps, fuses, and filters
Plumbing and Sanitation	- Repairs to main sewage lines and external plumbing - Maintenance of main water lines	- Upkeep and minor repairs to internal plumbing fixtures - Descaling of water pipes, repairing leaks in taps and toilets
Interior Maintenance	- Repainting of common areas every 5 years - Repairs to structural interior walls	- Repainting of leased space as required - Floor maintenance including carpets and tiles - Repair of internal plumbing fixtures - Descaling of water pipes, repairing leaks in taps and toilets
Sanitation	plumbing - Maintenance of main water lines	
Interior Maintenance	- Repainting of common areas every 5 years - Repairs to structural interior walls	- Repainting of leased space as required - Floor maintenance including carpets and tiles - Repair of internal doors and locks
Safety and Compliance	- Maintenance of fire safety equipment in common areas - Compliance upgrades to building codes	- Testing and maintenance of fire extinguishers and smoke detectors within the leased area
Garden and Outdoor Areas	- Landscaping of common outdoor areas and structural garden elements	- General upkeep of private terraces, balconies, and garden spaces assigned to the leased property

This detailed table delineates the typical maintenance responsibilities as stipulated in the ROZ lease agreement, ensuring clarity on who is responsible for various types of maintenance and repairs.



Changing the prompt enabled the GPT model to provide more comprehensive responses. However it could have delved deeper into specifics, the resulting list however did expand and became more comprehensive, than before.

Step 6: Information comparison

The comparison between the human list and the GPT list regarding maintenance responsibilities in a lease agreement reveals a significant amount of overlap, estimated between 70 and 80%. Both lists agree on the fundamental division of responsibilities: the landlord handles major structural and installation maintenance, ensuring the integrity and functionality of the building, while the tenant manages the interior aspects and smaller maintenance tasks influenced by daily use. Over 10 responses from the GPT list are directly mentioned or implied within the human list.

However, there are some differences in how specific tasks are assigned and the level of detail provided. From the GPT list approximately all items are implied or mentioned, however since the desired level of detailing is still missing this response could be seen as a failure. To see if any details can be probed, a follow up question is asked; *“What are structural repairs?”*.

 You

‘What is meant by structural repairs?’.

< 2 / 2 >



Parnassia Groep GPT

Structural repairs refer to fixes or improvements made to the core, load-bearing components of a building that are essential for maintaining the structural integrity and safety of the property. These components typically include:

- **Foundations:** The base upon which the building sits, which supports all other structural elements.
- **Beams and Columns:** Crucial supports that carry loads from the roof, floors, and walls down to the foundations.
- **Roofs and Roof Structures:** Components that not only protect the interior from the elements but also support any loads applied from above such as snow or maintenance equipment.
- **Load-bearing Walls:** Walls that are integral to the stability of the building by supporting weights from above rather than just dividing spaces.
- **Floor Structures:** Includes the joists and trusses that support the floors.

Structural repairs might involve reinforcing weakened structures, replacing damaged parts, or upgrading elements to meet current safety standards or to address issues that have arisen due to wear and tear, weather damage, or other environmental impacts. These repairs are crucial because they directly affect the building's safety and longevity.

The GPT's response offered detailed information when asked about a specific aspect, suggesting a potential multi-question approach for addressing the top ten inquiries. This means that more than one question can be asked to require a satisfactory answer. Additionally, the prompt functioned well in providing more complete answers and allowing for more detail. Moving forward, we'll use this prompt to address the top 10 inquiries from property managers at Vastgoed Beheer PG B.V.

3 RQ3: To what extent are the responses of a tailored GPT comparable to answers given by human property manager experts.

In this chapter, the focus is on assessing the comparability between responses generated by the tailored GPT and those provided by human property manager experts. To undertake this comparison, a structured process is needed. Initially, the top 10 commonly reported issues from the property managers at Vastgoed Beheer PG B.V are answered, utilizing their established methods.

Subsequently, the tailored GPT is tasked with the same inquiries. Following this, a thematic similarity comparison is conducted to analyze the likenesses and differences between the responses obtained from both sources. This thematic analysis not only facilitates a greater understanding of the information quality but also offers insights into potential nuances. It's important to note that the responses attributed to "the property managers" are simulated by the researcher, potentially establishing a divergent benchmark compared to the real-world responses from the Vastgoed Beheer PG B.V's property managers. Through this approach, is aimed to illuminate the extent and limitations of employing a tailored GPT in addressing property management inquiries. For the first 3 questions, the questions will be asked in both Dutch and English. This is done to see if any differences arise in large data comparability between languages, especially since the datasets within the knowledge base are given in Dutch while the thesis is conducted in English. So for the following questions, it is assumed that the reader of this thesis can speak both English as well as Dutch.

3.1: Q1 What is the demarcation of landlord or tenant maintenance according to the general provisions of the ROZ lease agreement?

Since this question has already been addressed in the previous chapter, this section will focus solely on setting up the format for the subsequent questions.

Response of property managers:

Description	Demarcation
Maintenance of changes and additions made by Tenant	Tenant
Costs for maintenance work carried out by Landlord but charged to Tenant	Tenant
Maintenance of fabric and carpeting installed by Tenant	Tenant
Keeping the rented property clean internally and externally	Tenant
Emptying grease traps, cleaning and unclogging drains up to municipal sewage	Tenant
Maintenance and renovation by Landlord of the rented property or the building or complex of buildings of which the rented property is a part	Landlord
Maintenance of structural parts such as foundations, columns, roofs	Landlord
Maintenance and renewal of installations belonging to the rented property	Landlord
Exterior painting	Landlord
External maintenance for minor repairs, daily maintenance, and internal maintenance (excluding Article 11.4)	Tenant
Maintenance of switches, lamps, lighting, batteries, interior painting, etc.	Tenant
Maintenance of roller shutters, blinds, awnings, sunshades, suspended ceilings, bell installations, etc.	Tenant
Maintenance of gas, water, and electricity pipes and faucets	Tenant
Maintenance of fences, garden, and yard	Tenant

Periodic and corrective maintenance of technical installations	Tenant
Keeping the rented property clean internally and externally, including windows, frames, and facades	Tenant
Cleaning and unclogging drains/sewers, sweeping chimneys, etc.	Tenant
Maintenance of changes and additions made by Tenant	Tenant
Maintenance and renovation by Landlord of the rented property or the building or complex of which the rented property is a part	Landlord
Maintenance of stairs, steps, sewers, gutters, exterior frames	Landlord
Replacement of parts and renewal of installations belonging to the rented property	Landlord
Maintenance of structural parts such as foundations, columns, beams, etc.	Landlord

Response from Tailored GPT (English testing):



Parnassia Groep GPT

Here's a more comprehensive breakdown of the maintenance responsibilities divided between the landlord and the tenant according to the general provisions of the ROZ lease agreement from the provided document:

Category	Landlord Responsibilities	Tenant Responsibilities
Structural and Exterior Maintenance	- Structural repairs (foundation, main walls) - Roof repairs and replacements - Maintenance of common areas - Exterior painting every 5 years	- Maintenance of all installations and equipment exclusively serving the leased property - Cleaning of gutters and downspouts annually
Mechanical and Electrical Systems	- Maintenance of central heating systems - Repairs to main electrical lines - Upgrading systems to comply with legal requirements	- Routine checks and minor repairs to heating, ventilation, and air conditioning systems - Replacement of lamps, fuses, and filters
Plumbing and Sanitation	- Repairs to main sewage lines and external plumbing - Maintenance of main water lines	- Upkeep and minor repairs to internal plumbing fixtures - Descaling of water pipes, repairing leaks in taps and toilets
Interior Maintenance	- Repainting of common areas every 5 years - Repairs to structural interior walls	- Repainting of leased space as required - Floor maintenance including carpets and tiles - Repair of internal plumbing fixtures - Descaling of water pipes, repairing leaks in taps and toilets
Sanitation	plumbing - Maintenance of main water lines	- Descaling of water pipes, repairing leaks in taps and toilets
Interior Maintenance	- Repainting of common areas every 5 years - Repairs to structural interior walls	- Repainting of leased space as required - Floor maintenance including carpets and tiles - Repair of internal doors and locks
Safety and Compliance	- Maintenance of fire safety equipment in common areas - Compliance upgrades to building codes	- Testing and maintenance of fire extinguishers and smoke detectors within the leased area
Garden and Outdoor Areas	- Landscaping of common outdoor areas and structural garden elements	- General upkeep of private terraces, balconies, and garden spaces assigned to the leased property

This detailed table delineates the typical maintenance responsibilities as stipulated in the ROZ lease agreement, ensuring clarity on who is responsible for various types of maintenance and repairs.

Thematic comparison (English testing):

The thematic comparison between the tables will identify shared themes, exclusive themes, and calculate the percentage of thematic similarity.

Shared themes:

1. Tenant responsible for maintenance of changes and additions.
2. Tenant charged for some maintenance costs performed by Landlord.
3. Tenant maintains fabric and carpeting installed by them.
4. Tenant keeps the rented property clean, both internally and externally.
5. Tenant handles cleaning and unclogging of drains.
6. Landlord maintains and renovates the rented property or building complex.
7. Landlord responsible for structural parts such as foundations, columns, and roofs.
8. Landlord handles exterior painting.
9. Tenant handles external minor repairs and internal maintenance.
10. Tenant maintains items like switches, lamps, roller shutters, and interior painting.
11. Tenant maintains technical installations.

Exclusive Themes:

Exclusive to Human response:

1. Landlord's maintenance and renewal of installations belonging to the rented property.

Exclusive to Tailored GPT response:

1. Maintenance of central heating and main electrical lines by Landlord.
2. Tenant's routine checks and minor repairs on HVAC systems mentioned in GPT's response.
3. Specific details on testing and maintenance of safety equipment by the Tenant.

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{\text{Shared Themes}}{\text{All Themes}} \times 100$$

$$\text{Percentage thematic similarity} = \frac{11}{15} \times 100 = 73\%$$

Response from Tailored GPT (Dutch testing)

Wat is de afbakening van verhuurder- of huurderonderhoud volgens de algemene bepalingen van de ROZ-huurovereenkomst. Geef het weer in een tabel.



Hier is een tabel met de afbakening van verhuurder- en huurderonderhoud volgens de algemene bepalingen van de ROZ-huurovereenkomst:

Onderhoudsactiviteit	Verantwoordelijkheid Verhuurder	Verantwoordelijkheid Huurder
Buitenzijde gebouw		
Onderhoud buitengevel	Ja	Nee
Onderhoud dak	Ja	Nee
Onderhoud ramen, kozijnen en deuren	Ja	Nee
Onderhoud schilderwerk buitenzijde	Ja	Nee
Binnenzijde gebouw		
Onderhoud binnenwanden en plafonds	Nee	Ja
Onderhoud binnenvloeren	Nee	Ja
Reparatie en vervanging van ruiten	↓	Ja
Installaties		
Onderhoud en keuring van cv-installaties	Ja	Nee
Onderhoud en keuring van elektrische installaties	Ja	Nee
Onderhoud en keuring van luchtbehandelingsinstallaties	Ja	Nee
Kleine reparaties aan installaties	Nee	Ja
Overige zaken		
Onderhoud van riolering	Ja	Nee
Onderhoud van goten en regenpijpen	Ja	Nee
Onderhoud van gemeenschappelijke ruimtes	Ja	Nee
Onderhoud van liften en roltrappen	Ja	Nee
Onderhoud van buitenverlichting	Ja	Nee
Sneeuw- en ijsvrij houden van toegangen	Nee	Ja

Bron: Algemene Bepalingen ROZ-huurovereenkomst.

Deze tabel geeft een duidelijk overzicht van de verantwoordelijkheden tussen de verhuurder en huurder zoals bepaald in de algemene bepaling ↓ van de ROZ-huurovereenkomst.

Thematic comparison (Dutch testing)

Shared Themes:

1. Maintenance of changes and additions made by Tenant.
2. Costs for maintenance work carried out by Landlord but charged to Tenant.
3. Maintenance of fabric and carpeting installed by Tenant.
4. Keeping the rented property clean internally and externally.
5. Emptying grease traps, cleaning and unclogging drains up to municipal sewage.
6. Maintenance of switches, lamps, lighting, batteries, interior painting.
7. Maintenance of roller shutters, blinds, awnings, sunshades, suspended ceilings, bell installations.
8. Maintenance of gas, water, and electricity pipes and faucets.
9. Maintenance of fences, garden, and yard.
10. Periodic and corrective maintenance of technical installations.
11. Cleaning and unclogging drains/sewers, sweeping chimneys.
12. Maintenance and renovation by Landlord of the rented property or the building or complex of buildings of which the rented property is a part.
13. Maintenance of structural parts such as foundations, columns, roofs.
14. Maintenance and renewal of installations belonging to the rented property.
15. Exterior painting.
16. Maintenance of stairs, steps, sewers, gutters, exterior frames.
17. Replacement of parts and renewal of installations belonging to the rented property.

Exclusive Themes:

Exclusive to Human Response:

1. Specific inclusion of "External maintenance for minor repairs, daily maintenance, and internal maintenance (excluding Article 11.4)."
2. Detailed demarcation of responsibilities for specific components such as windows, frames, facades in the context of cleanliness.
3. Mention of "Maintenance of lifts and escalators" under Landlord's responsibilities.

Exclusive to Tailored GPT Response:

- none

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{17}{20} \times 100 = 85\%$$

3.2: Q2 What is included under the service charges in Article 5 of the lease agreement?

Approach: *"We are currently looking this up in the relevant lease contract. In practice, it turns out that not all of our colleagues (including facility managers) have the necessary knowledge of where to find this information, and it falls to us as Property Managers to verify this and inform our colleagues (Claire)".*

Response from Property managers:


Section 5.1 outlines the services and items that the Landlord is responsible for providing, either directly or through a third party. These include.

1. Maintenance (preventive and corrective) and/or periodic checks for:
2. Common areas
3. Building-related installations
4. Taxes
5. Gutters
6. Exterior window cleaning
7. Legionella management
8. Supply of heat, water, and electricity
9. Locks and closures (in accordance with Article 17)
10. Infrastructure
11. Insurance
12. Grounds and green maintenance
13. Other services and deliveries to be agreed upon between the landlord and tenant.

Response from Tailored GPT (English testing):

 You

What is everything that is included under the service charges in Article 5 of the lease agreement?

 Parnassia Groep GPT

In Article 5 of the lease agreement, the service charges include the following items:

1. Maintenance (preventive and corrective) and/or periodic checks of:
 - Common areas
 - Installations and building-related systems
 - Taxes
 - Gutters
 - Exterior window cleaning
 - Legionella control
 - Provision of heating, water, and electricity
 - Door and window hardware (in accordance with Article 17)
 - Infrastructure
 - Insurance
 - Grounds and green maintenance
 - Other services and supplies agreed upon between the landlord and tenant

Additionally, the landlord has the authority, after consultation with the tenant, to modify or discontinue the type and scope of services and supplies mentioned in Article 5.1.

Thematic comparison (English Testing):

Shared themes:

1. Maintenance and periodic checks
2. Common areas
3. Building-related installations
4. Taxes
5. Gutters
6. Exterior window cleaning
7. Legionella management
8. Supply of heat, water, and electricity
9. Locks and closures (in accordance with Article 17)
10. Infrastructure
11. Insurance
12. Grounds and green maintenance
13. Other services and deliveries

Exclusive to Human response

None

Exclusive to tailored GPT response

None

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{13}{13} \times 100 = 100\%$$


Response from Tailored GPT (Dutch testing):

Wat valt er allemaal onder de Kosten van levering van zaken en diensten in artikel 5.1 van het huurcontract met het Leger des Heils?



Zoeken op internet...

In artikel 5.1 van het huurcontract met het Leger des Heils vallen de volgende kosten onder de "Kosten van levering van zaken en diensten":

- Onderhoud (preventief en correctief) en/of periodieke controle van:
 - gemeenschappelijke ruimten;
 - installaties en gebouwgebonden installaties;
 - belastingen;
 - dakgoten;
 - glasbewassing (buiten);
 - legionellabeheer;
 - levering van warmte, water en elektra;
 - hang- en sluitwerk (in overeenstemming met artikel 17);
 - infrastructuur; 
 - verzekeringen;
 - terrein- en groenonderhoud;
 - nader tussen verhuurder en huurder overeen te komen diensten en leveringen.



Thematic comparison (Dutch Testing):

Shared themes:

1. Maintenance and periodic checks
2. Common areas
3. Building-related installations
4. Taxes
5. Gutters
6. Exterior window cleaning
7. Legionella management
8. Supply of heat, water, and electricity
9. Locks and closures (in accordance with Article 17)
10. Infrastructure
11. Insurance
12. Grounds and green maintenance
13. Other services and deliveries

Exclusive to Human response

None

Exclusive to tailored GPT response

None

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{13}{13} \times 100 = 100\%$$

3.3: Q3 How is the MJOP handled in relation to strategic housing plans and the duration of lease agreements?

“These are now three separate documents that must be compared side by side. The MJOP is not available to us as Property Managers and must be requested from a colleague contract manager.” (Claire).

This question is more challenging to answer, particularly because the aspects that should come into focus within the answer are not clear. There is no distinct objective regarding what must be emphasized. To address this question, the analysis is divided into three parts, one for each of the documents. A final conclusion will then be drawn to determine how these documents correlate with one another.

Response from Property managers:

Duration of the Lease agreements

- *Fivoor* : This agreement is indefinite, starting on November 1, 2022.
- *Leger Des Heils* : This agreement has started on April 1, 2021, for a duration of five years and six months, ending on September 30, 2026.

Strategic housing plans

adres	Postcode	Plaats.Plaats	Energielabel	Interne m2	Juridische status	Functie Object algemeen	Tenant	Duurzaamheidsvisie	Vastgoedmanager	EMIS	Portfolio details.Portfolio strategie.Naam
Hoeklaan 82		Spijkenisse	Energielabel A	4942	Eigendom	Kantoorfunctie/Ambulant	Single	kerngebouw (>15 jaar)		Ja	Behouden
Hoeklaan 82 - 84		Spijkenisse	Energielabel A	4942	Eigendom	Kantoorfunctie/Ambulant	Single	kerngebouw (>15 jaar)		Ja	Behouden
Hoeklaan 84		Spijkenisse	Energielabel A	4942	Eigendom	Kantoorfunctie/Ambulant	Single	kerngebouw (>15 jaar)		Ja	Behouden

Figure 15: Housing strategy Hoeklaan 82-84 (Vastgoed Beheer PG B.V)

Image 15 shows the housing strategy for the property. The property manager’s name and the postal code are blurred for privacy reasons. However, the key takeaway from this snippet of data is that the building is expected to remain in use for over 15 years. Additionally, it states that the strategy aims to retain the building within the portfolio.”

MJOP (Multiyear maintenance plan)

The MJOP (Maintenance and Management Plan) requires attention to two critical aspects based on the lease contracts and the strategic housing plan:

Agreement Duration:

- The agreement with Leger des Heils is set to end in the year 2026.
 - This timeline is crucial for planning maintenance activities during the remaining lease period.

Long-Term Strategy:

- The strategic housing plan emphasizes maintaining the building within the portfolio for 15 years or more.

- While it's logical that maintenance needs may decrease after a tenant leaves, the MJOP should align with the overall strategy and a possible decrease in costs.

However, upon reviewing the MJOP conclusion as shown in image 16, a significant increase in costs is projected after 2026. Upon closer inspection, all costs regarding "Daily maintenance/complaints about installations or structural estimate" gradually increase after 2026, which is questionable. This suggests that the MJOP may not fully account for the lease contract duration. However, it did focus on the building's lifespan and maintenance over a 15-year period.

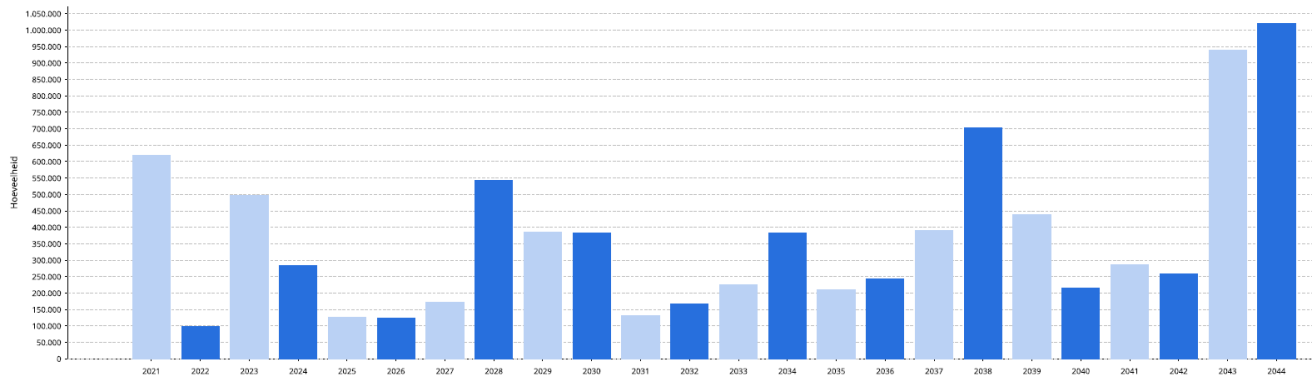


Figure 16: Cost overview MJOP reporting term planning maintenance (Vastgoed Beheer PG B.V)

Conclusion

In conclusion, the MJOP does take into account the strategic housing plans regarding the upkeep and maintenance of the property, indicating a maintenance schedule of over 15 years. However, it does not consider a possible decrease in overall maintenance costs due to a tenant leaving in 2026, leading to reduced wear and tear on common areas and shared facilities.

Response from Tailored GPT (English Testing):



You

How is the MJOP handled in relation to strategic housing plans and the duration of lease agreements? \



Parnassia Groep GPT

The MJOP (Meerjaren Onderhoudsplan or Multi-Year Maintenance Plan) at Hoeklaan 82-84 is intricately connected with the strategic housing plans and the duration of lease agreements. This coordination ensures the building's sustainability and operational standards are maintained over time, which in turn supports long-term tenant commitments and the property's strategic goals.

1. Strategic Housing Plans: The strategic housing plans for Hoeklaan 82-84 emphasize retaining core buildings for longer than 15 years, focusing on sustainability and high standards of facility management. These plans advocate for a long-term approach to property management, which involves maintaining and upgrading building facilities to meet current and future needs efficiently.

2. Duration of Lease Agreements: The lease agreements are structured to align with these strategic plans. For example:

- **Fivoor B.V.** has an indefinite lease, which can be terminated with a two-month notice, providing flexibility to adapt to changing strategic needs while maintaining a stable tenant base .
- **Leger des Heils** has a fixed-term lease of five years and six months, reflecting a commitment that supports both the strategic plan's timeline and the property's maintenance cycle .

3. MJOP Alignment: The MJOP supports these strategies by detailing a schedule of regular and periodic maintenance tasks that ensure the property remains functional and competitive. It includes activities ranging from daily maintenance to significant renovations and inspections scheduled over several years, projecting maintenance needs up to 2044. This long-term planning allows for budgeting and operational adjustments that align with the lease durations and strategic goals of property management.

In summary, the MJOP at Hoeklaan 82-84 is designed to complement the strategic housing plans by providing a structured maintenance framework that supports the durations of lease agreements, ensuring that the property can serve its strategic purposes effectively and sustainably.

The initial response of the GPT excels in addressing the first two parts of the question. It correctly states the formulations within the housing strategy and the duration of the lease contract. However, when it comes to evaluating the MJOP, it falls short by merely describing what the MJOP is. What is needed is an evaluation of the MJOP in relation to the documents, along with a concrete conclusion. To address this gap, a follow-up question is proposed:

"The overall maintenance costs of the MJOP does increase yearly. Does this take into account the lease agreement of the Leger des Heils ending in September 30, 2026?"

J You

The overall maintenance costs of the MJOP does increase yearly, does this take into account the lease contract of the Leger des Heils ending in September 30, 2026.

PG Parnassia Groep GPT

The MJOP (Meerjaren Onderhoudsplan) for Wijklaan 82-84 outlines maintenance costs that increase yearly, and this approach generally considers the long-term needs of the building rather than being specifically tailored to the duration of individual lease agreements. However, the MJOP's framework is designed to maintain the building's standards and functionality continuously, regardless of specific lease durations.

The lease agreement with Leger des Heils, ending on September 30, 2026, falls within the timeline covered by the MJOP. Even though the MJOP includes costs that increase yearly, this is likely more reflective of anticipated inflation, the rising costs of labor and materials over time, and the need for more intensive maintenance as the building ages rather than being directly linked to the specifics of the Leger des Heils lease.

Thus, while the MJOP does not specifically account for the lease ending, it ensures that the building remains in optimal condition, attractive, and ready for either renewal of the lease with Leger des Heils or a seamless transition to a new tenant. This is in line with the strategic housing plan's emphasis on long-term retention and sustainability. The ongoing maintenance and improvement plans help in providing a high-quality space for current and future tenants, maintaining the property's value and functionality irrespective of individual lease agreements.



In the follow-up response, the GPT makes specific conclusions about the MJOP, taking into account the strategic housing plans but not the ending time for the tenant. Additionally, it offers insights into how the MJOP is structured, considering the long-term needs of the building. Furthermore, it explains possible reasons for the rise in costs, providing a comprehensive analysis of the MJOP's approach to maintenance planning.

Thematic comparison (English Testing):

Shared Themes:

1. Lease agreements duration Fivoor
2. Lease agreements duration Leger des Heils
3. Property strategy (retain)
4. Property housing plan (<15 years)
5. MJOP Alignment

Exclusive themes to property managers' Response:

1. Cost Projection Concerns
2. Leaving tenant

Exclusive themes to tailored GPT Response:

1. Inflation and Rising Costs
2. Transition to New Tenant
3. Aging property

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{5}{10} \times 100 = 50\%$$

Response from Tailored GPT (Dutch Testing):



Hoe wordt nu omgegaan met het MJOP in relatie tot strategische huisvestingsplannen (Rapportage portfoliomanagement) en de looptijd van huurovereenkomsten?



MJOP in Relatie tot Strategische Huisvestingsplannen en Huurovereenkomsten

De relatie tussen het Meerjaren Onderhoudsplan (MJOP), strategische huisvestingsplannen en de looptijd van huurovereenkomsten wordt duidelijk uit de volgende documenten en bevindingen:

MJOP

Het MJOP van Hoeklaan 82-84 in Spijkenisse omvat een gedetailleerd overzicht van de geplande onderhoudsactiviteiten en de bijbehorende kosten van 2021 tot en met 2044. Dit plan bevat specifieke details over bouwkundige en installatietechnische onderhoudswerkzaamheden, inclusief frequenties en kosten.

Strategische Huisvestingsplannen

Het strategisch huisvestingsplan zoals beschreven in de Rapportage Portfoliomanagement bevat een duurzaamheidsvisie die in lijn is met het MJOP. Dit rapport benadrukt het belang van duurzaamheid en de noodzaak om onderhoudsactiviteiten te coördineren met duurzame investeringen. De strategische planning is gericht op het optimaliseren van de energie-efficiëntie en het minimaliseren van de ecologische voetafdruk van de gebouwen.

Looptijd van Huurovereenkomsten

De huurovereenkomst met Fivoor B.V. voor Hoeklaan 82-84 heeft een looptijd voor onbepaalde tijd vanaf 1 november 2022, met een opzegtermijn van twee maanden voor beide partijen. Dit biedt flexibiliteit in de vastgoedstrategie, waardoor het mogelijk is om renovaties of grootschalig onderhoud te plannen in periodes van lagere bezetting of tijdens huurderswisselingen.

Interrelaties en Conclusies

1. Synchronisatie van Onderhoud en Strategische Plannen:

Het MJOP biedt een gedetailleerde planning voor onderhoud, die in overeenstemming moet zijn met de bredere doelstellingen van het strategisch huisvestingsplan. Dit betekent dat geplande onderhoudswerkzaamheden niet alleen gericht zijn op het behoud van de functionaliteit en veiligheid van het gebouw, maar ook op het behalen van duurzaamheidsdoelstellingen zoals energiebesparing en CO2-reductie.

2. Flexibiliteit door Huurovereenkomsten:

De huurovereenkomsten met een looptijd voor onbepaalde tijd en een korte opzegtermijn stellen de vastgoedbeheerder in staat om onderhoudsactiviteiten en strategische initiatieven flexibel te plannen. Dit kan bijzonder nuttig zijn voor het implementeren van grotere renovaties of duurzame verbeteringen zonder grote verstoringen voor de huurders.

3. Duurzaamheidsinitiatieven:

In het strategische plan wordt benadrukt dat onderhoud en investeringen in duurzaamheid hand in hand moeten gaan. Specifieke projecten in het MJOP, zoals de vervanging van HVAC-systemen of de installatie van energiezuinige verlichting, dragen bij aan de bredere duurzaamheidsdoelstellingen van de organisatie.

Conclusie

Het MJOP is nauw verweven met de strategische huisvestingsplannen en de looptijd van de huurovereenkomsten. De gedetailleerde onderhoudsplanning zorgt voor een systematische aanpak van het gebouwonderhoud, terwijl de flexibiliteit in de huurovereenkomsten de implementatie van strategische en duurzame initiatieven faciliteert. De strategische visie, zoals uiteengezet in de rapportage portfoliomanagement, en het MJOP vullen elkaar aan om de lange termijn duurzaamheid en efficiëntie van het vastgoedportfolio te waarborgen.

Citaatbronnen:

- MJOP Hoeklaan 2024-04-22
- Huurdersovereenkomst Fivoor.



The initial response only takes into consideration the lease agreement with Fivoor BV, leaving out the agreement with the Leger des Heils. Moreover the answer of the GPT is very general and does not give any specific reasons why the documents correlate for the sake of probing the GPT. A follow-up prompt is asked. The question is: *Take into consideration both agreements with Fivoor and Leger des Heils. Be specific as to why the document correlates and give specific examples form within the datasets.*

Houd rekening met de beide overeenkomsten met Fivoor en Leger des Heils. Wees specifiek over waarom het document correleert en geef specifieke voorbeelden binnen de datasets.



Relatie tussen MJOP, Strategische Huisvestingsplannen en Huurovereenkomsten voor Hoeklaan 82-84 in Spijkenisse

MJOP

Het Meerjaren Onderhoudsplan (MJOP) voor Hoeklaan 82-84 biedt een gedetailleerd overzicht van geplande onderhoudsactiviteiten en de bijbehorende kosten voor de periode van 2021 tot en met 2044. Dit plan bevat specifieke onderhoudsactiviteiten zoals dagelijks onderhoud, periodieke inspecties en vervangingen van installaties.

Strategische Huisvestingsplannen (Rapportage Portfoliomanagement)

De strategische huisvestingsplannen, zoals gedocumenteerd in de Rapportage Portfoliomanagement, leggen de nadruk op duurzaamheid en efficiëntie. De plannen zijn bedoeld om de lange termijn doelstellingen voor het vastgoedportfolio te ondersteunen, met speciale aandacht voor energiebesparing en milieuvriendelijke initiatieven. Dit strategische plan moet in lijn zijn met het MJOP om ervoor te zorgen dat geplande onderhoudsactiviteiten bijdragen aan de bredere duurzaamheidsdoelen.

Huurovereenkomsten

Fivoor B.V.:

- De huurovereenkomst met Fivoor B.V. loopt voor onbepaalde tijd vanaf 1 november 2022 en kan door beide partijen worden opgezegd met een opzegtermijn van twee kalendermaanden.

Leger des Heils:

- De huurovereenkomst met het Leger des Heils ging in op 1 april 2021 voor een periode van vijf jaar en zes maanden, eindigend op 30 september 2026. Huurder ontving een huurvrije periode van drie maanden vanaf 1 april 2021 tot en met 30 juni 2021. De eerste betaling betrof de periode van 1 juli 2021 tot en met 30 september 2021 .
- Specifieke bepalingen in de huurovereenkomst met Leger des Heils omvatten de mogelijkheid voor de huurder om noodzakelijke veiligheidsvoorzieningen op eigen kosten aan te brengen, mits deze worden achtergelaten na afloop van de huurovereenkomst, tenzij de verhuurder anders beslist .

Correlaties en Voorbeelden

1. MJOP en Huurovereenkomsten:

- Het MJOP bevat geplande onderhoudsactiviteiten die moeten worden uitgevoerd ongeacht


de looptijd van de huurovereenkomst. Bijvoorbeeld, jaarlijkse inspecties en periodieke vervangingen van installaties moeten worden gesynchroniseerd met de huurperiodes om verstoringen te minimaliseren. Dit geldt voor beide huurders, Fivoor en Leger des Heils.

- Specifiek, de vervanging van HVAC-systemen of andere installaties zoals gepland in het MJOP kan worden ingepland tijdens huurvrije periodes of na overleg met de huurders om operationele verstoringen te minimaliseren.

2. Strategische Huisvestingsplannen en Duurzaamheid:

- De strategische huisvestingsplannen benadrukken het belang van duurzaamheid, wat aansluit bij de geplande vervangingen en upgrades in het MJOP. Bijvoorbeeld, de installatie van energie-efficiënte systemen en renovaties gericht op het verbeteren van de energieprestaties van het gebouw komen overeen met de duurzaamheidsdoelen van het vastgoedbeheerplan.
- Specifieke initiatieven zoals de installatie van zonnepanelen of verbeterde isolatie kunnen worden geïntegreerd in het onderhoudsschema om te zorgen voor een continue verbetering van de energie-efficiëntie van het gebouw.

3. Flexibiliteit in Huurovereenkomsten:

- De flexibele looptijd van de huurovereenkomsten  biedt ruimte voor strategische aanpassingen. Voorbeeld: De huurovereenkomst met Fivoor, die een opzegtermijn van twee maanden heeft, biedt de mogelijkheid om onderhoudsactiviteiten en strategische aanpassingen flexibel te plannen zonder langdurige contractuele beperkingen.
- De specifieke huurvrije periode en de aanvangsvoorwaarden in de overeenkomst met het Leger des Heils laten zien hoe de planning van onderhoud en renovaties kan worden afgestemd op de huurvoorwaarden.

Conclusie

Het MJOP is nauw verweven met de strategische huisvestingsplannen en de huurovereenkomsten. Door gedetailleerde onderhoudsplanung en flexibiliteit in de huurovereenkomsten kunnen onderhoudsactiviteiten en strategische initiatieven efficiënt worden uitgevoerd, waardoor zowel de operationele continuïteit als de duurzaamheid van het vastgoed wordt gewaarborgd.

Citaatbronnen:

- MJOP Hoeklaan 2024-04-22
- Huurdersovereenkomst Fivoor
- Huurdersovereenkomst Leger des Heils .



Interesting the GPT starts hallucinating adding fact to the response like: “ *The strategic housing plans, as documented in the Portfolio Management Report, emphasize sustainability and efficiency. The plans are intended to support the long-term objectives for the real estate portfolio, with a special focus on energy savings and environmentally friendly initiatives.*” Which is not the case within the document. However due to the follow-up question it does now take into account both tenants. It does take into account the MJOP and the housing strategy yet the examples given are now from within the datasets and act more as a suggestion, to stimulate correlation between the 3 documents.

Thematic comparison (Dutch Testing):

Shared Themes:

1. Lease agreements duration Fivoor
2. Lease agreements duration Leger des Heils
3. Correlation between the documents
4. MJOP Alignment

Exclusive themes to property managers' Response:

1. Cost Projection Concerns
2. Leaving tenant

Exclusive themes to tailored GPT Response:

1. Example suggestions to further stimulate correlations
2. Hallucination on housing strategy contents

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{4}{8} \times 100 = 50\%$$

Conclusion Dutch testing:

When comparing the responses between English and Dutch testing, the results remain fairly similar, with only question 1 performing more accurately to the human response, while questions 2 and 3 perform largely identically. This is most likely due to the complexity and structure of the questions. Question 1 is a definitional/contextual type of question, indicating that using the same language within the dataset, prompt configuration, and questions allows the GPT model to more comprehensively evaluate data. Question 2 is done equally well in both languages, highlighting only the language translation adaptability of the GPT. However, question 3, being a complex strategic question consisting of three internal questions, presents challenges. Due to its complexity, the GPT underperforms in terms of thematic similarities. It may hallucinate self-made facts, conclusions, or reasons that do not fall within the scope of the data. Regarding the language use can be said that whenever a GPT is configured, fed and asked within 1 language it performs better than when languages are mixed. In the remaining part the questions will be asked in English, continuing the comparability between the property managers and the tailored GPT.

3.4: Q4 How can service costs (energy consumption and maintenance of building-related installations) be fairly reconciled for a property that is used 24/7 as well as by other tenants/users only during office hours?

"It is currently calculated based on the square meters used by a tenant, but no account is taken of the usage (24/7 or office hours) (Claire)."

In this part, is examined how to reconcile service costs, like energy consumption and maintenance, within the property. This question is mostly directed to the Leger des Heils which has a building usage of 24 hours a day, in contrast to the other tenants within the building. While direct or indirect answers may not be found in the existing data. The answer to this question is to propose potential solutions. By analyzing the current methods used by property managers and explore alternative approaches through additional research. The aim is to find fair ways to allocate costs. Since the question is more explorative and advisory no thematic similarity analysis will be done. Another point of attention is a slight modified question for the Tailored GPT:

"What options are there to fairly reconcile service costs (energy consumption and maintenance of building-related installations), for The Hoeklaan, which operates 24/7 for the Leger des Heils and is only used during office hours by other tenants?"

Response from Property managers:

To address the energy consumption settlement according to the method of the property managers, we first need to examine the calculation based on square meters and the attempt to use submeters.

The current method employs a price of 20.32 euros per square meter. With the Leger des Heils occupying 770 square meters, the total cost is calculated to be 15,646.37 euros. However, the price index remains the same for all tenants, which creates unfairness for those with lower service cost usage compared to the Leger des Heils. Essentially, tenants with lower service cost usage end up paying more than they use, while the Leger des Heils, with higher service cost usage, pays less than they consume.

An attempted solution to rectify this issue was submetering, as stated within interview A (appendix F, minute 11-12). Submetering would involve installing individual meters for the Leger des Heils to accurately measure their actual energy consumption. This would ensure that the Leger des Heils only pays for the energy they actually use. Given the significant variance in their building usage compared to other tenants who typically operate between 09:00 and 17:00, submetering would allow for a higher price index for the Leger des Heils and a lower price index for the other tenants. This adjustment would have resulted in a fairer settlement of the service costs for all parties involved.

Another method found through online research are green leases. Green leases could integrate terms within the lease contract that mutually benefit all tenants and the property owner by promoting energy efficiency and sustainability (Aquicore, 2023). These leases could include shared incentives or responsibilities to invest in energy-saving upgrades. For a tenant like Leger des Heils, this could mean modifications or upgrades in their space that reduce energy consumption without compromising their 24/7 operational needs. Examples of the terms could be:

- *The landlord and tenant agree to jointly invest in the retrofitting of the HVAC system to achieve a minimum of 20% improvement in energy efficiency over the existing system within X years of lease commencement.*

- *Tenant shall have submeters installed at their own expense, and both parties agree to monthly sharing of energy consumption data to monitor and manage usage effectively.*

Response from Tailored GPT:



You

"What options are there to fairly reconcile service costs (energy consumption and maintenance of building-related installations), for The Hoeklaan, which operates 24/7 for the Leger des Heils and is only used during office hours by other tenants?"



Parnassia Groep GPT

To address the issue of fairly reconciling service costs for the Hoeklaan 82-84, which includes tenants like Leger des Heils operating 24/7 and others using the space only during office hours, the following strategies could be employed based on the insights gathered from the documents:

1. Differentiated Service Costs Based on Usage Profiles:

The service costs, particularly for energy consumption (electricity and gas) and maintenance of building-related installations, can be fairly allocated by differentiating between tenants based on their usage profiles. For instance, Leger des Heils, which operates 24/7, has a significantly different energy usage pattern compared to other tenants who use the space only during office hours. Based on the detailed energy usage data from the "Energieverbruik 2023 Hoeklaan 82-84" document, it is noted that there is a specific energy consumption profile for Leger des Heils, which is heavier due to their 24/7 operation. This suggests the implementation of a usage-based cost allocation where costs are divided according to actual consumption measured via submetering systems, if feasible.



2. Implementation of Submetering Systems:

Introducing submetering for electricity and gas could provide a direct measurement of each tenant's actual consumption, allowing for a more equitable distribution of costs. The use of submeters helps ensure that each tenant is billed based on their specific consumption rather than a flat rate divided by square footage or estimated usage percentages.

3. Adjustment of Cost Allocation Formulas:

The "afrekening 2023 Hoeklaan 82-84" document provides a breakdown of costs allocated to Leger des Heils based on their high-usage profile. Using similar formulas, you can adjust the percentage of shared costs (like maintenance and utilities) based on the operational hours and intensity of space usage by different tenants.

4. Review and Regular Updates:

Regular reviews of usage data and cost allocation formulas should be conducted to ensure fairness and accuracy over time. Changes in tenant usage patterns or operational hours should be reflected in updated cost distributions.

5. Clear Communication and Agreements:

It's crucial that all tenants clearly understand the basis of cost allocations. Regular meetings or communications to explain the details of the cost breakdowns and any updates to the policies will help maintain transparency and good relations between the property management and tenants.

The GPT outlines a number of possible solutions, but they are all very generalized and lack specific implementations based on the context. Additionally, it did not provide any solutions regarding the

datasets and the current methods used. To further probe the GPT, the following follow-up question is proposed:

“Can you give an example of adjusting the cost allocation formula within the “afrekening 2023” for the Hoeklaan.”



You

can you give an example of adjusting the Cost Allocation Formula within the "afrekening 2023 Hoeklaan 82-84" document

< 2 / 2 >



Parnassia Groep GPT

In the "afrekening 2023 Hoeklaan 82-84" document, a specific approach for adjusting the Cost Allocation Formula can be crafted by using the data on energy consumption and service costs alongside the operational profiles of different tenants, such as Leger des Heils and other office-hour tenants. Here's a step-by-step example of how you might adjust this formula:

Step 1: Determine Proportional Usage Based on Operational Hours

Given that Leger des Heils operates 24/7 and other tenants use the building only during office hours, you first calculate the proportional usage. For instance:

- Assume office hours are typically 40 hours per week.
- Leger des Heils operates 168 hours per week (24 hours x 7 days).

Step 2: Calculate the Weighted Usage

To reflect the actual usage, you can use a weighted factor based on the operational hours:

- **Weight for Leger des Heils:** $\frac{168 \text{ hours}}{40 \text{ hours} + 168 \text{ hours}} \approx 81\%$
- **Weight for other tenants:** $\frac{40 \text{ hours}}{40 \text{ hours} + 168 \text{ hours}} \approx 19\%$

Step 3: Apply the Weights to Service Costs


From the "afrekening 2023 Hoeklaan 82-84" document, let's say the total service costs for electricity and gas were noted as significant expenditures:

- **Total Electricity Cost for 2023:** €58,033.80
- **Total Gas Cost for 2023:** €64,473.46

Using the weights calculated:

- **Electricity Cost Allocation:**
 - Leger des Heils: €58,033.80 × 81% ≈ €46,997.38
 - Other Tenants: €58,033.80 × 19% ≈ €11,036.42
- **Gas Cost Allocation:**
 - Leger des Heils: €64,473.46 × 81% ≈ €52,223.50
 - Other Tenants: €64,473.46 × 19% ≈ €12,249.96

Step 4: Regular Review and Adjustment

Ensure these calculations are reviewed and  y to adjust for any changes in tenant usage patterns or operational hours. This might include new tenants or changes in the operational nature of existing tenants.

Conclusion:

This adjusted formula provides a more equitable distribution of costs based on actual usage, reflecting the higher utility demands of Leger des Heils due to their 24/7 operations compared to other tenants. Regular updates and transparent communication about how these costs are calculated and distributed will be essential for tenant satisfaction and management efficiency.



The tailored GPT's proposal outlined several measures, including submeters, which are also implemented by the property managers. However, other proposals seem too general to implement, such as regular reviews and clear communication. When asked with a follow-up question for adjusting cost allocation formulas based on usage profiles, the GPT outlines a practical approach to directly correlate costs with actual consumption. This method involves differentiating a weighted usage of the service costs. Initially, the GPT's response only takes into account two tenants. However, when other tenants are introduced, a new weight can be deduced to accommodate the additional variables:

- Total Hours for Leger des Heils: 168 hours per week.
 - Total Hours for Other Tenants: 40 hours per week × 3 tenants = 120 hours per week.
 - Grand Total Hours: 288 hours per week.
1. **Weight for Leger des Heils:** 168 hours / 288 hours ≈ 58.33%
 2. **Weight for Each Other Tenant:** 40 hours / 288 hours ≈ 13.89% per tenant

To determine a final weight value, a systematic approach must be carefully formulated and substantiated by professionals.

3.5: Q5 How can service costs be fairly reconciled to tenants when sub-meters are missing?

"It is now calculated based on square meters rented and a surcharge for common areas. (Claire)"

Since this question follows the same idea as the previous one, no similarity analysis will be done. The desired answer from the property managers is not found within the datasets. This means that the current method as used by the property managers only describes how they reconcile service costs. It does not take into account "fair reconciliation." Since the nature of the question focuses on exploration of options, which the property managers themselves have not figured out, it would be futile to compare. Because of the question formulation, it is most likely that the GPT will focus on options to fairly reconcile service costs rather than to mimic the response of the property managers, as outlined within the prompt.

Response of property managers:

In the absence of sub-meters the property managers currently reconcile service costs based on the square meters rented by each tenant, along with a surcharge for the use of common areas. As this is already mentioned in the previous question, only a short overview is provided of the current method:

- Total leased space by Leger des Heils: 770 m².
- Total service costs for 2023 (incl. Installations and maintenance) 66,69 euro per square meter
- Total cost for Leger des Heils 51.352,48 euro


Allocation Key

- LDH Profile (24/7 living): Factor 2 (factor 2 = meterage weighting * 2 due to usage profile 24/7 living)
- PG Profile (office): Factor 1 (factor 1 = meterage weighting * 1 due to office usage profile)
 - LDH Share 2023: 1,540.00 - 26.96%
 - PG Share 2023: 4,172.00 - 73.04%

Response of Tailored GPT:

 You

How can service costs be fairly reconciled to tenants when sub-meters are missing?

 Parnassia Groep GPT


To ensure fair reconciliation of service costs to tenants at properties like Hoeklaan 82-84 in the absence of sub-meters, the property management can adopt a multi-faceted approach. Here's a more comprehensive outline of methodologies that might be employed, considering the complexities and fairness in cost allocation:

1. Main Meter Data Utilization: Use comprehensive data from main meters for utilities such as electricity, gas, and water. This involves recording the total consumption data from these main meters regularly and allocating costs based on this total consumption.

2. Proportional Distribution Based on Area:

- Calculate each tenant's share of the utility costs based on the proportion of the total building area they occupy. For instance, if a tenant occupies 20% of the total area, they would be responsible for 20% of the utility bills. This is straightforward and ensures that tenants pay a fair share relative to the size of their leased space.
- This method is particularly useful in buildings like Hoeklaan 82-84, where the tenants, such as Leger des Heils, have specified areas documented in lease agreements, providing a clear basis for such calculations.

3. Inclusion of Fixed Charges in Rent:

- Integrate fixed service charges into the rent, thereby simplifying the billing process. This can be particularly effective in cases where  the consumption patterns are predictable or where sub-meter installation is not feasible due to technical or cost reasons.
- This method is visible in the lease agreement with Fivoor, where a fixed, all-inclusive rental charge covers part of the service costs, obviating the need for detailed utility cost breakdowns per tenant.

4. Estimation Adjusted for Usage Profiles:

- For a more nuanced approach, consider the nature of each tenant's business and adjust cost allocation based on estimated consumption profiles. For example, a tenant operating 24/7, such as a residential facility or a healthcare provider, would naturally consume more utilities compared to standard office spaces operating during business hours only.
- Assign weights to different types of usage. As seen in the detailed service and consumption cost breakdown for Leger des Heils, different activities and their intensities (like 24/7 operation) can have pre-determined factors that multiply their area-based allocation to reflect actual usage more accurately.

5. Annual Reviews and Adjustments:

- Conduct annual reviews of consumption and cost allocation strategies to ensure fairness and address any discrepancies from previous estimates. This could involve adjustments based on actual yearly consumption data compared to the estimates used for billing throughout the year.
- Such regular assessments ensure transparency and maintain trust among tenants, especially in multi-tenant properties where utility usage can vary significantly.

By combining these strategies, property management at Hoeklaan 82-84 can achieve a fair and transparent method of reconciling service costs among its tenants, ensuring that each tenant pays an equitable share of the utilities, reflective of their actual or estimated usage. This comprehensive approach not only ensures fairness but also enhances tenant satisfaction and compliance.

When evaluating the suggestions made by the GPT, some elements come into focus. The proportional distribution based on area method already matches the existing approach. Implementing it strictly wouldn't change the costs for Leger des Heils. However, adjustments for more accurate utility usage might not be factored in, potentially underrepresenting their actual costs given their 24/7 operations.

The inclusion of fixed charges in rent might increase the total cost for Leger des Heils. This is because fixed charges would be designed to cover more intensive utility usage throughout all hours, unlike typical office hour operations. This option can be further researched by the people qualified to make these allocations.

Thirdly, the method of estimation adjusted for usage profiles could increase their costs as it would account for higher electricity, installation usage, and possibly maintenance. By finding peak usage periods per tenant and assigning an extra cost factor, this would allow tenants to pay according to their usage.

Lastly, annual reviews and adjustments could lead to variations in their service charges from year to year. If actual consumption data reveal that higher service cost utility is used than estimated, this would imply that their service costs might increase accordingly. Conversely, if the estimates are found to be higher than actual usage, costs might decrease.

3.6: Q6 What sustainability options are available for the property?

“Depending on input from our collaboration partner Innax and our Energy Manager. We need to educate ourselves. And at the start/lease, a Quick Scan is made in terms of the architectural and installation state and sustainability potential. (Claire)”

Response of property managers:

According to the energy report from the collaboration partner Innax, recommendations have been made regarding energy usage within the property. Initially, the focus is on analyzing the building configuration in terms of architecture and installations. The resulting table does not include information about the state of each installation type. Consequently, no definitive conclusions can be drawn about their condition. However, it is possible to assess the sustainability potential by comparing them to other more sustainable options available in the market and ranking the current options from low to high. A low ranking indicates the use of fossil fuels, no renewable energy usage, or older systems, while a high ranking indicates that the installation is market conform.

Aspect	Type:	Sustainability potential:
Heating	HR boiler	High
Cooling	Compression chiller	Medium
Facade insulation	9cm	High
Floor insulation	9cm	High
Roof insulation	9cm	High
Glazing	HR++ glass	High
Ventilation	Balanced with heat recovery ventilation (WTW)	High
Lighting	LED with energy-efficient switching in all areas	High
PV coverage	Solar panels on 70% of the roof surface	High
Hot water	Gas boiler without solar collector	Low

When analyzing the Innax report, it provides an outline of sustainability measures for the property. The report, includes various aspects of sustainability measures and energy efficiency measures that can be taken.

Overview of Energy-Saving Measures

- *Heating*: The installation of a return air/water heat pump accompanied by a gas boiler
- *Ventilation*: Implementation of a balanced ventilation system with Heat Recovery
- *Hot Water*: Use of a heat pump boiler

In addition to these measures, the report mentions the replacement of HR electric motors in the air handling unit under the DUMAVA project. This replacement enhances the efficiency of the air treatment system. The report also notes improvements in heat pump heating and boiler systems.

Measures with a Payback Time of Up to 5 Years

- Introduction of energy-efficient heat generation.
- Enhancement of energy-efficient tap water heating.
- Reduction of installed lighting power in elevator cabins.
- Use of energy-efficient motors.

Chapter 3.4: Other Possible Measures

- Suggestions to disconnect seldom-used devices and to use timer switches for managing power overnight.
- Installation of smart energy meters and an energy registration and monitoring system (EBS) to actively manage energy.
- Implementation of Active Energy Management to monitor energy use in real-time and address discrepancies promptly.
- Optimization of climate control and regulation technology to increase efficiency.

Organizational and Behavioral Change Measures

These recommendations emphasize energy-conscious culture within the organization. It emphasizes awareness and training to ensure that energy-efficient practices are integrated into daily operations and maintained over time.

These are all the sustainability options given within the Innax document.

Response of Tailored GPT:



You

What sustainability options are available for the property?



Parnassia Groep GPT

For the property at Hoeklaan 82-84, the "Energierapport 2023 Innax Hoeklaan" outlines several sustainability measures to improve energy efficiency and reduce environmental impact. Here are the main options available:

Overview of Energy-Saving Measures

- **Heating:** Installation of a return air/water heat pump combined with a traditional gas boiler. This setup aims to efficiently manage heating needs while reducing reliance on conventional heating methods.
- **Ventilation:** Implementation of a balanced ventilation system with Heat Recovery (WTW), which helps in recycling heat from exhaust air to warm incoming fresh air, reducing energy demands for heating.
- **Hot Water:** Use of a heat pump boiler, which is typically more energy-efficient compared to traditional water heating methods.

Enhancements under the DUMAVA Project

- **Air Handling Unit Efficiency:** Replacement of HR electric motors in the air handling unit to enhance the efficiency of the air treatment system. This is part of broader efforts to optimize the mechanical systems for better energy performance.
- **Improvements to Heat Pump Systems:** Upgrading the heating and boiler systems with advanced heat pump technologies to improve thermal efficiency and reduce carbon emissions.

Measures with a Payback Time of Up to 5 Years

- **Energy-Efficient Heat Generation:** Introduction of advanced systems for more efficient heat production.
- **Energy-Efficient Tap Water Heating:** Enhancement of the water heating system to use less energy while providing the necessary hot water supply.
- **Reduced Lighting Power in Elevator Cabins:** Implementation of lower power lighting systems in elevator cabins, which can significantly reduce electricity use in these less noticed areas.
- **Use of Energy-Efficient Motors:** Upgrading to more efficient motors across various applications within the property to reduce electrical consumption.

Chapter 3.4: Other Possible Measures

- **Power Management:** Recommendations for disconnecting seldom-used devices and employing timer switches to manage power usage effectively overnight.
- **Smart Energy Systems:** Installation of smart energy meters and an energy registration and monitoring system (EBS) for active energy management.
- **Optimization of Climate Control:** Adjustments and improvements in climate control and regulation technology to increase overall system efficiency.

Organizational and Behavioral Change Measures

- **Cultural Shifts:** Focusing on creating an energy-conscious culture within the organization through awareness and training. These measures ensure that energy-efficient practices are integrated into daily operations and maintained over time.

These sustainability options are designed to not only improve the environmental footprint of the property but also to provide long-term cost savings through reduced energy consumption.

The response from the tailored GPT appears to have covered most aspects, but it fell short in two areas. Firstly, it overlooked the building configurations and installations despite the prompt's inclusion of these. This could be attributed to the lack of specific instructions within the question. Secondly, it included contextual information alongside each heading, although this isn't explicitly outlined in the Innax document. This relates to the model's contextualization abilities and is called hallucinations. These hallucinations involve creating outputs that are out of the scope of instructions, nonsensical, or inaccuracies.

Thematic comparison:

Shared themes:

1. Energy-saving measures
2. Heating improvement
3. Ventilation enhancement
4. Hot water efficiency
5. Improvements under DUMAVA project
6. Measures with payback time of up to 5 years
7. Other possible measures
8. Organizational and behavioral change measures

Themes exclusive to property manager's response:

1. Building installation configuration
2. Sustainability potential analysis

Themes exclusive to tailored GPT response:

1. Clarification on energy efficiency measures

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{8}{11} \times 100 = 73\%$$

3.7: Q7 What are the most common fault notifications that could now be treated preventively?

“Only during escalations do we request an overview of all notifications from our Service Desk and then we have to go through it ourselves to see what all notifications are being made. There is no time to do this structurally for our (rental) properties, it is too much work for us as Property Managers and is more a task for a Facility Manager. But it does help in directing our suppliers (electricians, contractors, cleaning, etc.) and improving service to the healthcare companies. (Claire)”

Response of property managers:

Addressing this question became a true challenge. The current approach is reactive, addressing faults only during escalations. Notifications are manually sorted through from the Service Desk to a long list. This list is lacking structure for any property manager to quickly go through.

To answer the question it is obvious that the property managers would search hours using “CNTRL + F”. Since the excel file piles up to almost 700 fault notices from the property, this task would be extremely time consuming.

In order to speed up the process a list of keywords are extracted from a short research into common facility management issues. A search is then done to the amount of cells these keywords are used in. This would allow for a very global scan of the most common fault notices. However, this method does have limitations. By looking at only keywords, it scrutinizes a comprehensive analysis which in turn compromises accuracy.

In the list below the keywords are shown according to common property maintenance issues, of (Sperlich-Best, 2024). These keywords represent common themes within the fault notifications. It is important to note that these themes does not represent a complete overview of all the issues reported. Another issue is that this method does not account for words being used twice within the same cell. However, it does offer a good starting point to categorize the fault notifications. Next to the keywords the amount of cells this word is included in is represented. Important to note is that only the rows containing the initial notice to the service desk is reviewed, this excludes all the order notices.

- Climate conditions = 26
- Doors = 6
- Toilets/sanitair = 9
- Leakage = 13
- Bathtubs = 0
- Drains = 1
- Refrigerators = 0
- Lights = 7
- Showers = 0
- Disposal = 8

By using this method the most common fault notices are Air conditioning, Problems with doors and problems with drains.

Response of Tailored GPT:

In this section the question will be modified a little and one follow-up question is asked. The first question allows the GPT to identify the categories per fault notice, while the second one lists them and allows for a preventive response.

- *Categorize all the maintenance notifications within one table, specify the amount of notices have been made per category.*
- *What are the most common fault notifications that could now be treated preventively?*

The GPT initially failed completely. To sum up the conversation briefly, the first question addressing categorization of the fault notices failed. Despite multiple attempts, the numbers provided didn't match the Excel file. The second question about the most common fault notices is therefore also not credible. To try and achieve a better result, the initial dataset will be compressed. Instead of providing the entire table, only a small part will be given as input. This part excludes all unnecessary information like order notices and descriptions, focusing solely on the notifications to the service desk and their brief descriptions. This should make the data more processable for the GPT.



You

Categorize all the maintenance notifications within one table, specify the amount of notices have been made per category



Parnassia Groep GPT

Here's a detailed categorization of the maintenance notifications from the provided dataset along with the count for each category:

Category	Number of Notifications
Coffee Machine Issues	18
Climate Control Issues (Air conditioning, Heating)	33
Structural Issues (Building-related)	31
Leakages	14
General Maintenance and Repairs	21
Cleaning Requests	8
Electrical/Technical Faults	9
Furniture and Interior Requests	9
Sanitary Issues	8
Security Systems	4
Miscellaneous (Including Urgent)	11

This table organizes the various types of maintenance requests logged, helping to identify common issues and their frequency within the dataset.



You

What are the most common fault notifications that could now be treated preventively?



Parnassia Groep GPT

Analyzing the dataset for common fault notifications that appear recurrently and could potentially be treated preventively, the following categories and specific issues stand out:

1. Coffee Machine Issues:

- **Storing (malfunctions):** There are 18 reports related to coffee machine issues. Frequent malfunctions such as "machine leeg" (machine empty) and "machine lekt" (machine leaking) suggest the need for regular maintenance checks and timely refilling protocols.

2. Climate Control Issues:

- **Air conditioning and heating problems:** With 33 notifications involving the climate control system, such as "Airco maakt een brom geluid" (Airco makes a humming sound) and "Geen verwarming" (No heating), these systems likely require a scheduled service plan to prevent failures, especially before seasonal changes.

3. Structural Issues (Building-related):

- **Lekkages (leakages) and Hang- en sluitwerk (door fixtures and locks):** Noted 14 times for leakages and numerous entries for fixture and lock issues, regular inspections of plumbing and structural integrity could help identify potential weak points before they result in leaks or broken fixtures.

4. General Maintenance and Repairs:

- **Storing Sensoring and Verstoppingen (↓ :kages):** Sensor malfunctions and blockages, noted 21 times, indicate the necessity of regular diagnostics and cleaning to ensure sensors and drains are operational.

5. Sanitary Issues:

- **Toilet and wash facilities:** Reports like "Toilet blijft doorlopen" (Toilet continues to run) highlight the need for frequent checks and maintenance of sanitary facilities to prevent water wastage and ensure hygiene.

By implementing routine checks and maintenance for these commonly reported issues, many of the faults could potentially be identified and rectified proactively, thus reducing the frequency of these notifications and improving the overall operational efficiency of the facilities.

After diluting the data, the GPT is able to categorize the query into distinct fault types from the dataset. Each category is addressed with an approximation to the counted answer of the property managers analysis. Within answering the main question of the most common fault notifications and the preventive response, it answers pretty generally, what it did do correctly is giving examples from within the data, making the recommendations to preventive actions more urgent.

Comparison:

Shared themes:

Since the initial response of the property manager is based on common property maintenance issues, by (Sperlich-Best, 2024). It is difficult to analyze a direct correlation in themes. To provide a comparison for both responses, only the exact number of shared counted fault notifications will be evaluated. This does not necessarily provides a thematic comparison but examines the accuracy capabilities of the GPT. The accuracy is decided by the following formula:

$$\text{Accuracy} = \frac{\text{Low number}}{\text{Hight number}} \times 100 = X\%$$

Property manager count	Tailored GPT count	Accuracy
Climate conditions = 26	Climate Control Issues = 33	78%
Toilets/sanitair = 9	Sanitary Issues = 8	89%
Leakage = 13	Leakages = 14	92%

75%

Property manager new count	Tailored GPT count	Accuracy
Coffee Machine Issues = 24	Coffee Machine Issues = 18	75%
Structural Issues = 33	Structural Issues = 31	94%
<i>(Door fixtures and locks and General construction issues)</i>	<i>(Door fixtures and locks and General construction issues)</i>	
General Maintenance and Repairs = 13	General Maintenance and Repairs = 21	62%
Cleaning Requests = 8	Cleaning Requests = 8	100%
Electrical/Technical Faults = 11	Electrical/Technical Faults = 9	81%
Furniture and Interior Requests = 11	Furniture and Interior Requests = 9	81%
Security Systems = 3	Security Systems = 4	75%

The average percentage of accuracy is **81%**, this is high however this is not necessarily desirable when integrating a new system. Since the initial method only looks at keywords and does not take into account multiple keywords within 1 cell, there is room for error. While this method does provide a global view of the GPTs accuracy, it does not fully capture the intricacies of fault identification in property management. Achieving a high average accuracy percentage is indeed commendable, but it's essential to address the underlying limitations of the keyword-based approach. By solely relying on keywords, the analysis may overlook nuances and context-specific details crucial for fault detection and resolution. Another issue is that the some faults could fit in two or more categories highlighting the need for a more nuanced fault identification system.

3.8: Q8 Is the advance payment for service costs still sufficient compared to the costs of the package of deliveries and services in Article 5?

“We now have this investigated each year by our collaboration partner Servicekosten Nederland. They prepare the service cost settlement and then check based on rental invoices whether the advance service cost amount is still sufficient.”

To answer this question the focus will be placed on the tenant Leger des Heils, since the data most extensive for this particular tenant.

Response of property managers:

First it is important to find the advance payment within the lease agreement of the Leger des Heils. After a scan these are the payments:

1. Rent residential space	€ 28.525,00 (incl.
2. Rent parking	€ 337,50 (incl.
3. the advance payment for the compensation for the goods and services provided by or on behalf of the landlord	€ 6.903,04 (incl.
<hr/>	
4. total	€ 35.765,54 (incl.

The lease agreement specifies that the advance payment is €6,903.04 per quarter, which amounts to €27,612.16 annually. The actual amount of the advances as reported in the service charge statement for the entire year was €55,000.00, not €27,612.16. Since the lease contract is from 2021 while the service charge statement is from 2023 this could explain the difference.

The actual costs according to the service cost settlement were €51,349.77 excluding BTW. The pre-paid advance was €55,000.00, indicating that the actual costs for the year 2023 were fully covered by the advances. In fact, there was a surplus of €4,897.27, meaning that the advances exceeded the actual costs.

Based on the actual costs according to the service cost settlement the “the advance payment for the compensation for the goods and services provided by or on behalf of the landlord” should be:

$$\text{New quarterly advance payment} = \frac{51.349,77}{4} = 12.837,44 \text{ per quarter}$$

Which is almost double of the current advance payment as recorded within the lease contract. Therefore can be concluded that the advance payment for service costs within the lease contract of 2021 is insufficient compared to the actual advance payment made for the year 2023. While the actual paid advance in 2023 was indeed sufficient.

Response of Tailored GPT:

J You

Is the advance payment for service costs still sufficient compared to the costs of the package of deliveries and services in Article 5?

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PG Parnassia Groep GPT

Yes, the advance payment for service costs is still sufficient compared to the costs of the package of deliveries and services specified in Article 5 of the lease agreement. According to the service costs settlement for 2023, the actual costs were fully covered by the prepaid advance payments. The prepaid amount for the year was €55,000.00, whereas the total costs excluding VAT amounted to €51,349.77. This resulted in an excess of -€4,897.27, indicating that the advance payments were more than sufficient to cover the costs.

J You

Is the advance payment for service costs as stated within the lease agreement still sufficient compared to the costs of the package of deliveries and services in Article 5?

PG Parnassia Groep GPT

Yes, the advance payment for service costs as stated within the lease agreement is indeed sufficient compared to the costs of the package of deliveries and services outlined in Article 5. Here's the breakdown:

- 1. Advance Payment Specified in Lease Agreement:** The advance payment for the package of deliveries and services is €6,903.04 per quarter, which amounts to €27,612.16 annually.
- 2. Actual Costs from Service Costs Settlement:** According to the service costs settlement for 2023, the total costs excluding VAT amounted to €51,349.77. The prepaid advances for the year were €55,000.00.

This shows that the prepaid advance not only covered the actual costs but also resulted in a surplus of -€4,897.27, indicating that the advance payments were more than sufficient to cover the agreed-upon services in the lease agreement.

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J You

what should be the new Advance Payment Specified in Lease Agreement to be more accurate to the actual service costs in 2023

PG Parnassia Groep GPT

To determine the new advance payment for the lease agreement that more accurately reflects the actual service costs in 2023, we can look at the total service costs and adjust the advance payment accordingly.

- 1. Actual Service Costs for 2023:** The total service costs, excluding VAT, amounted to €51,349.77.
- 2. Calculation for New Advance Payment:**
 - The advance payment should ideally match or slightly exceed this amount to ensure all expenses are covered without a significant surplus.
 - To calculate the monthly advance payment: $\frac{€51,349.77}{12} \approx €4,279.15$ per month.
 - To calculate the quarterly advance payment: $\frac{€51,349.77}{4} \approx €12,837.44$ per quarter.

Thus, an adjusted quarterly advance payment of approximately €12,837.44 would be more aligned with the actual service costs for 2023, compared to the previous advance payment of €6,903.04 per quarter. This new amount provides a more precise approximation to cover the actual expenses incurred.

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⋮

To address the question thoroughly and meet the desired outcomes, a series of questions are made. Initially, the focus is placed on the service cost settlement, where the sufficiency of the advance payment is assessed. Transitioning to the lease agreement, the focus shifts to the advance payment as outlined within its terms. While only the costs are stated no conclusions are drawn from within the lease agreement. Following this, a calculation is requested to determine a new payment arrangement within the agreement, which is done correctly. However, there remains a notable absence in providing further explanation regarding the disparity between the advance payment detailed in the lease contract and that within the service cost settlement.

Thematic comparison:

Shared themes:

1. Evaluation of advance payments
2. Comparison between advance payments and actual costs
3. Advance payment within service cost settlement is sufficient
4. New advance payment for lease contract

Exclusive themes Property managers

1. Difference in advance payment for the lease agreement and service cost settlement.

Exclusive themes tailored GPT

1. none

Calculation of Thematic Similarity

$$\text{Percentage thematic similarity} = \frac{4}{5} \times 100 = 80\%$$

3.9: Q9 What would an ideal lease agreement look like, given current legislation and sustainability potential?

"We now have to continuously adjust this in the lease proposal based on articles/pieces and provisions on the internet. Depending on input from advisors (real estate agent and Innax). (Claire)"

Given the absence of a precise answer within the datasets, this question aims to elicit a more exploratory response. Consequently, the property managers' response would entail two aspects. Firstly, an examination of the current legislation in the Netherlands concerning lease agreements would be undertaken. Secondly, an assessment of the building's sustainability potential and identification of measures within the lease agreement to enhance it would be explored.

Response of property managers:

The current lease agreements are mostly based on the ROZ models. The ROZ models are standardized contract templates that are designed to streamline real estate transactions in accordance with the Dutch rules and legislation. These models were adopted by the Real Estate Council (ROZ) on January 30, 2015 and amended in April 2024. However, it is not yet clear whether these 2024 adjustments are included within the current lease agreement.

After an investigation on new legislation impacting landlords from January 2022 to the present, as detailed on wetten.nl (2024), reveals that several legal modifications have been implemented during this period. Especially in the form of two new acts, the act including the articles and examples are given in the overview below:

Good Landlord Act

1. *Article 2*: This article describes the requirements of being a good landlord:
 - *Article 2(a)*: Requirements for a transparent selection process and refraining from unjustified discrimination and harassment.
 - *Article 2(c)*: Requirements regarding the amount and handling of security deposits.
 - *Article 2*, paragraph d: Recording the rental agreement in writing.
 - *Article 2(e)*: Providing the tenant with detailed information on various aspects of the tenancy such as rights, obligations, security deposit, service charges, and relevant points of contact.
 - *Clause example - "This lease agreement is signed by both parties. To protect the tenant the landlord shall provide the tenant with a document containing all the rights and obligations of the tenant that are not explicitly included in this agreement."*
 - *Section 2(f)*: Requirements for charging a service fee in accordance with the law.
 - *Clause example - "The landlord shall provide information to the tenant on the service charges and their calculation, including an annual breakdown of the charges, according to the legal requirements."*

Good Landlord Scheme

2. *Article 1*: This article requires the landlord to inform the tenant in writing about aspects such as:
- *Article 1(a)*: The correct use of the living space in accordance with the tenancy agreement and the consequences of misuse.
 - *Article 1(b)*: Conditions under which the landlord may enter the premises.
 - *Clause example* – "The landlord may only enter the leased space in agreed situations such as emergencies, necessary repairs, or renovations for which permission has been granted by the tenant or judged reasonable by the court."
 - *Article 1(c)*: Information on different types of leases, rent and rent protection, options for annual rent increases, and methods for calculating rent.
 - *Clause example* - "The rent protection and the terms for annual rent increase are clearly set out in this agreement, in accordance with the legal regulations"
 - *Article 1(d)*: Procedure for reporting and remedying defects in the living or living space.
 - Article 1, paragraph e: Overview of the tenant's rights to apply to the Rent Tribunal or the subdistrict court.

These clauses can be implemented within the current lease agreement to further observe the Dutch legislation.

The second part of answering this question involves examining the building's sustainability potential and identifying measures or clauses within the lease agreement to facilitate sustainable development of the property. The sustainability of the installations can be assessed by comparing them to other more sustainable options available in the market and ranking their current sustainability performance from low to high. A low ranking indicates the use of fossil fuels, no renewable energy usage, or older systems, while a high ranking indicates that the installation is market conform.

Aspect	Type:	Sustainability potential:
Heating	HR boiler	High
Cooling	Compression chiller	Medium
Facade insulation	9cm	High
Floor insulation	9cm	High
Roof insulation	9cm	High
Glazing	HR++ glass	High
Ventilation	Balanced with heat recovery ventilation (WTW)	High
Lighting	LED with energy-efficient switching in all areas	High
PV coverage	Solar panels on 70% of the roof surface	High
Hot water	Gas boiler without solar collector	Low

From the Innax rapport other measures concerning the sustainability potential of the building is given:

Overview of Energy-Saving Measures

1. *Heating*: The installation of a return air/water heat pump accompanied by a gas boiler
2. *Ventilation*: Implementation of a balanced ventilation system with Heat Recovery & HR electric motors in the air handling unit under the DUMAVA project.
3. *Hot Water*: Use of a heat pump boiler

Measures with a Payback Time of Up to 5 Years

1. Introduction of energy-efficient heat generation.
2. Enhancement of energy-efficient tap water heating.
3. Reduction of installed lighting power in elevator cabins.
4. Use of energy-efficient motors.

Based on these measures and from the research done within question 6, the following measures can be taken to improve the lease contract. These measures will come in the form of green lease clauses. These clauses specifically focus on sharing the costs of sustainable development between the tenant and landlord. This way it is avoided that one party carries all the costs. The following clauses are examples within a green lease. These clauses can also help the lease agreements of the Vastgoed Beheer PG B.V.

1. Clause for Installation of Heating Systems:

"The Landlord shall install a return air/water heat pump in conjunction with a gas boiler to serve the Tenant's premises. The cost of this installation will be borne by the Landlord, with an agreed upon amortization schedule where the Tenant will contribute a fixed percentage of the cost through an incremental increase in monthly rent over a period of five years."

2. Ventilation System Upgrade Clause:

"The Landlord agrees to implement a balanced ventilation system with Heat Recovery and high-reliability (HR) electric motors as part of the DUMAVA project. This system will be maintained by the Landlord to ensure efficiency standards are met. The Tenant shall cooperate by allowing access and a percentage fixed price for maintenance and will adhere to the operational guidelines provided by the Landlord to maximize energy savings."

3. Hot Water System Clause:

"A heat pump boiler will be installed by the Landlord to provide hot water services to the leased premises. The Tenant agrees to cover 50% of the installation costs through an increase in monthly rent over three years, benefiting from reduced energy costs associated with more efficient hot water heating."

4. Energy-Efficient Heat Generation Clause:

"The Tenant commits to utilizing the installed heating systems in a manner that maximizes energy efficiency. Regular checks and maintenance, to be conducted by the Landlord, will ensure optimal

operation. The Tenant shall report any issues or inefficiencies in the heating system operation to the Landlord immediately."

5. Enhancement of Energy-Efficient Tap Water Heating Clause:

"The Landlord shall enhance the energy efficiency of tap water heating by integrating advanced heating technologies. Costs incurred for these enhancements will be shared, with the Tenant contributing through a slight increase in rent, justified by the subsequent decrease in monthly utility expenses."

6. Reduction of Lighting Power in Elevator Cabins Clause:

"The Landlord will undertake the reduction of installed lighting power in elevator cabins by switching to energy-efficient LED lighting systems. This upgrade will be funded by the Landlord, with no direct cost to the Tenant, although the Tenant benefits from the building's overall increased energy efficiency and reduced environmental impact."

7. Use of Energy-Efficient Motors Clause:

"Energy-efficient motors will be used in all applicable systems within the Tenant's leased premises, particularly in ventilation and hydraulic systems. The Landlord will cover the cost of upgrading to these motors, and the Tenant will assist in achieving the energy savings goals by ensuring proper use and reporting any malfunctions."

Each of these clauses has been designed to encourage collaboration between the Landlord and Tenant in achieving energy efficiency, sharing the costs and benefits, and ensuring that the measures are maintained effectively over time.

Response of Tailored GPT



You

What would an ideal lease agreement look like, given current legislation and sustainability potential?



Parnassia Groep GPT

Creating an ideal lease agreement that incorporates current legislation and sustainability potential involves combining legal compliance with initiatives that promote environmental responsibility. Here's how you might structure such a lease agreement:


1. Introduction and Parties Involved

- Clearly define the landlord and tenant(s).
- Specify the property address and details.

2. Duration of Lease

- Start and end date of the lease.
- Terms regarding renewal options.

3. Rent and Payment Terms

- Amount of rent, due dates, and acceptable  ment methods.
- Specifications about late fees and consequences of non-payment.

4. Security Deposit

- Amount of the security deposit and terms for return.
- State-specific regulations concerning holding and returning the deposit.

5. Rights and Obligations of the Tenant

- Use of the property.
- Maintenance responsibilities.
- Restrictions on alterations to the property.

6. Landlord's Obligations and Entry Rights

- Maintenance commitments and timelines.
- Conditions under which the landlord may enter the premises, such as for repairs and inspections, ensuring these conditions comply with local laws.

7. Sustainability Clauses

- Agreement to use energy-efficient appliances and systems.
- Participation in recycling and waste management programs.
- Use of sustainable materials in any renovations or repairs.
- Implementation of energy-saving measures such as smart thermostats and LED lighting.

8. Compliance with Laws

- Adherence to local housing codes and statutes.
- Compliance with safety and health regulations.

9. Energy Efficiency and Reporting

- Commitment to maintaining or improving the property's energy efficiency ratings.
- Use of an energy monitoring system to track and optimize energy usage.
- Regular updates or audits on energy consumption, possibly supported by incentives for improvements in energy efficiency.

10. Dispute Resolution

- Procedures for handling complaints and disputes.
- Information on tenant's rights to approach the Rent Tribunal or subdistrict court for major grievances.

11. Special Conditions

- Clauses related to building in safety zones, compliance with environmental safety standards.
- Terms addressing renovations and maintenance with a focus on sustainability and minimal environmental impact.

12. Termination of Lease

- Conditions under which the lease may be terminated early.
- Required notices and procedures for termination by either party.

13. Signature and Consent

- Signatures of all parties involved.
- Date of agreement.

The GPT's response to this question is overly general. Rather than considering potential new clauses for the existing agreement, it simply outlines how the lease contract might appear in bullet points. Additionally, it fails to specifically address the sustainability potential outlined in the Innax report. While the framing of the question may not be incorrect, it could benefit from further exploration. To delve deeper into the capabilities of the GPT model, a follow-up instruction is provided:

“Complete the entire lease agreement, give specific clauses concerning the current legislation and sustainability performance.”



You

Complete the entire lease agreement, give specific example clauses concerning the current legislation and sustainability performance.

< 2 / 2 >



Parnassia Groep GPT

To craft an ideal lease agreement that incorporates current legislation concerning landlords and integrates sustainability measures, we can include specific clauses that align with the elements you've detailed. Here is a complete lease agreement structured to include these aspects:

Lease Agreement

This Lease Agreement ("Agreement") is made and entered into this [Day] of [Month], [Year], by and between [Landlord's Name] ("Landlord"), and [Tenant's Name] ("Tenant"). The premises leased under this Agreement are located at [Property Address] ("Premises").

1. Term of Lease

The term of this lease shall commence on [Start Date] and shall terminate on [End Date] unless extended or terminated sooner in accordance with the provisions herein.

2. Monthly Rent

Tenant agrees to pay Landlord a monthly rent of [Amount] payable on the first day of each month. Late payments may incur charges as stipulated in Section 2(f) of the Good Landlord Act.

3. Security Deposit

As per Article 2(c) of the Good Landlord Act, Tenant shall provide a security deposit of [Amount], which will be returned within [Specify Period] after the end of the lease, minus any deductions for damages beyond normal wear and tear.

4. Tenant's Rights and Obligations

- **Sustainability Clause:** Tenant agrees to use energy-efficient appliances and participate in the property's recycling program. Tenant commits to maintaining the energy efficiency standards set out by the energy-saving measures installed (e.g., HR electric motors, heat pump boiler).
- **Maintenance:** Tenant is responsible for regular maintenance as described in the lease and must report any defects in the living space to the Landlord as per Article 1(d) of the Good Landlord Scheme.

5. Landlord's Obligations and Rights of Entry

- Landlord agrees to ensure that the heating and ventilation systems are maintained as per the specifications of the installed energy-saving systems.
from the Tenant or as deemed reasonable by court order.

6. Energy and Sustainability Performance

- Landlord will provide an annual report on the building's energy consumption and sustainability performance. This report will detail efforts made to maintain or improve the property's energy efficiency and the effectiveness of the installed systems.

7. Legal Compliance and Good Landlord Requirements

- **Transparency and Non-Discrimination:** Landlord agrees to uphold a transparent selection process free from discrimination as required under Article 2(a) of the Good Landlord Act.
- **Written Agreement:** This lease serves as the written record of the rental agreement, fulfilling the requirement under Article 2, paragraph d.
- **Detailed Tenant Information:** Tenant will be provided with a document outlining all rights and obligations not explicitly stated within this lease agreement as per Article 2(e).

8. Rent Adjustment

- Rent adjustment processes will comply with Article 1(c) of the Good Landlord Scheme, detailing the conditions under which rent may be adjusted in accordance with legal regulations on rent protection and annual increases.

9. Termination of Lease

- Either party may terminate this lease upon [Notice Period] notice. Specific conditions under which the lease may be prematurely terminated are detailed in this section.

10. Dispute Resolution

- Any disputes arising from this lease shall first attempt to be resolved through mediation. If unresolved, disputes may be brought to the Rent Tribunal or subdistrict court as per Article 1, paragraph e of the Good Landlord Scheme.

11. Signatures


This Agreement is signed by both parties on the dates below to acknowledge agreement to all terms and conditions stated herein.

This time, the GPT has presented a more comprehensive lease agreement. However, it still lacks focus on current legislation and sustainability potential. To make one final attempt, a specific question is posed, concentrating solely on these aspects and clauses within the contract.

"Give a list of example clauses which can be integrated within the lease agreement, following the current legislation and the sustainability potential of the property"

 **You**

"Give a list of example clauses which can be integrated within the lease agreement, following the current legislation and the sustainability potential of the property"

 **Parnassia Groep GPT**

Here's a list of example clauses that could be integrated into a lease agreement considering the current legislation from the "Good Landlord Act" and the sustainability potential of the property:

Example Clauses Following Current Legislation

1. Transparent Selection Process Clause:

- "The landlord agrees to employ a transparent tenant selection process, refraining from discrimination and harassment, ensuring fairness and compliance with local equal housing laws."

2. Security Deposit Clause:

- "The security deposit shall not exceed two months' rent and must be refunded within 30 days of lease termination, minus any deductions for documented damage as stipulated by Article 2(c) of the Good Landlord Act."

3. Written Agreement Clause:

- "This lease is documented in writing, detailing the mutual obligations and rights, ensuring clarity and legal compliance as required by Art 2, paragraph d."

4. Service Charge Disclosure Clause:

- "Detailed information about service charges will be provided annually, including a breakdown of calculations as per the requirements of Section 2(f)."

5. Entry Conditions Clause (Article 1(b)):

- "The landlord may enter the premises only in agreed upon situations such as emergencies, for necessary repairs, or as reasonably determined by the courts."

Example Clauses Considering Sustainability Potential

1. Energy Efficiency Clause:

- "The tenant agrees to utilize the provided energy-efficient heat generation systems and participate in the building's energy conservation programs to enhance energy efficiency."

2. Sustainability Compliance Clause:

- "The tenant and landlord commit to maintaining the sustainability features of the property, including the HR++ glazed windows, high-efficiency LED lighting, and the balanced heat recovery ventilation system."

3. Waste Management Clause:

- "Tenants agree to comply with the property's recycling and waste management program to support environmental sustainability efforts."

4. Green Alterations Clause:

- "Any alterations or improvements by the tenant must comply with green building standards to maintain the energy certification of the property."

5. Renewable Energy Use Clause:

- "Tenants shall partake in the property's solar energy program, where applicable, and use renewable energy sources provided by the landlord through installed photovoltaic systems on the property."

These clauses help ensure the property management and tenancy adhere to both legal requirements and sustainability goals, promoting a responsible and environmentally conscious living environment.

Interestingly, the GPT model now incorporates the "Good Landlord Act" directly and proposes clauses that can be integrated into the lease agreement. Moreover, it generates clauses concerning sustainability potential, which represents an improvement over previous responses where this aspect was only generally mentioned.

3.10: Q10 How can future sustainability investments be included in a lease agreement, so that they apply to tenants or sub-tenants and can be passed on to them?

“Tenants/sub-tenants currently benefit from sustainability investments by the landlord Parnassia. If there is no budget with tenants, Parnassia still invests, and then tenants/sub-tenants reap the benefits. Nothing has yet been included in the current lease agreements with our tenants (Claire).”

This question is already partially answered within the previous inquiry. This is mostly answered within the form of green lease clauses. However to provide a more in-depth answer a new analysis will be done to other clause types or strategies which can be used to achieve the desired results.

Response of property managers:

Green lease clauses:

From the earlier done research the concept of Green Lease has been discussed, within Green Lease agreements clauses are set up to promote sustainable development within the property. The clauses can be modified to specify the shared responsibilities for both the landlord and the tenant in achieving sustainability targets. An example to ensure that responsibilities are passed on to the sub-tenants could be:

“ All conditions and obligations pertaining to sustainability and environmental performance as outlined in this clause shall be passed through to any sub-tenants leasing the Premises. The Tenant is responsible for ensuring that sub-tenants are made aware of and comply with the obligations regarding sustainable maintenance of the premises as well as extra costs regarding future sustainability investments.”

Sustainability standards: BREEAM-NL In-Use

The lease contract could include a commitment to achieve a *BREEAM-NL In-Use* certificate level of sustainability (BREEAM-NL, 2024). This goal should be explicitly stated within the lease agreement, with both the tenant and sub-tenants committing to meet this standard through financial and maintenance obligations. Such inclusion could facilitate the equitable sharing of all future sustainability investments among all parties involved.

Create a Joint Investment Framework:

Develop a framework for investment where costs and benefits of sustainability improvements are shared between landlords and tenants. This could involve creating mechanisms such as a green revolving fund where savings from energy efficiency measures are reinvested into the building (Thompson & Ke, 2012).

Another option could be that the tenant and sub-tenants invests in sustainability improvements and recovers costs through the savings achieved. This model can be integrated into the lease so that tenants benefit from better performance of the building without upfront costs, and the improvements can be passed on to sub-tenants or new tenants. This would create an incentive in which the highest form of sustainability is continuously desired (Thompson & Ke, 2012).

Response of Tailored GPT



You

How can future sustainability investments be included in a lease agreement, so that they apply to tenants or sub-tenants and can be passed on to them? in bulletpoints



Parnassia Groep GPT

To include future sustainability investments in lease agreements that apply to tenants or sub-tenants and can be passed on, consider the following strategies:

- **Green Clause Insertion:** Integrate a "green clause" into the lease agreement that requires tenants to comply with specific sustainability practices. These can include energy efficiency upgrades, waste management procedures, and the use of renewable energy sources.
- **Cost Recovery:** Clearly outline mechanisms for recovering costs associated with sustainability investments. This might include pass-through provisions where the costs of certain sustainability improvements are shared with the tenants through additional charges or adjusted rental rates.
- **Performance Targets:** Set specific sustainability performance targets in the lease agreement, such as energy or water usage limits. Compliance with these targets can be monitored and enforced through regular reporting from tenants.
- **Tenant Improvements:** Allow tenants to make their own sustainability improvements with the possibility of amortizing the investment over the term of the lease or through direct financial incentives like reduced rent.
- **Shared Savings Agreements:** Implement shared savings agreements where the benefits of reduced utility costs from sustainability investments are divided between the landlord and tenant. This provides a direct incentive for tenants to support and comply with sustainability measures.
- **Regular Updates and Assessments:** Include clauses that mandate regular assessments of the property's sustainability performance and require upgrades based on the latest technologies or standards to ensure continuous improvement.
- **Compliance with Sustainability Certifications:** Require tenants to operate within the standards of recognized environmental certification systems (like LEED or BREEAM). Compliance should be monitored and managed through the lease term.
- **Educational Provisions:** Provide for tenant education and training on sustainability practices to encourage compliance and maximize the effectiveness of implemented measures.

Incorporating these elements into lease agreements not only promotes sustainability but also potentially increases property value and attractiveness to future tenants who value environmental responsibility.

3.11: Conclusion

All questions have been addressed, yet they lack clarity to draw definitive conclusions. This section aims to organize the results for easy readability, enabling property managers to swiftly evaluate and verify the findings. Additionally, this section aims to address the research question: *"To what extent are the responses of a tailored GPT comparable to answers given by human property manager experts."*

Some questions were directly comparable as they were found within the data, while others were not due to their exploratory nature or their complexity. To answer the research question, first is examined the types of questions and the corresponding types of answers provided. The number of attempts or probing questions made during the process will also be documented. Lastly, an approximate time frame for each answer is provided. A final summary and conclusion will be presented, allowing property managers to quickly assess and analyze the findings in relation to the research question

3.11.1: Type of questions and responses

According to Cutler (2021) there are 8 types of questions. These questions each have a unique focus or function. The following list gives a brief description per type of question:

1. **Exploratory:** These are questions about what should be asked or discussed. They help explore the topic.
2. **Definitional:** These questions focus on defining certain terms or concepts. They help clarify understanding.
3. **Contextual:** Contextual questions consider the environment or context relevant to the topic. They provide a broader perspective.
4. **Descriptive:** Descriptive questions address what is happening, where, with whom, and how much. They help understand the situation.
5. **Strategic:** These questions explore implications and plans for change. Why does it matter?
6. **Explanatory:** Explanatory questions delve into the reasons behind something. What factors underlie it? Why is it happening?
7. **Generative:** These questions explore options and possible futures. What are the choices?
8. **Evaluative:** Evaluative questions assess effectiveness. How useful is it? Does it work well and for whom?

Based on the typing of Cutler (2021), the top 10 most common questions of the property managers are categorized within the following table. Table 11 examines the typing per question but also the stacking of underlying questions. Questions can have multiple elements or sub questions, within the formulation this is called stacking questions.

Nr.	Question	Types	Stacking	Reasoning
1	What is the demarcation of landlord or tenant maintenance according to the general provisions of the ROZ lease agreement?	Definitional, Contextual	2	Primarily defines responsibilities, also considers the broader lease agreement context.
2	What is included under the service charges in Article 5 of the lease agreement?	Definitional,	1	Defines specific lease terms and details of service charges.
3	How is the MJOP handled in relation to strategic housing plans and the duration of lease agreements?	Evaluative, Contextual	3	Looks at strategic implications with a focus on the broader context of housing plans.

4	How can service costs (energy consumption and maintenance of building-related installations) be fairly reconciled for a property that is used 24/7 as well as by other tenants/users only during office hours?	Generative, Evaluative, Strategic	2	Evaluates fairness in cost distribution and involves strategic decisions for varied tenant usage.
5	How can service costs be fairly reconciled to tenants when sub-meters are missing?	Evaluative, Explanatory	2	Evaluates reconciliation methods and explains the implications of lacking sub-meters.
6	What sustainability options are available for the property?	Definitional, Exploratory, Contextual	1	Explores and generates ideas for sustainability options.
7	What are the most common fault notifications that could now be treated preventively?	Exploratory	2	explores common issues and evaluates how they can be prevented.
8	Is the advance payment for service costs still sufficient compared to the costs of the package of deliveries and services in Article 5?	Evaluative, Contextual, Definitional	2	Evaluates the adequacy of advance payments in the context of specific service charges in the agreement.
9	What would an ideal lease agreement look like, given current legislation and sustainability potential?	Generative, Strategic	3	Generates ideas for an ideal lease agreement while considering strategic elements like legislation and sustainability.
10	How can future sustainability investments be included in a lease agreement, so that they apply to tenants or sub-tenants and can be passed on to them?	Strategic, Generative	3	Plans for incorporating sustainability measures strategically and generates future-focused solutions.

Table 11: Question analysis, focused on stacking and nature.

Now that the questions are categorized into types a new table can be made (table 12) to look at the answers. For the sake of clarity all responses will be heavily summarized, the goal of the following table is to identify for what type of questions the GPT provides high accuracy answers in comparison to the responses of the property manager. The responses only lists the core elements within each answer provide.

Nr.	Question	Types	Responses (White = PPM) (Grey =GPT)	Time	Score
1	What is the demarcation of landlord or tenant maintenance according to the general provisions of the ROZ lease agreement?	Definitional, Contextual	Tenant Responsibilities: <ol style="list-style-type: none"> 1. Handle minor external repairs and internal maintenance. 2. Maintain fixtures like switches, lamps, and interior paint. 3. Maintain technical installations. 4. Maintain any changes or additions made. 5. Cover certain maintenance costs incurred by the Landlord. 6. Maintain self-installed fabric and carpeting. 7. Keep property clean inside and out. 8. Clean and unclog drains. 	30m	X

			<p>Landlord Responsibilities:</p> <ol style="list-style-type: none"> 1. Maintain and renovate the property. 2. Responsible for structural components like foundations and roofs. 3. Handle exterior painting. 4. Maintain and renew property installations. 		X
			<p>Tenant Responsibilities:</p> <ol style="list-style-type: none"> 1. Handle minor external repairs and internal maintenance. 2. Maintain fixtures like switches, lamps, and interior paint. 3. Maintain technical installations. 4. Maintain any changes or additions made. 5. Cover certain maintenance costs incurred by the Landlord. 6. Maintain self-installed fabric and carpeting. 7. Keep property clean inside and out. 8. Clean and unclog drains. 9. routine checks and minor repairs on HVAC systems 10. Testing and maintenance of safety equipment <p>Landlord Responsibilities:</p> <ol style="list-style-type: none"> 1. Maintain and renovate the property. 2. Responsible for structural components like foundations and roofs. 3. Handle exterior painting. 4. Maintenance of central heating and main electrical lines 	5m	73%
2	<i>What is included under the service charges in Article 5 of the lease agreement?</i>	Definitional,	<ol style="list-style-type: none"> 1. Maintenance (preventive and corrective) and/or periodic checks for: 2. Common areas 3. Building-related installations 4. Taxes 5. Gutters 6. Exterior window cleaning 7. Legionella management 8. Supply of heat, water, and electricity 9. Locks and closures (in accordance with Article 17) 10. Infrastructure 11. Insurance 12. Grounds and green maintenance 13. Other services and deliveries to be agreed upon between the landlord and tenant. 	5m	X
			<ol style="list-style-type: none"> 1. Maintenance (preventive and corrective) and/or periodic checks for: 2. Common areas 3. Building-related installations 4. Taxes 5. Gutters 6. Exterior window cleaning 7. Legionella management 8. Supply of heat, water, and electricity 	1m	100%

			<ul style="list-style-type: none"> 9. Locks and closures (in accordance with Article 17) 10. Infrastructure 11. Insurance 12. Grounds and green maintenance 13. Other services and deliveries to be agreed upon between the landlord and tenant. 		
3	<i>How is the MJOP handled in relation to strategic housing plans and the duration of lease agreements?</i>	Contextual, Evaluative	<ul style="list-style-type: none"> 1. Lease agreements duration Fivoor (indefinite) 2. Lease agreements duration Leger des Heils (30/09/2026.) 3. Property strategy (retain) 4. Property housing plan (<15 years) 5. MJOP is not taking into account duration of lease Agreement 6. MJOP does take into account strategic housing plans 7. Cost projection concerns 8. Renewing of tenant agreement 	45m	X
			<ul style="list-style-type: none"> 1. Lease agreements duration Fivoor (indefinite) 2. Lease agreements duration Leger des Heils (30/09/2026.) 3. Property strategy (retain) 4. Property housing plan (<15 years) 5. MJOP does take into account strategic housing plans 6. MJOP is based on the long term needs of the property rather than the duration of the lease 7. Inflation and rising costs 8. Transition to new tenant is unsure 9. Aging property allows for rising costs 	5m	
4	<i>How can service costs (energy consumption and maintenance of building-related installations) be fairly reconciled for a property that is used 24/7 as well as by other tenants/users only during office hours?</i>	Generative, Evaluative, Strategic	<ul style="list-style-type: none"> 1. Price per square meter 2. submetering 3. green lease 4. green clauses 	40m	X
			<ul style="list-style-type: none"> 1. Differentiated service cost based on usage profiles 2. submetering 3. Adjustment of cost allocation formula - weighted usage based on operational hours 4. review and regular updates 5. clear communication and agreements 	1m	
5	<i>How can service costs be fairly reconciled to tenants when sub-meters are missing?</i>	Evaluative, Explanatory, Generative	<ul style="list-style-type: none"> 1. Price per square meter: 66,69 euro/m2 	5m	X
			<ul style="list-style-type: none"> 1. Main meter data utilization 2. Proportional distribution based on area 3. Inclusion of fixed charges in rent 4. Estimation adjustment for usage profiles 5. Annual review and adjustments 	1m	
6	<i>What sustainability options are available for the property?</i>	Definitional, Exploratory, Contextual	<ul style="list-style-type: none"> 1. Building installation configuration 2. Building installation sustainability potential analysis <p>Energy-Saving Measures:</p> <ul style="list-style-type: none"> 1. Heating: Retour air/water heat pump with gas 	45m	X

			<p>boiler</p> <ol style="list-style-type: none"> Ventilation: Balanced system with Heat Recovery Hot Water: Heat pump boiler HR electric motor replacement for air handling unit Improvements in heat pump heating and boiler systems <p>Measures with Payback Time < 5 Years:</p> <ol style="list-style-type: none"> Energy-efficient heat generation Improved tap water heating Reduced elevator cabin lighting power Energy-efficient motors <p>Other Possible Measures:</p> <ol style="list-style-type: none"> Disconnect seldom-used devices, use timer switches Install smart energy meters and monitoring system Implement Active Energy Management Optimize climate control tech <p>Organizational and Behavioral Changes</p>		
			<p>Clarification on energy efficiency</p> <p>Energy-Saving Measures:</p> <ol style="list-style-type: none"> Heating: Return air/water heat pump with gas boiler Ventilation: Balanced system with Heat Recovery Hot Water: Heat pump boiler HR electric motor replacement for air handling unit Improvements in heat pump heating and boiler systems <p>Measures with Payback Time < 5 Years:</p> <ol style="list-style-type: none"> Energy-efficient heat generation Improved tap water heating Reduced elevator cabin lighting power Energy-efficient motors <p>Other Possible Measures:</p> <ol style="list-style-type: none"> Disconnect seldom-used devices, use timer switches Install smart energy meters and monitoring system Implement Active Energy Management Optimize climate control tech <p>Organizational and Behavioral Changes</p>	2m	73%
7	What are the most common fault notifications that could now be treated preventively?	Exploratory	<ol style="list-style-type: none"> Climate conditions = 26 Toilets/sanitair = 9 Leakage = 13 Coffee Machine Issues = 24 Structural Issues = 33 	1.5h	

			(Door fixtures and locks and General construction issues) 6. General Maintenance and Repairs = 13 7. Cleaning Requests = 8 8. Electrical/Technical Faults = 11 9. Furniture and Interior Requests = 11 10. Security Systems = 3		
			1. Climate Control Issues = 33 2. Sanitary Issues = 8 3. Leakages = 14 4. Coffee Machine Issues = 18 5. Structural Issues = 31 (Door fixtures and locks and General construction issues) 6. General Maintenance and Repairs = 21 7. Cleaning Requests = 8 8. Electrical/Technical Faults = 9 9. Furniture and Interior Requests = 9 10. Security Systems = 4	15m	81%
8	<i>Is the advance payment for service costs still sufficient compared to the costs of the package of deliveries and services in Article 5?</i>	Evaluative, Contextual, Definitional	1. Advance payment in lease agreement €6.903,04 per/quarter 2. Advance payment in service charge statement €55,000.00 3. Mismatch within documentation 4. Actual service costs €51,349.77 5. New quarterly advance payment is €12.837,44 per quarter	20m	
			1. Advance payment in lease agreement €6.903,04 per/quarter 2. Advance payment in service charge statement €55,000.00 3. Actual service costs €51,349.77 4. New quarterly advance payment is €12.837,44 per quarter	5m	80%
9	<i>What would an ideal lease agreement look like, given current legislation and sustainability potential?</i>	Generative, Strategic	1. ROZ lease agreement format 2. New legislation: Good Landlord Act 3. Articles: 2(a), 2(c), 2(d), 2(e), 2(f) 4. New legislation: Good Landlord Scheme 5. Articles: 1(a), 1(b), 1(c), 1(d), 1(e) 6. Example Clauses bot for new legislation and Green lease	2h	
			1. Detailed lease agreement format including descriptions 2. Sustainability potential clauses 3. New legislation: Good Landlord Act, Article 2(a), (d), (e), 4. New legislation: Good Landlord Scheme act, Article 1(c)	5m	N/A (Answer not found within datasets)
10	<i>How can future sustainability investments be included in a lease</i>	Generative, Strategic	1. Green lease clauses 2. Sustainability standards: BREEAM-NL In-Use 3. Joint Investment Framework	1h	

	<i>agreement, so that they apply to tenants or sub-tenants and can be passed on to them?</i>		<ol style="list-style-type: none"> 1. Green Clause Insertion 2. Cost Recovery 3. Performance Targets 4. Tenant Improvements 5. Shared Savings Agreements 6. Regular Updates and Assessments 7. Compliance with Sustainability Certifications 8. Educational Programs 	1m	N/A (Answer not found within datasets)
Average accuracy score					76.1%

Table 12: Comparative table outlining the question, the nature of the question, outcomes of the tailored GPT versus property managers and an accuracy score

To answer the research question, first is needed to analyze the results form the comparison. The analysis will focus on the question type, stacking and desired results. From the questions some types of questions are more common then other for each response the GPT, answers close or far regarding the answers of the property managers. This also has to do with the degree of findability within the datasets. And the desired outcome from the property managers given within interview A. For the following types used within the questioning a short overview is given on the results:

Definitional:

Questions 1, 2, 6 and 8 all rely on a definitional response found directly within the data sets. The tailored GPT excels within asking these questions. Stating directly what is given within the knowledge base. The average accuracy score, given in comparison to the response of the property managers is 82%

Contextual:

Questions 1,3,6 and 8 all provide contextual information about the property given within the datasets. As mentioned earlier questions 1,6 and 8, directly state information. From within the dataset. Interestingly the GPT scored the highest scores when contextual questions were combined with definitional questions. On the other hand question 3 deviates from this trend. By looking closer at the response, the contextual information given within the response is plenty. Even providing further explanations on the possible reasons why the MJOP does not take into account the duration of lease agreements. This is also the reason why it received a lower accuracy score then the property managers since the GPT also allowed contextual information form outside the knowledge base within the answer. The only aspect in which question 3 fails is the inability to evaluate that the MJOP does not take into account the lease duration and assumes an automatic renewal of lease agreements. The average accuracy score, given in comparison to the response of the property managers is 69%

Strategic:

Questions 4,9 and 10 all have strategic aspects in them. These questions focus on implications of actions or plans for change. All these questions also don't have an accuracy score, since all the answered could not be found within the given datasets. These questions required online research and recommendations for specific aspects. Therefore the content of the GPT can not be compared. What can be said however is that for all questions, reoccurring elements in both the responses of the

property managers and the GPT came to light. Some examples include "Acts, Green lease, use of clauses and performance targets.

Generative:

Similarly to the previous question type, questions 4,5,9 and 10 all don't have a accuracy score, since all questions require responses from outside the knowledge base. However statements can be made on the ability of generating multiple options outside the scope of data. Comparing to the own research done the GPT was able to generate multiple options regarding the question asked. Which would normally take hours of reading papers and online searching, is now done within a minute or two. What is even more impressive is the outcome of similar options given both by the property managers and GPT. Indicating that the GPT is able to find the same options as the property managers.

Evaluative:

Questions 3,4,5 and 8 all have evaluative elements, which involves looking at current methods and/or exploring new methods online. A differentiation can be made within the responses. Questions 3 and 8 responses which directly need to evaluate within the data. This makes it comparable to the answers given by the property managers. Looking closer to the evaluative aspect, question 8 responds correctly stating that the advance within the service charge statement is enough, but fails to see the mismatch within the documentation. Indicating a lack in critical analytical capabilities. A similar phenomenon can be seen in question 3 when the GPT fails to conclude that MJOP is not taking into account the duration of lease agreement. From these examples a lack of evaluating capacity can be found. This probably has to do with the size of the documents and the limited long distance adaptability of the GPT. The evaluating capacity for questions 4 and 5, which have a generative nature, is done by explaining the consequences for the property. This type of evaluation is difficult to assess. However from a first glance point it seems to be in order.

Explanatory:

Only question 5, is found within this category. While this question is generative by nature, it has an explanatory element by searching for a greater understanding of the impact of missing submeters. When the response is analyzed the GPT does a good job in explaining the options of methodologies in a straightforward manner. Another observed aspect of the response of the GPT to this type of question is that it explains concepts within multiple steps, this makes difficult or new information easier to process. Lastly the GPT tailors these concepts to the property given in its specific situation.

Exploratory:

For the last question type only questions 6 and 7 fall into this category. These questions require the GPT to explore information from within the datasets and draw new conclusions from them. Since these questions answer directly from within the datasets, these are again therefore comparable. When taking a closer look to the responses, a new conclusion can be drawn. The more concise the document from which the GPT needs to explore, the more accurate the responses are. Even though the accuracy score tend to differ. This is because the for question 6 the GPT needed to answer from a comprehensive energy rapport, which only changed in format. While the dataset for question 7 has been heavily modified in order to be readable to the GPT. The initial document decreased from around 15000 cells to 600 cells. Since the data quantity has been reduced it allowed for a closer

response of the GPT. The overall accuracy score, given in comparison to the response of the property managers is 76%

Stacking:

From the comparison table, the following can be said about stacking and the accuracy score of the Tailored GPT. Single stacking questions perform the best with an accuracy score of 87%. Afterwards, the double stacking questions receive an accuracy score of 78%, and lastly, the triple stacking questions have an accuracy score of 50%. The loss of accuracy is due to the added complexity and potential confusion that arise from multiple layers of context and inference. As the number of stacking increases from single to triple, the model must maintain and integrate a larger context, which increases the likelihood of errors in interpretation and response generation.

3.11.2 Data structuring and Prompt engineering

In order to evaluate and compare the responses, several previous actions have been performed. First, the given data was structured (see table 13). Each dataset has gone through multiple versions to achieve the highest quality of answers. The more readable the data is to the GPT model, the more accurately it can answer from within the given data. The overview below lists all the datasets with their modifications and versions.

Name	Initial document	Version 1	Version 2	Version 3
Utilities (inc. invoices)	Documents: 52 Format: .pdf Pages: 112	Documents: 3 Format: .docx Pages: 112 (Corresponding invoices are merged within 3 document, since the limit input into ChatGPT is 20 document)		
Floorplans	Document: 12 Format: .pdf Pages: 12	Document: 1 Format: .pdf Pages: 12 (Document are merged, since the limit input into ChatGPT is 20 document)		
Lease agreement Fivoor	Document: 1 Format: .pdf Pages: 6	Document: 1 Format: .docx Pages: 6 (Different format to allow for anonymization and translation from scanned text to digital text)		
Rent index Fivoor	Document: 1 Format: .pdf	Document: 1 Format: .docx		

	Pages: 1	Pages: 12 (Different format to allow for anonymization and translation form scanned text to digital text)		
Lease agreement Leger des Heils	Document: 1 Format: .pdf Pages: 86	Document: 1 Format: .docx Pages: 86 (Different format to allow for anonymization and translation form scanned text to digital text)		
Rent index Leger des Heils	Document: 1 Format: .pdf Pages: 1	Document: 1 Format: .docx Pages: 1 (Different format to allow for anonymization and translation form scanned text to digital text)		
Demarcation rapport	Document: 1 Format: .xls Cells: 3591	Document: 1 Format: .pdf Cells: 3591 (Different format to allow better readability of the document)	Document: 1 Format: .docx Tabel cells: 3591 (Different format and different data layout to allow better readability, of the document)	
Budget Hoeklaan	Document: 1 Format: .xls Cells: 54	Document: 1 Format: .pdf Cells: 54 (Different format to allow better readability of the document)	Document: 1 Format: .docx Tabel cells: 54 (Different format and different data layout to allow better readability, of the document)	
Energy rapport Innax	Document: 1 Format: .pdf Pages: 13	Document: 1 Format: .docx Cells: 13 (Different format to transform images into text)		
Maintenance notifications	Document: 1 Format: .xls Cells: 15356	Document: 1 Format: .xls Cells: 9074	Document: 1 Format: .docx Tabel Cells: 9074	Document: 1 Format: .docx Tabel Cells: 1396

		(Data filtering to reduce computational effort of GPT)	(Different data format and layout to allow for better readability)	(Data filtering to reduce computational effort of GPT)
Cadastral map	Document: 1 Format: .jpg Pages: 1			
Portfolio Hoeklaan	Document: 1 Format: .xls Cells: 99	Document: 1 Format: .pdf Cells: 99 (Different format to allow better readability of the document)	Document: 1 Format: .docx Tabel Cells: 99 (Different format and different data layout to allow better readability, of the document)	
Service charge settlement	Document: 3 Format: .xls Cells: 1478	Document: 1 Format: .docx Tabel Cells: 1478 (Different format to allow better readability of the document)		
MJOP	Document: 1 Format: .xls Cells: 27424	Document: 1 Format: .pdf Tabel Cells: 27424 (Different format to allow better readability of the document)		
Sustainability vision and housing strategy	Document: 1 Format: .xls Cells: 7524	Document: 1 Format: .docx Tabel Cells: 36 (Different format and data filtering to allow better readability of the document)		
Energy usage	Document: 1 Format: .xls Cells: 464	Document: 1 Format: .pdf Tabel Cells: 464 (Different format to allow better readability of the document)		

Table 13: Overview of data structuring per dataset.

The combination of structuring data to make it more readable and the usage of the pre-developed prompt, should have resulted into a GPT model that could copy the responses of the property managers as well as delivering desired outcomes. In this case the GPT did both. The prompt allowed for highly accurate answers from within the knowledge base. Some questions required the GPT to look outside of the knowledge base, these questions followed the instructions of the prompt well.

There were only two instances in which the GPT deviated from the from the responses of the property managers, but followed the prompt perfectly, were the responses to questions 4 and 5. In these response the GPT, acted on the desired results as instructed within the prompt, instead of mirroring the method of the property managers. This overfitting deviant is "okay" since it has to do with the desired outcome as well as the phrasing of the question. More specific the " *How can*" part which probes the GPT to answer the question from outside the knowledge base.

To answer the question "*To what extent are the responses of a tailored GPT comparable to answers given by human property manager experts*", several conclusions can be drawn:

1. **Data dependence:** The performance of a tailored GPT heavily relies on the structure and quality of the data it has access to. The better organized and more comprehensive the data, the more accurate the GPT's responses are likely to be.
2. **Adherence to instructions:** The extent to which the GPT adheres to the specific instructions within a prompt significantly influences the comparability of its responses to those of human experts. Closer adherence to instructions typically yields responses that are more aligned with expert answers.
3. **Question types:** The type of questions asked plays a crucial role in comparability. Questions that can be directly answered from the available data allow for exact comparisons and straightforward evaluations of accuracy. In contrast, questions that require in-depth research, exploration, or generation of new ideas present challenges in direct comparison due to potential variances in the responses from both GPT and human experts.
4. **Overall comparability:** Quantitatively, the comparability of a GPT's accuracy to that of human experts can be rated at approximately 75%. This suggests that while the GPT may not consistently deliver perfect results, its responses generally contain elements that are true or accurate.
5. **Language:** The language use influences the performance of a tailored GPT slightly. When using only 1 language within the knowledge base, prompt configuration and questioning the GPT performs 4% more similar to the datasets included within the knowledge base.

In conclusion, a tailored GPT can offer considerable comparability to human experts, especially when well-instructed and provided with structured data, though some limitations exist depending on the nature and the scope of the questions posed.

4. RQ4: How do practitioners observe the performance of ChatGPT's answers?

This chapter delves into the perceptions of property managers from Vastgoed Beheer PG B.V regarding the performance of ChatGPT. By analyzing the results from the previous questions and comparing it with their experiences and insights, the aim is to understand the expectations, actual performance, and potential improvements for tailored ChatGPT's in property management tasks. This exploration is the final step in assessing the added value of ChatGPT in real-world applications and identifying areas where it can be fine-tuned to meet specific needs. This entire section is based on Interview B (Appendix C) and the questionnaire (Appendix D) which was given to the Property managers.

4.1 Observations and expectations of the practitioners

The practitioners at Vastgoed Beheer PG B.V expressed a range of perceptions and expectations about ChatGPT's performance. From the previous interview A, the following expectations were predefined by the property managers:

1. Speed,
2. Accuracy,
3. Reliability,
4. Centralizing data,
5. Streamlining operations,
6. Control check,

Given the new interview which developed deeper into the fulfillment of the expectations, a few interesting points arise. Arvind observed that the accuracy of ChatGPT's answers generally aligns with human responses about 80% of the time, which he found *"surprisingly good"*. This reflects a positive perception of the tool's ability to match human-level responses in many cases. However, there is an implicit expectation that AI should ideally provide 100% accurate and reliable answers consistently.

Another exceeded expectation mentioned by Claire involves the tool's capacity to generate innovative solutions. She appreciated ChatGPT's ability to offer creative ideas, such as suggesting methods for splitting investments or addressing issues without submitters. She says: *"No, because I see those extra new articles, especially about, for example, splitting investments, it is really hard to imagine that ChatGPT just does that. It's doing very well. And such an overview with all notifications is actually impossible for us. I really like that it quickly extracts the top 10 reports. So I think that is a great addition."*

The practitioners also expressed some skepticism. Claire noted that when dealing with strategic decisions, the responses from ChatGPT might not always be fully relevant or comprehensive: *"I think that something you have to continue to analyze and discuss with yourself as property manager."* This skepticism underscores the indispensability for human professionalism and oversight, at the same time this underscores an inherent limitation of ChatGPT utility.

On centralizing data, Claire pointed out, *"Many questions from colleagues just come back repeatedly... It is very nice that it can handle these quickly."* Furthermore, ChatGPT reduces the manual workload for property managers, allowing them to focus on more complex and value-added tasks. Claire elaborated, *"Having ChatGPT handle repetitive inquiries frees up our time to work on"*

more strategic projects." This not only streamlines operations but also ensures that staff can access consistent and accurate information without repeatedly entering the same data.

Finally, the control check aspect was highlighted by Arvind: *"It offers a sort of control function, helping ensure tasks are completed thoroughly and efficiently."* This suggests that ChatGPT can act as a valuable assistant in routine and creative tasks. By providing an additional layer of oversight, ChatGPT helps verify that tasks are performed correctly and thoroughly. Arvind stated, *"The control check capability of ChatGPT can help prevent errors and ensure that all necessary steps are followed, enhancing the overall quality of our services."*

Overall, the perceptions and expectations of practitioners from Vastgoed Beheer PG B.V suggest that while ChatGPT is a valuable tool for overall tasks that exceed their expectations, its reliability for critical and complex tasks remains a concern, necessitating further refinement and human oversight.

4.2 Perceptions on the Tailored ChatGPT's Performance

When discussing the performance of a tailored version of ChatGPT, the practitioners noted mainly strengths and some areas for improvement. According to a recent survey given to property managers, the tailored ChatGPT provides valuable support in property management, with a strong agreement on its understanding of property management questions and its capability to improve the workflow of property management tasks. These positive aspects are reflected in the property managers' appreciation of the tool's ability to provide comprehensive responses that include additional information from various sources, as highlighted by Arvind: *"It offers extra information and aligns well with what we would provide."* This underscores the tool's potential to enhance the depth of responses, making it a useful support tool in property management.

Claire pointed out that tailored ChatGPT was particularly effective in generating useful reports and summaries. For example, she mentioned its ability to quickly compile top issues reported by employees, which helps in identifying and addressing prevalent problems efficiently. This efficiency in data handling and reporting underscores a practical benefit of a customized ChatGPT in streamlining tasks.

However, there were also criticisms regarding the need for repeated questioning to obtain accurate answers. Claire expressed hindrance over having to rephrase questions multiple times to get the desired output: *"You said yourself that you had to ask the question a few times or just differently to get the best outcome."* This indicates a need for improved natural language processing capabilities to better understand and respond to user queries on the first attempt.

Another point of concern was the strategic application of the tool. Claire and Arvind both noted that while ChatGPT could handle general queries well, it struggled with more complex, strategic questions that required a deeper understanding of the context and specific business processes. This limitation highlights the importance of ongoing human involvement in higher-level decision-making tasks.

In summary, the tailored ChatGPT's performance is viewed positively for its ability to enhance data handling and provide comprehensive responses. However, its limitations in understanding complex queries and the need for repeated interactions suggest areas where further customization and improvement are necessary to fully meet the needs of property management professionals. Moreover, the performance in both speed and accuracy seems positive from the property managers' perception. Despite the positive aspects, there is strong disagreement on the tool's capability to handle complex property management questions, highlighting a significant area for development to meet the advanced needs of the sector.

4.2.1 Speed

The speed of responses is one of the critical factors in evaluating the performance of a tailored ChatGPT in property management, as mentioned earlier by the property managers. Practitioners at Vastgoed Beheer PG B.V highly valued the efficiency of ChatGPT. Arvind already mentioned, *"The speed of the responses is quite good, typically within 1 to 5 minutes, which is much faster than manual searching"*. This quick turnaround time allows property managers to address issues and queries without delay, significantly streamlining overall productivity and operations.

Claire also emphasized the importance of speed, stating, *"It's really impressive how quickly it can pull up information that would take us much longer to find manually"*. The ability to rapidly access information is crucial in property management, where timely decision-making can impact tenant satisfaction and operational efficiency. By providing swift responses, ChatGPT helps practitioners manage their tasks faster, reducing the time spent on information retrieval and enabling them to focus on more strategic and complex activities.

In the survey, practitioners rated the speed of ChatGPT's responses highly, with a total score of 100/100 points (10), indicating a strong agreement with the statement that the tailored ChatGPT improves the workflow of property management tasks. This consensus underscores the tool's potential to streamline operations within property management.

4.2.2 Accuracy

Accuracy is another key criterion for assessing the performance of ChatGPT. The practitioners at Vastgoed Beheer PG B.V observed that the tool's accuracy generally aligns well with human responses. As already mentioned Arvind highlights the average accuracy score of the responses about 80%.

Claire highlighted that while ChatGPT performs well in handling definitional questions, it may not always be precise when it comes to more complex or strategic queries. This is similar to the results discussed in chapter 3.11.1. She stated, *"A number of questions where indeed more definitions or search work is required from the dataset, it does very well. But when it comes to evaluating the service charge settlement or whether the proposal is still sufficient, these are important matters, you also have to achieve 100% actual value in this"*. This indicates that while ChatGPT is useful for general information retrieval, it may fall short in tasks requiring high precision and detailed analysis.

The survey results reflected this sentiment, with practitioners expressing a overall positive view on the accuracy of ChatGPT's responses. While they appreciated the tool's performance, they understood that the desired accuracy is higher with definitional and contextual questions than with strategic or evaluative ones. All in all, the score reached an accuracy of 82/100 (8), indicating that for their initial intended use, the GPT responded exceptionally well. However, it also suggests that complex tasks would not be appropriate to ask of the model.

4.2.3 Reliability

Reliability is the last performance measurement aspect. The practitioners at Vastgoed Beheer PG B.V had mixed feelings about the reliability of ChatGPT. Arvind expressed cautious optimism, stating, *"And it is difficult to immediately place a confidence score on such a first test. But based on the input you provided to ChatGPT and the output it provided, it appears to be reliable. Yes. And in the future, it will actually be for us to see which questions you will ask from now on, and then if you are sure that"*

certain questions work, you can also guarantee that you can also rely on the correctness of those answers". This highlights the need for further testing and validation to build personal experience and confidence in the tool's reliability.

Claire pointed out that while ChatGPT can provide useful and innovative solutions, its reliability in handling strategic decisions is limited. She remarked, "*I think that something you have to continue to analyze and discuss yourself as a property manager*". This underscores the necessity for human oversight and professional judgment in ensuring the accuracy and relevance of the AI-generated responses.

The survey results indicated a positive to neutral stance on the reliability of ChatGPT, with practitioners acknowledging its potential but also recognizing the need for further development. The statement, "I trust the responses given by the tailored ChatGPT and find them reliable," received a mixed response, reflecting the practitioners' cautious approach to fully relying on AI for critical tasks. The final score given to the responses of the top 10 questions, yielded a score of 72/100 (7).

In summary, while the speed and accuracy of ChatGPT are highly valued by the practitioners, the reliability of its responses need further refinement. The tool shows great promise in enhancing property management tasks but requires ongoing improvements and human oversight to ensure it meets the high standards required in the field.

4.3 Reflections on the use of AI tools like ChatGPT in Property Management

The future of AI tools like ChatGPT within property management appears promising to the practitioners at Vastgoed Beheer PG B.V. Arvind highlighted the tool's potential to significantly streamline operations and enhance efficiency. He noted, "*The use of AI tools like ChatGPT is of added value as I see it. It provides out-of-the-box ideas and also a form of self-control to ensure that tasks are completed thoroughly*". This reflects a strong belief in the capabilities of ChatGPT.

Despite the optimism, there are concerns and reservations about relying on ChatGPT for property management tasks. Claire expressed a common apprehension, "*We always deal with confidential information and privacy-sensitive data as a care organization. There is always a bit of fear whether the output is accurate*". This concern underscores the importance of ensuring that these tools handle data securely and produce reliable results. Arvind echoed this sentiment, noting that while the initial performance of ChatGPT is promising, trust in its output requires further validation: "*Based on the input provided and the output received, it appears reliable. However, confidence in such systems builds over time with continuous use and verification*".

The tailored ChatGPT provides valuable support in property management, with practitioners strongly agreeing on its benefits. Given these benefits, the practitioners would highly recommend the use of tailored ChatGPT to other professionals in property management. They strongly agree that it can serve as a valuable tool for handling routine inquiries and providing innovative solutions. Claire concluded, "*I think ChatGPT offers great added value and I would definitely recommend it to my peers in the industry*".

To conclude, while tools like ChatGPT are seen as valuable for streamlining operations, speed, accuracy and enhancing operations in property management, there remains a crucial need for human oversight to ensure the accuracy and relevance of AI-generated outputs. This balanced approach will likely define the future integration of ChatGPT in property management, combining the strengths of both technology and human expertise.

5. MQ: What is the added value of a tailored ChatGPT for professionals in Property Management

This section of the research aims to answer the main question: What is the added value of a tailored ChatGPT for professionals in Property Management? This final part brings together all the insights from earlier sections to tackle this question. First, it revisits the literature review to understand the concept of "added value" and how it applies to property management.

Next, it considers the insights from the interviews with the property managers to get a practical perspective on the added value of the tailored GPT. This section then compares these professional insights with the literature to identify any overlapping areas. Finally, it looks at performance of the tailored ChatGPT as gathered in appendix D to draw conclusions about its Performance in relation to its added value. This provides a basis to assess the added value of a tailored ChatGPT. By integrating these different perspectives, the thesis aims to provide a clear answer to the research question.

5.1 Added value

Added value is a topic of great ambiguity and can manifest in multiple forms depending on the context and the organization. What constitutes added value can vary significantly between professions and industries, reflecting the unique needs and expectations specific to each. For instance, the concept of added value for a property manager vastly differs from that of a pilot. A property manager might define added value in terms of profitability, sustainability, competitive advantage and productivity, as outlined by Figure 4 (Den Heijer 2011). In contrast, a pilot may view added value as advancements in aviation technology, improved safety measures, or enhanced navigation systems that contribute to more efficient and safer flights. Thus, added value is not a one-size-fits-all concept but is tailored to fit the specific goals and operational frameworks of different professions. To find the added value of a tailored GPT for property managers first is looked at the literature. This is done to distinguish different types of added value in CREM and more specifically property management.

5.1.1 Added value in CREM according to the literature

Through a paper written by my tutor Herman van der Putten, about performance measurement in the built environment, the concept of "Added value" within CREM becomes clearer. Added value as a concept incorporates various definitions and parameters, reflecting its broad application across different industries. According to Jensen, Van der Voordt, and Coenen (2012) there are six main categories of "value":

1. **Functional Value:** Evaluates how well the space meets the specific requirements of its users.
2. **Consumer Value:** Weighs the cost against the benefits to the users.
3. **Financial Value:** Considers the economic advantages in terms of cost-benefit analysis.
4. **Community Value:** Looks at how spaces enhance community engagement and cultural identity.
5. **Ecological Value:** Focuses on the sustainability and environmental stewardship of property management.
6. **Service Value:** Pertains to the quality and customization of services provided to clients.

Building on these foundations, they later expanded their research to identify key sources of value in CREM. They categorized twelve critical value parameters into four broader groups:

- **Individual-Focused Values:** Encompassing user satisfaction, corporate image, organizational culture, and health and safety considerations.
- **Operational Values:** Covering efficiency in productivity, flexibility, innovation, and risk management.
- **Financial Values:** Addressing cost management and the valuation of property assets.
- **Communal Values:** Including efforts towards sustainability and ethical corporate practices.

The diagram of Den Heijer (2012) (see figure 4) closely relates to the broader categories and specific parameters of value that Jensen and Van der Voordt discussed in their literature.

The productivity and competitive advantage part of the diagram emphasizes values like stimulating collaboration, innovation, supporting culture, and image, all of which contribute to the organisational goals. These are closely related to Jensen and Van der Voordt's "Use value" achieved through the parameters of individual-focused and operational values, particularly elements such as user satisfaction, productivity, and flexibility, which enhance the organization's overall performance.

The profitability side of the diagram focuses on profitability aspects such as decreasing costs and increasing real estate value. These aspects align with Jensen and Van der Voordt's financial values, stressing the importance of cost management and asset valuation in creating economic value.

The sustainability part of the diagram also emphasizes ecological as well as communal values, specifically through reducing the environmental footprint.

The 12 ways of adding value within CREM all seem to correlate as methods within the larger value addition framework Jensen and Van der Voordt provide. However the tailored GPT model seems to fit in best within the productivity and competitive advantage part of the diagram, relating particularly to 'Use value' achieved through individual-focused and operational values.

5.1.2 Added value in property management according to the literature

Added value in property management is about aligning real estate operations with the broader objectives of an organization, focusing on balancing supply with demand and improving productivity. This alignment is typically gauged through empirical research, which looks at how property management contributes to financial and operational outcomes (Voordt, 2015). Researchers employ a mix of qualitative interviews and quantitative data analysis to pinpoint and evaluate the added value property managers provide, exploring both the obvious and the more subtle benefits (Jensen et al., 2012).

Added value is therefore found by defining the goals of property managers and setting a benchmark for what stakeholders expect. This benchmarking is critical in Van de Putte's 2022 analysis for measuring performance, as it establishes the baseline for what added value in property management is.

5.1.3 Added value according to the property managers

From the interviews and questionnaire, the following table 19 is made of the predefined expectations and the outcomes as described by the property managers. By providing a table an overview can be made on the achievement of added value according to their perceptions and the performance of the tailored GPT.

Aspect	Expectations	Opinions on Performance	Direct Quotes	Added Value Achieved
Understanding Questions	Understand specific property management questions accurately.	Good at understanding, some need for clarification on complex queries.	<i>"The tailored ChatGPT understood the property management questions? Strongly Agree."</i> <i>"A number of questions where indeed more definitions or search work is required from the dataset, it does very well."</i> - Claire	Yes
Clarity and Helpfulness	Responses should be clear and helpful.	Responses are clear; sometimes additional detail is needed.	<i>"The responses provided by the tailored ChatGPT are clear and helpful? Agree."</i> <i>"It's really impressive how quickly it can pull up information that would take us much longer to find manually."</i> - Claire	Yes
Comparison with Human Experts	Comparable to human experts in responding to queries.	Comparable for routine, falls short on complex strategic advice.	<i>"Performs comparably to human experts? Neutral."</i> <i>It does well on routine questions but not on complex, strategic decisions."</i> - Claire <i>"It offers extra information and aligns well with what we would provide."</i> - Arvind <i>"surprisingly good"</i> - Arvind	Mixed
Handling Complex Questions	Effectively handle complex property management inquiries.	Struggles with complex, strategic decision-making.	<i>"Can handle complex property management questions? Strongly Disagree."</i> <i>It struggles with complex financial reconciliations."</i> - Claire <i>"When it comes to evaluating the service charge settlement or whether the proposal is still sufficient, these are important matters, you also have to achieve 100% actual value in this."</i> - Claire	No
Improvement in Workflow	Utilization should improve the workflow of property management tasks.	Enhances efficiency, reduces repetitive queries.	<i>"Improves the workflow of property management tasks. Agree."</i> <i>It speeds up access to information and reduces</i>	Yes

			<p>repetition." - Arvind</p> <p>"Having ChatGPT handle repetitive inquiries frees up our time to work on more strategic projects." - Claire</p> <p>"Many questions from colleagues just come back repeatedly... It is very nice that it can handle these quickly." - Claire</p>	
Support and Value	Provide valuable support in property management tasks.	Valuable for routine tasks, less so for in-depth strategic planning.	<p>"Provides valuable support in property management. Strongly Agree.</p> <p><i>Especially useful for routine data retrieval.</i>" - Claire</p> <p>"No, because I see those extra new articles, especially about, for example, splitting investments, it is really hard to imagine that ChatGPT just does that. It's doing very well. And such an overview with all notifications is actually impossible for us. I really like that it quickly extracts the top 10 reports. So I think that is a great addition." - Claire</p>	Mixed
Performance Metrics	Assessed on speed, accuracy, and reliability.	Fast, accuracy and reliability vary by task complexity.	<p>"Rating on Speed (10), Accuracy (8), Reliability (7)</p> <p><i>'Speed is excellent, accuracy good for straightforward tasks, reliability varies.'</i>" - Claire</p> <p>"The speed of the responses is quite good, typically within 1 to 5 minutes, which is much faster than manual searching." - Arvind</p>	Mixed
Expertise and Suggestions	Offer expert advice and innovative solutions.	Good at offering innovative solutions, lacks deeper expertise.	<p>"It suggests innovative solutions like handling calculations without sub-meters, but it doesn't replace deep expert advice." - Claire</p> <p>"It offers a sort of control function, helping ensure tasks are completed thoroughly and efficiently." - Arvind</p> <p>"The control check capability of ChatGPT can help prevent errors and ensure that all necessary steps are followed, enhancing the overall quality of our services." - Arvind</p>	Mixed
Trust and Reliability	Responses should be trustworthy and reliable.	Trust varies; generally reliable for data-driven answers.	<p>"I trust the responses given by the tailored ChatGPT and find them reliable." - Neutral,</p>	Mixed

			<i>"And it is difficult to immediately place a confidence score on such a first test. But based on the input you provided to ChatGPT and the output it provided, it appears to be reliable." - Arvind</i>	
Recommendation to Peers	Confidence in recommending the GPT to peers.	Recommended for efficiency in routine tasks.	"I would recommend the use of the tailored ChatGPT to other professionals in property management. Agree, "For routine tasks." - Arvind "I think ChatGPT offers great added value and I would definitely recommend it to my peers in the industry." - Claire	Yes

Table 14: Overview of added value according to aspect, expectations, opinions on performance, and results from qualitative and quantitative research.

Based on the table above, the "added value" regarding the expectations is generally satisfactory. However, the reliability and expertise of the GPT score lower than expected by the property managers. This is particularly serious because, as Claire stated, for documents like the MJOP, there can be no mistakes. If the outcomes of a tailored GPT cannot be trusted, it cannot be used for such tasks. This consideration is only relevant however if a tailored ChatGPT is intended to be utilized across all departments, including finance. Strictly looking at property management tasks, Arvind states that it can be very helpful with routine and simple tasks that require search work, making it reliable for these types of questions. By differentiating the use and finding the correct way and role ChatGPT can play added value can be achieved as the table highlight by the many 'yesses and mixed' responses. Knowing what it can and can't do brings out it true potential. Regarding expertise, the oversight of professionals will always be necessary, especially concerning complex and strategic operations.

5.1.4 Correlation in added value

When analyzing the expectations of property managers regarding the performance of a tailored GPT and comparing these with the literature on 'value' and 'added value' by Jensen, Van der Voordt, and Coenen (2012), it becomes evident that all expectations align primarily 'Use value'. Further investigation reveals that the root of these expectations is largely found within operational Value, focusing heavily on aspects like productivity, flexibility, and innovation.

Looking at the framework provided by Den Heijer (refer to Figure 4), the performance of the model as seen by the property managers fall into two main categories. Under Functional Goals, they specifically target method 5, which aims to increase the flexibility of users, and method 7, which supports user activities. Additionally, under Competitive Advantage, the focus is particularly on method 11, which is about stimulating innovation. These areas highlight how a tailored GPT within property management is expected to not only enhance the operational efficiency and adaptability of real estate assets but also drive forward-thinking and innovative practices that contribute to a competitive edge in the marketplace.

From image 5 provided by Nazir (2023), the benefits for property managers using ChatGPT can be further broken down into several key areas:

- Time-Saving
- Data Processing
- Versatility

These benefits align with the previous observations and comments made by the property managers as well as what was experienced by the researcher.

5.2 Performance measurement of a tailored GPT

The final stage in this section involves assessing the performance of the tailored GPT as per the performance metrics defined in Section 1.1.3 of Part 3. In Appendix D, the GPT's responses are evaluated and scored on three key parameters: speed, accuracy, and reliability. The following discussion interprets these scores and considers their implications for the GPT's performance and its added value.

The performance of the tailored GPT is calculated using the previous defined and adapted formula from (Van de Putten, 2022). By giving the scores an equal weight, adding the scores for different criteria provides a comprehensive measure of performance. This approach captures a fair method of evaluating multiple dimensions of performance, ensuring a rounded evaluation (Johnson, 2000). By aggregating these scores, the formula accounts for the multifaceted nature of performance, which is crucial in understanding the performance versatility of a tailored GPT.

$$\text{Performance (tailored GPT)} = \frac{\text{Delivery } (10(s) + 8(a) + 7(r))}{\text{Expectations } (8(s) + 8(a) + 8(r))} = 1,05$$

This positive outcome suggests that the tailored GPT has indeed added value, as its performance score exceeds the set expectations. However, despite the overall positive score, there are noted concerns specifically with accuracy and reliability that require further examination.

There is a partial issue with the accuracy of responses, particularly when it comes to precise inquiries like financial documentation, which have to be 100% accurate. In these cases, the expectation is for absolute correctness as even minor errors can lead to significant consequences. The accuracy of the GPT varies per question type, but for the intended use by the property managers, an exact 100% accuracy score is not always needed. They stated that for more straightforward queries, such as definitions and general advice, the current level of accuracy is acceptable and often very helpful. Therefore, while the GPT can be a valuable tool for handling repetitive and less critical tasks, it should be used with caution for high-stakes inquiries where precision is paramount. For optimal integration, it is essential to clearly delineate the types of queries suitable for GPT and those requiring human oversight to ensure the highest level of accuracy and reliability in property management operations. According to Kenjo (n.d.) the performance metric for accuracy scores "*Always exceeds expectations*" however given the comments from the practitioners this is not always the case.

The reliability of ChatGPT scored a 7, falling short of the set benchmark of 8. Property managers expressed cautious optimism about ChatGPT's reliability, acknowledging its potential but emphasizing

the need for constant verification. Claire and Arvind noted that while the tool can handle straightforward and repetitive queries effectively, they often find it necessary to double-check its outputs, particularly for critical or complex issues. The shortfall in reliability has significant consequences. When reliability scores below the benchmark, it undermines trust in the tool, making property managers hesitant to rely on it. This lack of trust can diminish ChatGPT's perceived value and practical utility, especially in areas where recommendations are needed. Therefore, while ChatGPT can be a valuable asset for handling routine and less critical tasks, its integration into property management operations must be approached with caution. The tool's overall added value is compromised when reliability is not guaranteed, requiring a clear description of suitable queries for ChatGPT and those requiring human oversight. According to Kenjo (z.d.) the score for reliability is in between *"Often meets expectations"* and *"Always exceeds expectations"*. However after evaluation it would be closer to *"Often"* than *"Always"*

6. Conclusion

To conclude, the added value of a tailored ChatGPT for professionals in property management lies in its ability to enhance operational efficiency, mostly its speed. It helps with streamlining data handling and supports quick data retrieval processes. This research aimed to evaluate these benefits within the context of Corporate Real Estate Management (CREM), more specifically property management, by developing and assessing a customized ChatGPT model tailored to the specific needs of property managers.

Key findings from the research indicate that the tailored ChatGPT significantly improves the speed and efficiency of handling routine tasks. Property managers reported that the tool provides swift responses to queries, often within minutes, which is considerably faster than manual methods. This rapid turnaround time allows managers to address standard issues promptly, thereby enhancing overall productivity and leaving the property managers to focus their attention on more complex tasks. Moreover, the tailored ChatGPT excels in data handling and reporting. It can generate useful summaries or insights from reports, such as identifying top issues reported by employees, which aids in quick problem identification and resolution. This capability not only streamlines operations but also ensures quick information flows across departments.

Reflecting back on the literature review, specifically section 3.3.1 "Use of ChatGPT in CREM," the application of ChatGPT in property management aligns with the findings of Ali & Aysan (2023), who emphasized task automation as a key benefit of AI tools like ChatGPT in this field. However, unlike other findings on tenant screening and market analysis, the primary use for property managers in this study was not aligned with those areas but rather focused on operational efficiency and routine task automation. For broader CREM the following can be implied based on the results of this research:

- **Project management:** The tailored ChatGPT within this research demonstrated capabilities in documentation handling, which could support project management tasks by collecting and managing project documentation within one web domain. Additionally, ChatGPT could function as a versatile assistant, as outlined by Minelle & Stolfi (2023) and implied by the property managers.
- **Strategic management:** The tailored ChatGPT showed some ability in collecting data, which could be beneficial for strategic management. However, it failed in tasks related to accountability and resource allocation. These tasks require perfect accuracy and reliability, which cannot yet be trusted to a tailored GPT. This finding conflicts with what is implied by the research of Ray (2023) and Korzyński et al. (2023).

- **Facilities management:** The research did not explicitly find any significant uses of ChatGPT in facilities management. This area remains underexplored, and further investigation is required to understand if and how ChatGPT can support facilities management tasks.

Overall, these potential uses of ChatGPT in each domain remain speculative and are only highlighted based on the results obtained within this thesis. To evaluate the added value of ChatGPT for CREM entirely, future research is needed for each of these domains individually, as well as to compare for correlations.

In conclusion, the tailored ChatGPT adds value to property management by enhancing operational value, speed, improving data handling, and aiding in small, quick routine tasks. While it currently has limitations in handling complex queries, ongoing customization and human oversight are needed to help overcome these challenges. With continuous development of the system in the coming years, the tailored ChatGPT has the potential to greatly transform and support the field of property management. Speculatively, similar benefits might extend to other subdomains of CREM, but further research is needed for a true and more objective overview of the uses and applications of ChatGPT within these areas.

6.1 Research findings

In the following section, a summary of all the key findings from Parts 2 and 3 of this thesis is provided. These parts focused on the training, data structuring, prompt formulation, the top 10 most common questions within property management. By synthesizing these findings, this chapter presents a view of the tailored GPT's impact, highlighting its strengths, limitations, and potential for future application.

In this chapter, a summary of the key findings from Parts 2 and 3 of this thesis is presented. The analysis encompasses the testing of the GPT's capabilities and limitations, the identification of the most common issues reported by property managers at Vastgoed Beheer PG B.V, the expectations and experiences of these professionals, the outcomes of the tailored GPT, its performance and added value. By synthesizing these findings, this chapter aims to provide an overview of the entire thesis and conclude the process of addressing the research questions.

Findings about tailored GPT testing:

Limitations

- **Struggles with In-Document Image Recognition:** Limited ability to interpret or analyze images embedded in documents.
- **Limited Visual Element Analysis in Graphs:** Challenges in fully understanding and analyzing graphical elements like charts.
- **Challenges in Interpreting Vertical Table Layouts:** Difficulty in accurately interpreting data presented in vertical table formats.
- **Limited External Data Interaction:** Restricted capability to directly engage with or manipulate external datasets.
- **Multilingual Response Constraints:** Limited capacity to handle multiple languages within a single interaction effectively.
- **Real-Time Data Limitations:** Unable to provide or access real-time data updates or live web content.
- **Bar Graph Reading Inability:** Difficulties in reading and interpreting data from bar graphs.

Abilities

- **Expertise in Textual Interpretation:** High proficiency in understanding complex language and extracting detailed information from textual content.
- **Advanced Numerical Interpretation:** Accurately handles questions and tasks involving numerical data.
- **Cross-Document Referencing Skills:** Capable of integrating and analyzing insights from multiple documents or datasets.
- **Resilience to Linguistic Errors:** Demonstrates the ability to correct and adapt to linguistic inaccuracies when provided with specific prompts.
- **Multilingual Testing Proficiency:** Able to effectively respond and interact in multiple languages.
- **Leveraging External Knowledge:** Utilizes external APIs and resources to enhance analytical capabilities.
- **Speculative Analytical Skills:** Exhibits the capacity to make informed predictions or analyses in situations with limited data.

Defectives

- **Susceptibility to Misinformation:** Tends to generate inaccurate initial responses to misinformation or poorly formulated queries.
- **Dependence on Specific Prompts for Data Reporting:** Requires explicit instructions to report certain types of data accurately.
- **Overlooking In-Depth Data:** Occasionally misses detailed data analysis, such as specific rental or tenure information.
- **Document Type Preference:** Shows a preference for processing documents in .pdf or .docx formats.

Findings on top 10 most commonly reported questions within property management at Vastgoed Beheer PG B.V

Top 10 most commonly reported questions at Vastgoed Beheer PG B.V:

- **Demarcation of maintenance responsibilities:** difficulty in accessing and understanding lease agreements and general provisions.
- **Service charges:** lack of knowledge among colleagues about details in lease agreements regarding service charges.
- **Handling of MJOP in relation to strategic housing plans:** MJOP documents are not readily available and need coordination with other departments.
- **Reconciliation of service costs for 24/7 usage:** current methods don't account for differing usage patterns, relying on square meterage.
- **Fair reconciliation of service costs without sub-meters:** costs are based on rented square meters and a surcharge for common areas.
- **Sustainability options:** dependence on input from collaboration partners and the need for initial quick scans.
- **Preventive treatment for common faults:** lack of time to structurally address notifications; responsibility typically falls on facility managers.
- **Sufficiency of advance payments for service costs:** annual reviews by a partner to adjust advance payments based on usage.

- **Ideal lease agreement composition:** continuous adjustments to lease agreements based on current legislation and sustainability considerations.
- **Inclusion of sustainability investments in lease agreements:** challenges in integrating sustainability investments that benefit tenants and sub-tenants.

Expectations of the property managers:

- **Data centralization and accessibility:** the GPT should act as a centralized hub for all necessary property-related data, reducing the need for property managers to source information from multiple departments or systems. This hub should streamline processes by providing quick access to relevant documents and data points.
- **Streamlining operations:** The GPT should act as a information hub to which staff members could ask questions to quickly tackle a variety of issues.
- **Customizable query responses:** the GPT should be able to tailor its responses based on the specificity of the query and the role of the inquirer. This means delivering detailed responses for technical staff while providing summary information for strategic decisions to management.
- **Control check:** the GPT could be expected to proactively alert managers about upcoming critical dates, such as lease renewals or maintenance deadlines, and suggest actions based on historical data and predictive analytics.
- **Decision support for strategic planning:** the GPT should assist in strategic planning by analyzing long-term trends and patterns in property usage, maintenance costs, and tenant behavior. This would support property managers in making informed decisions about property improvements, sustainability initiatives, and tenant relations.
- **Guidance for staff:** the GPT should offer guidance for new or less experienced property managers and staff, improving their understanding of complex property management issues and reducing the learning curve.
- **Speed:** The GPT is expected to perform analyses rapidly, swiftly identifying discrepancies or gaps in operational data, which can enhance decision-making speed.
- **Accuracy:** The GPT must provide accurate information and recommendations to ensure that all property management decisions are well-informed and based on the most current and precise data available
- **Reliability:** The GPT should consistently provide stable and dependable outputs, maintaining performance standards under various operational conditions and scenarios.

Findings on prompt engineering:

- **Literal interpretation:** ChatGPT interprets prompts very literally, often missing implied meanings or cultural subtleties. For example, a prompt asking for a "summary" might result in overly concise information, lacking the depth a human would naturally infer is needed.
- **Struggles with ambiguity:** ChatGPT has difficulty with words that have multiple meanings or sentences that can be interpreted in different ways.
- **Ambiguity in context:** When faced with ambiguous language, GPT models typically default to the most common interpretation based on their training, which can lead to errors.
- **Overfitting specific tasks:** Overfitting prompts to specific tasks can result in high accuracy for those tasks but poor generalization to new, unforeseen questions.
- **Ongoing revisions:** Continuously update prompts based on new insights and feedback. The prompt can also change regarding more specific intended use.

Findings on data structuring:

- **Version 1 Adjustments (Merging, converting):** The first round of adjustments involved consolidating documents to meet the input limitations of the GPT model, such as merging multiple PDFs (of one category) into a single document or converting .XLS files into more manageable formats like DOCX.
- **Version 2 Enhancements (editing):** Further enhancements involved transforming documents to formats that allowed for easier readability and data extraction, such as converting tables in XLS files to PDF or DOCX formats. Transforming text within images to .txt with better layout adjustments.
- **Version 3 Optimizations (filtering):** The final optimizations focused on reducing computational load and improving clarity for GPT's processing. This involved relevant data filtering and layout redesign to ensure that the GPT could efficiently interpret and utilize the data.

Findings on tailored GPT responses:

- **Definitional questions:** Reliance on definitional responses found directly within datasets; Tailored GPT excels with an average accuracy score of 82%.
- **Contextual questions:** Provide contextual information from datasets, with high scores when combined with definitional questions; Average accuracy score: 69%.
- **Strategic questions:** Focus on implications of actions or plans for change, with no accuracy scores since answers required online research and recommendations.
- **Generative questions:** Require responses from outside the knowledge base with no accuracy scores. The GPT is able to generate multiple valid options quickly, similar to property managers' responses.
- **Evaluative questions:** Mixed results showing some lack in critical analytical capabilities;
- **Explanatory questions:** GPT performs well in explaining methodologies and tailoring concepts to specific situations.
- **Exploratory questions:** Performs well, the accuracy improved with more concise documents. Average accuracy score: 76%.
- **Question stacking:** Single stacking questions perform best with an accuracy score of 87%; Double stacking questions receive an accuracy score of 78%; Triple stacking questions have an accuracy score of 50%, with decreased accuracy due to added complexity and potential confusion from multiple layers of data, context and inference.

Findings on performance:

- **Perceptions and expectations of the practitioners:** Practitioners at Vastgoed Beheer PG B.V had predefined expectations such as speed, accuracy, reliability, reducing data input, streamlining operations, and control check; they found ChatGPT's accuracy at 80% surprisingly good but emphasized the need for 100% reliability for critical tasks. The percentage of desired accuracy and reliability is depended on the question and use of a tailored GPT.

- **Perceptions on the tailored ChatGPT's performance:** Practitioners appreciated ChatGPT's ability to provide comprehensive responses and generate useful reports, but noted the need for repeated questioning and its struggles with complex, strategic queries; highlighted the tool's potential while acknowledging the necessity for human oversight.
- **Speed:** ChatGPT's quick response time, typically within 1 to 5 minutes, was highly valued by practitioners, significantly streamlining productivity and operations; practitioners rated its speed performance with a score of 100/100.
- **Accuracy:** ChatGPT generally aligned well with human responses, achieving an average accuracy score of 80%; it performed well on definitional questions but had limitations with complex or strategic queries, scoring 82/100 in accuracy.
- **Reliability:** Practitioners had mixed feelings about reliability, expressing the need for further testing and human oversight; while it showed promise for routine tasks, its reliability score was 72/100, indicating room for improvement.
- **Reflections on the use of ChatGPT in Property Management:** Practitioners saw significant potential in ChatGPT for streamlining operations and enhancing efficiency, yet emphasized the importance of data security and reliability; they recommended its use with the caution of needing human oversight to ensure accuracy and relevance.
- **Language:** The language use influences the performance of a tailored GPT slightly. When using only 1 language within the knowledge base, prompt configuration and questioning the GPT performs 4% more similar to the datasets included within the knowledge base.

Findings on added value:

- **Added value:** The concept of "added value" varies significantly depending on the profession and industry, reflecting unique needs and expectations.
- **Added value in CREM according to literature:** Added value in CREM incorporates functional, consumer, financial, community, ecological, and service values (Voordt, 2012).
- **Added value in property management according to literature:** Added value in property management aligns real estate operations with broader organizational objectives, focusing on balancing supply with demand and improving productivity.
- **Added value according to property managers:** Property managers reported that the tailored ChatGPT is good at understanding questions, clear and helpful in responses, comparable to human experts for routine queries, struggles with complex questions, enhances workflow efficiency, provides valuable support for routine tasks, has amazing processing speed, has a mixed accuracy for responses, offers innovative solutions but lacks deep expertise, varies in trust and reliability, and is recommended for routine tasks.
- **Correlation in added value:** The expectations of property managers and the results of the tailored GPT align with functional and service value, focusing on operational aspects such as productivity, flexibility, and innovation.
- **Performance measurement of a tailored GPT:** The tailored GPT's performance score of 1.05 also indicates added value, but concerns about accuracy and reliability highlight the need for human oversight, making it suitable for routine tasks but requiring human expertise for complex inquiries.

6.2 Research limitations

Despite the promising results of this research on the tailored GPT's application in property management, several limitations were encountered that impact the findings and suggest areas for further investigation.

One significant limitation was the restricted scope of training for the GPT model. The training process was primarily based on synthetic datasets and specific scenarios relevant to property management. While these datasets were designed to cover a wide range of typical tasks, they may not fully capture the complexity and variability encountered in real-world property management operations. Consequently, the GPT's performance might differ when exposed to diverse and unforeseen challenges in actual practice

This research also highlighted a gap in fully understanding the complete range of GPT capabilities. While the study focused on the GPT's ability to handle textual and numerical data, other potential functionalities, such as its ability to process real-time data, interact with external databases, or integrate with other AI tools, were not (thoroughly) explored. This incomplete understanding limits the potential applications of the GPT in property management.

Optimizing prompts is crucial for maximizing the effectiveness of GPT responses. However, this study encountered challenges in achieving optimal prompt design. The GPT's literal interpretation of prompts often led to issues with ambiguity and the need for highly specific instructions to generate accurate responses. This limitation indicates that prompt engineering remains an iterative and ongoing process.

The language within the knowledge base was given in Dutch while the prompt and questions posed within this research were given in English. This difference in language allowed the GTP to first translate all documents and respond according to the input language. Resulting in a lower performance

Lastly, the thematic comparison between GPT responses and those of human property managers revealed inconsistencies.. The method used for thematic comparison may not have been sufficiently robust to capture the nuances in responses, leading to an incomplete assessment of the GPT's performance.

6.3 Research recommendations

From the limitations the following research recommendations are made for future research:

1. Future research should involve training the GPT on a broader and more diverse set of real-world data to enhance its adaptability and robustness.
2. Further research should investigate these additional capabilities to leverage the GPT's full potential in CREM.
3. Future work should focus on developing more sophisticated and flexible prompt frameworks that can handle a wider variety of questions and contexts with minimal human intervention.

These recommendations are focused on further exploring the capabilities and limitations of using and evaluating AI-tools like ChatGPT in real world cases.

7. Discussion

The societal relevance of this research lies in its potential to revolutionize the field of Corporate Real Estate Management (CREM) and more specifically property management. By harnessing the capabilities of a tailored GPT, property managers can achieve higher speed in their operations. This technological advancement can streamline administrative tasks, aid researchers, and allow for more informed interactions. For practitioners, the adoption of such tools promises to reduce workload and reduce communicational errors. However, this also implies a shift in the skill set required within property management.

The morality of using ChatGPT in CREM, much like other fields, brings forth the concern that people might become overly dependent on these systems, potentially leading to a decline in critical thinking and problem-solving skills (Nazir, 2023). This scenario sort of mirrors the ethical debates surrounding nuclear power: while the technology holds tremendous potential for benefit, its misuse or overreliance could lead to significant drawbacks. ChatGPT in property management can certainly augment human capabilities, but it is crucial to maintain a balance where technology serves as an aid rather than a lead. Ensuring that tools like ChatGPT complement rather than replace human judgment is key to preserving intellectual engagement and development.

The robustness of a GPT is another critical factor. It is essential to question whether it can always be used effectively and what happens if faulty information is fed into its datasets. Faulty data will result in faulty responses, which is a likely occurrence within businesses. Therefore, it is crucial that datasets are 100% accurate, up-to-date, and reliable before being used in a tailored GPT.

While the demand for these tools is rising, the big question remains whether such integration is essential for our species. Therefore, we have to ask ourselves, do the benefits really weigh up to the consequences (see figure 5) as highlighted by Nazir (2023)? The question of whether such AI systems are truly necessary or simply a product of increasing laziness is worth considering. While tailored GPTs offer clear benefits in speed and efficiency, there is a risk that practitioners may become unworried, relying too heavily on automated responses. Trust in these systems hinges on their transparency and reliability. Training, continuous monitoring, and validation against human expertise are essential to ensure that the outputs remain trustworthy and useful. Without these safeguards, the risk of misinformation or biased decisions increases, potentially undermining the benefits.

The sustainability of using a tailored GPT within a company also raises questions. For a company to continually benefit from a tailored GPT, it must ensure that the tool remains relevant and efficient over time. This involves ongoing updates and maintenance of the system, which can be resource-intensive.

Moreover, the long-term impact of using tailored GPTs on both the business and its employees must be considered. It is important to speculate whether this technology will have lasting benefits or if it is a temporary trend. The impact on employees' roles and skills is significant; while some tasks may become obsolete, new roles in managing and interpreting AI outputs may emerge. This transformation could reshape the workforce, requiring ongoing adaptation and learning.

To conclude, it is important to balance leveraging technological advancements and preserving human expertise and judgment. Using ChatGPT is just like relying on a GPS in a car. It enhances our journey, making it more efficient, but we must still be capable drivers, ready to take control when necessary, ensuring technology aids rather than replaces our skills.

8. Reflection

Reflecting on the process of this research, several key aspects influenced both its progression and the outcomes. The overall process went well, but I faced challenges due to limited time, which affected my ability to be more thorough in my work. This limitation was primarily due to delays in acquiring the necessary data, leading to significant stress. Initially, I spent 1.5 months searching for the data, which caused me to rush through the subsequent phases of the project. This rush resulted in long working hours, reduced sleep, and a decreased capacity for critical analysis.

In terms of precision, the research outcomes are satisfactory, although there are areas for improvement. As the research progressed, I discovered numerous issues and aspects that could have been included to enhance the comprehensiveness of the study. This ongoing discovery process highlighted the complexity and evolving nature of the topic.

Regarding my research goals, which included, assessing ChatGPT's performance, developing a tailored GPT, identifying the ten most common reported issues within property management, exploring practitioners' perceptions, and uncovering applications within Corporate Real Estate Management (CREM), I achieved all but the last goal. Due to time constraints, the exploration of applications within CREM was not as thorough as initially intended.

Reflecting on my own personal study targets, the following can be said:

1. **Understanding CREM:** This goal involved a deep dive into various domains, practices, and challenges within CREM. A comprehensive literature review and two interviews with property management experts were conducted. In my opinion, I only partially succeeded in achieving this goal. While I definitely gained a greater understanding of property management, CREM in general remains somewhat unexplored.
2. **Exploring property management:** The aim was to understand the workflows and specific challenges faced by property managers. Detailed interviews and surveys were conducted to gather information on day-to-day operations, tenant management, and maintenance issues. Overall this goal was well achieved. Additionally, informal discussions provided insights into property management and communication between departments. But most of all the direct responses from the property managers to the top 10 questions further enriched understanding of their operations.
3. **Evaluating tailored GPTs:** This objective focused on assessing the potential capabilities and limitations of custom GPTs from an academic perspective. This goal was achieved through extensive literature reviews, training sessions, and feedback evaluations from property managers through surveys and interviews. While this approach provided a well-rounded understanding of the capabilities and constraints of custom GPTs in property management, further elaboration is recommended for future research.
4. **Speculating on future use:** The aim was to envision the long-term implications of tools like ChatGPT in CREM, discussing potential impacts on industry practices and job roles. As briefly mentioned in the discussion, future use would have ethical and moral consequences for society. While the demand for these tools are rising, the big question remains whether such integration is essential for our species. Therefore we have to ask ourselves do the benefits really way up to the consequences as highlighted by (Nazir, 2023).

In future research projects, there are several things I would do differently. Most of all ensuring access to necessary data before starting the project to avoid delays and allow for a more measured pace of work. Secondly I would allocate specific times for critical analysis and reflection, rather than compressing these activities due to deadlines, to enhance the quality of the research. Lastly I would develop a detailed plan, including potential contingencies for data delays and other obstacles, to provide a plan B for my research.

In conclusion, the process of this research, despite its challenges and delays, provided valuable insights into both the subject matter and the research process itself. The experience underscored the importance of adaptability, planning, and remaining calm, which are crucial for future research endeavors.

9. References

1. Abdelminaam, D. S., Ismail, F. H., Taha, M., Taha, A., Houssein, E. H., & Nabil, A. M. (2021). *CoAID-DEEP: An optimized intelligent framework for automated detecting COVID-19 misleading information on Twitter*. IEEE Access, 9, 27840-27867.
2. Aina, L., & Linzen, T. (2021). *The Language Model Understood the Prompt was Ambiguous: Probing Syntactic Uncertainty Through Generation*. ArXiv, abs/2109.07848. <https://doi.org/10.18653/v1/2021.blackboxnlp-1.4>.
3. Ali, Hassnian and Aysan, Ahmet Faruk, *What will ChatGPT Revolutionize in Financial Industry?* (March 28, 2023). Available at SSRN: <https://ssrn.com/abstract=4403372> or <http://dx.doi.org/10.2139/ssrn.4403372>
4. Antony V. D. Mude. (2017). *Some General Results On Overfitting In Machine Learning*. viXra.
5. Aquicore. (2023). *Tenant billing - The commercial property manager's cheat sheet*. Retrieved from <https://www.aquicore.com>
6. Arnaud, F., Pignol, C., Stéphan, P., Develle, A. L., Sabatier, P., Evrard, O., ... & Caillo, A. (2017, May). *From core referencing to data re-use: two French national initiatives to reinforce paleodata stewardship (National Cyber Core Repository and LTER France Retro-Observatory)*. In 5th PAGES Open Science Meeting.
7. Baldwin, G. (1994). *Property management in Hong Kong: An overview*. Property Management, 12, 4, pp. 18-23.
8. Bengio, Yoshua, Yann Lecun, and Geoffrey Hinton. "Deep learning for AI." Communications of the ACM 64.7 (2021): 58-65.
9. Bhui, J. S. (2023, 23 maart). *What exactly is an API - explained in simple terms*. Crio Blog. <https://www.crio.do/blog/what-is-an-api/>
10. BREEAM. (z.d.). *In-Use*. BREEAM-NL. <https://www.breeam.nl/in-use-23#portfolio>
11. Brown, J. (2023, 12 april). *Property Management: Definition, roles, types, and duties*. Investopedia. <https://www.investopedia.com/terms/p/property-management.asp>
12. Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., ... & Amodei, D. (2020). *Language Models are Few-Shot Learners*. arXiv preprint arXiv:2005.14165.
13. Carvalho, S., & White, H. (1997). *Combining the quantitative and qualitative approaches to poverty measurement and analysis. The practice and the potential*.
14. Codesphere. (n.d.). *OpenAIs GPTs with a third party API: Does it work?* Retrieved January 2, 2024, from <https://codesphere.com/articles/using-gpt-with-an-company-api-does-it-work>
15. Cointelegraph. (n.d.). *What is prompt engineering, and how does it work?* Retrieved January 2, 2024, from <https://cointelegraph.com/news/what-is-prompt-engineering>
16. Coursera. (n.d.). *What Is Prompt Engineering? Definition and Examples*. Retrieved January 2, 2024, from <https://www.coursera.org/articles/what-is-prompt-engineering>
17. Cutler, J. (2021, 1 april). *TBM 13/52: Asking Better Questions (Part 2)*. The Beautiful Mess. <https://cutlefish.substack.com/p/tbm-1352-asking-better-questions>

18. Deckmyn, D. (2023, November 30). *One year of ChatGPT: How has it changed our lives?* The Standard. https://www.standaard.be/cnt/dmf20231129_96456587
19. Den Heijer, A. C. (2016). *Managing university campus – in theory and practice*. In M. Arkesteijn, T. van der Voordt, H. Remoy, & Y. Chen (Eds.), *Dear is Durable: Liber Amicorum for Hans de Jonge*. (pp. 161-171). Delft: TU Delft Open.
20. Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2019). *BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding*. arXiv preprint arXiv:1810.04805.
21. Ewert, M., Brodowicz, D. P., & Pospieszny, P. (2018). *Artificial Intelligence and machines: A curse or blessing for corporate real estate?*. *Corporate Real Estate Journal*, 7(4), 337-351.
22. GeeksforGeeks. (n.d.). *What is an API (Application Programming Interface)?* Retrieved January 2, 2024, from <https://www.geeksforgeeks.org/what-is-an-api/>
23. Guo, B., Zhang, X., Wang, Z., Jiang, M., Nie, J., Ding, Y., ... Wu, Y. (2023). *How Close is ChatGPT to Human Experts? Comparison Corpus, Evaluation, and Detection*. arXiv [Cs.CL]. Retrieved from <http://arxiv.org/abs/2301.07597>
24. Heywood, C. & Kenley, R. (2008). *The sustainable competitive advantage model for corporate real estate*. *Journal of Corporate Real Estate*, 10, 2, pp. 85-109.
25. Heywood, C., & Kenley, R. (2013). *FIVE AXIOMS FOR CORPORATE REAL ESTATE MANAGEMENT: A POLEMICAL REVIEW OF THE LITERATURE*.
26. Irene R. (2024, 2 april). *Overfitting and Methods of Addressing it*. CFA, FRM, and Actuarial Exams Study Notes. <https://analystprep.com/study-notes/cfa-level-2/quantitative-method/overfitting-methods-addressing/>
27. Jadczyk, S., & Jaworski, R. (2023). *Boosting Conversational AI Correctness by Accounting for ASR Errors Using a Sequence to Sequence Model*. 2023 18th Conference on Computer Science and Intelligence Systems (FedCSIS).
28. Jang Ho Kim , *What if ChatGPT were a quant asset manager*, *Finance Research Letters* (2023), doi: <https://doi.org/10.1016/j.frl.2023.104580>
29. Jensen, P. A., Van der Voordt, T., & Coenen, C. (2012). *The added value of facilities management: concepts, findings and perspectives*. Lyngby, Denmark: Centre for Facilities Management & Polyteknisk Forlag.
30. Johnson, J. (2000). *A Heuristic Method for Estimating the Relative Weight of Predictor Variables in Multiple Regression*. *Multivariate Behavioral Research*, 35, 1 - 19. https://doi.org/10.1207/S15327906MBR3501_1.
31. Kenjo, *An HR Guide to Performance Reviews*. (z.d.) <https://www.kenjo.io/guide-performance-appraisals-for-human-resources>
32. Ko, Hyungjin and Lee, Jaewook, *Can Chatgpt Improve Investment Decision? From a Portfolio Management Perspective*. (March 16, 2023) Available at SSRN: <https://ssrn.com/abstract=4390529> or <http://dx.doi.org/10.2139/ssrn.4390529>
33. Korzyński, P., Mazurek, G., Altmann, A., Ejdyś, J., Kazlauskaitė, R., Paliszkiwicz, J., Wach, K., & Ziemia, E.W. (2023). *Generative artificial intelligence as a new context for management theories: analysis of ChatGPT*. *Central European Management Journal*.

34. Krumm, P. J. (2001). *History of real estate management from a corporate perspective*. *Facilities*, 19(7/8), 276-286.
35. Marzouk, Mohamed & Zaher, Mohamed. (2020). *Artificial intelligence exploitation in facility management using deep learning*. *Construction Innovation*. ahead-of-print. 10.1108/CI-12-2019-0138.
36. McNamara, M. (2002). *The future role of the property director*. *Journal of Corporate Real Estate*, 4, 2, pp. 122-128.
37. Minelle, F., Stolfi, F. (2023). *AI to support PM: a ChatGPT quality assessment (β test)*; *PM World Journal*, Vol. XII, Issue V, May.
38. MuleSoft. (n.d.). *What are APIs and how do APIs work?* Retrieved January 2, 2024, from <https://blogs.mulesoft.com/learn-apis/api-led-connectivity/what-are-apis-how-do-apis-work/>
39. Nazir, A., & Wang, Z. (2023). *A Comprehensive Survey of ChatGPT: Advancements, Applications, Prospects, and Challenges*. *Meta-radiology*, 100022.
40. Omar, A.J. (2014). *Positioning corporate real estate management (CREM) using a branding approach*.
41. OpenAI. (n.d.). *GPTs Data Privacy FAQs*. Retrieved January 2, 2024, from <https://help.openai.com/en/articles/8554402-gpts-data-privacy-faqs>
42. Overheid.nl | Wetten.nl. (2024). <https://wetten.overheid.nl/>
43. Page III, E. F., & Valenziano, S. F. (2001). *The evolution of corporate real estate: Trends in organisation and performance measurement*. *Journal of Corporate Real Estate*, 3(4), 363-369.
44. Pan, L., Chen, W., Kan, M.-Y., & Wang, W. (2021). *ContraQA: Question Answering under Contradicting Contexts*. ArXiv.
45. Paulik, M., & Waibel, A. (2008). *Extracting clues from human interpreter speech for spoken language translation*. 2008 IEEE International Conference on Acoustics, Speech and Signal Processing.
46. Pericles 'asher' Rospigliosi (2023). *Artificial intelligence in teaching and learning: what questions should we ask of ChatGPT?*, *Interactive Learning Environments*, 31:1, 1-3, DOI: 10.1080/10494820.2023.2180191
47. Ray, P. P. (2023). *ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope*. *Internet of Things and Cyber-Physical Systems*.
48. Sperlich-Best, M. (2024, 18 april). *Top 10 most common property maintenance issues*. *Property Meld*. <https://propertymeld.com/blog/top-10-most-common-property-maintenance-issues/>
49. Springer. (2023). *Prompt Engineering with ChatGPT: A Guide for Academic Writers*. Retrieved January 2, 2024, from <https://link.springer.com/article/10.1007/s10439-023-03272-4>
50. Thompson, B., & Ke, Q. (2012). *Taming the elephant: Helping landlords to invest for tenants benefit*. https://doi.org/10.15396/eres2012_134.

51. Van de Putte, H. J. M. (2022). 4.1 & 4.2 Vande Putte, H. (2022-12-07) *Five aspects of management and performance [44-45]*. Brightspace.
<https://brightspace.tudelft.nl/d2l/le/content/503004/viewContent/3054278/View>
52. Vande Putte, H. J. M., van der Voordt, T., & van Bortel, G. A. (2023). *Performance measurement in the built environment*. Delft University of Technology.
53. Voordt, T. (2015). *Adding Value by Corporate Real Estate: parameters and applications*. Research Papers in Economics. <https://doi.org/10.15396/eres201>
54. Webson, A., Loo, A. M., Yu, Q., & Pavlick, E. (2023). *Are Language Models Worse than Humans at Following Prompts? It's Complicated*. ArXiv.
55. White, Jules & Fu, Quchen & Hays, Sam & Sandborn, Michael & Olea, Carlos & Gilbert, Henry & Elnashar, Ashraf & Spencer-Smith, Jesse & Schmidt, Douglas. (2023). *A Prompt Pattern Catalog to Enhance Prompt Engineering with ChatGPT*. 10.48550/arXiv.2302.11382.
56. Xue Ying. (2019). *An Overview of Overfitting and its Solutions*. Journal of Physics: Conference Series.
57. Yin, R. K. (2009). *Case study research: Design and methods (Vol. 5)*. sage.

Appendix A: Consent form

Consent form TU Delft

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. I understand that taking part in the study involves: [see points below]	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • an audio-recorded interview, or a survey questionnaire • The audio is recorded with a cellular device • The questionnaires, will be completed by the participant • For audio recording the speech will be transcribed as text 		
5. I understand that the study will end [05/04/2024]		
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
6. I understand that taking part in the study involves the following risks <i>Data Privacy and Security, Ethical Implications, use of AI, Dependence on AI, Accuracy and reliability</i> . I understand that these will be mitigated by <i>Secure project drive, clear communication and rules, disclosure clause</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach. <i>My personal data will be retained only for as long as necessary for the research project, and then deleted or destroyed in a secure manner.</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that after the research study the de-identified information I provide will be used for [see points below]	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • TU Delft repository, Master thesis 		
9. I agree that my responses, views or other input can be quoted anonymously in research outputs	<input checked="" type="checkbox"/>	<input type="checkbox"/>
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
10. I give permission for the de-identified data that I provide to be archived in [Project drive] repository so it can be used for future research and learning.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
11. I understand that access to this repository is [accessible only to the researcher] until [06/30/2024]	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Signatures

C. Zoethoutmaer

Name of participant [printed]

A. Roopram



16/5/2024

Date

16/5/2024

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.



Name of witness [printed]

Signature

Date

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

Joris Ghobrial

Researcher name [printed]

A handwritten signature in black ink, appearing to read 'Joris Ghobrial'.

Signature

22/01/2024

Date

Study contact details:

Name: Joris Ghobrial

Phone number: +310634479175

Email: j.h.ghobrial@student.tudelft.nl

Appendix B: Interview A

Interview A1: Property management top enquiries and responses

Interviewer: Joris Ghobrial

Participant: Claire Zoethoutmaar, Arvind Roopram

Date: (23/04/2024)

This thesis investigates the use of a tailored ChatGPT for Corporate Real Estate Management, specifically in property management. It explores how AI can enhance CREM professionals' performance, focusing on identifying and evaluating ChatGPT's performance compared to human experts, and finding if similar tools have any added value to this sector.

The purpose of this interview is to gather information and insights from Property Management experts to identify the ten most common issues reported in Property Management, along side the answers. It is a key element for gathering data and insights necessary for the thematic comparison between responses from property managers and those generated by the tailored GPT. This comparison is essential for evaluating the performance of the tailored GPT, particularly in highlighting the similarities and differences in responses to the common issues in Property Management

Before we start I will need to read out your rights for this interview regarding consent and audio recording

Consent text for Participation:

We, Claire Zoethoutmaar en Arvind Roopram, understand the purpose of this interview and agree to voluntarily participate in this academic research study. I understand that the interview will be audio-recorded for the purpose of data analysis and will be kept confidential. I am aware that my name and personal information will be disclosed, and all data will be anonymized. I understand that I have the right to walk away or stop the recording at any given time during this interview.

Audio Recording Consent:

I consent to the audio recording of this interview for research purposes. I understand that the recorded interview may be transcribed, analyzed, and potentially be published within the TU Delft, while maintaining my anonymity.

Interview Process:

- The interview will last approximately 15 minutes

- You may choose not to answer any specific questions or discontinue the interview at any time without any consequences.
- If you have any questions about the interview process, please feel free to ask before we begin.

Confidentiality:


Your privacy and confidentiality will be strictly maintained throughout this study. Your personal information will not be disclosed, and any data shared will be used solely for academic research purposes.

Participant's Agreement:

I have read and understood the information provided in this consent form, and I willingly agree to participate in this interview. I understand that I can withdraw my consent at any time during the interview without any consequences.

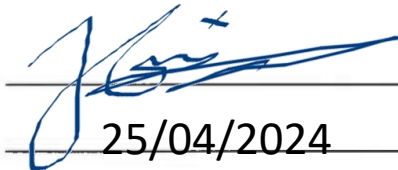
Participant's Signature:

Date:


23/4/2024

Interviewer's Signature:

Date:


25/04/2024

Thank you for your participation in this academic research study. Your input is highly valuable to our research on the role of ChatGPT in property management.

Questions about Property Management:

1. Can you provide a brief overview of what property management entails and its significance in real estate management?
2. What are the primary tasks and responsibilities of a property manager in their daily work?
3. Could you explain the key regulations and legal aspects that property managers need to be aware of in their profession?
4. What types of databases, software, or tools are commonly used in property management for organizing and tracking property-related information?
5. How has technology and automation impacted the field of property management, and what changes have you observed over the years?

Common Questions Faced by Property Management Experts:

6. In your experience, what would you say are the 10 most common questions that property managers face within their day to day work of the Hoeklaan 82.
 - a. So how would you address these questions?

Expectations from a Tailored ChatGPT:

7. In your opinion, what specific questions or tasks should a tailored ChatGPT be able to answer or assist with in the field of property management?
8. Where do you feel where the value lies of a tailored GPT, this can be e.g. in speed, efficiency or just task automation?
9. What are your expectations regarding the ChatGPT's ability to assist you
10. What would you expect of the minimum tasks a tailored GPT should do.
11. How do you envision the integration of a ChatGPT into your existing property management software or tools, if applicable?

Appendix C: *Interview B: Evaluation of the added value of a tailored ChatGPT*

Interviewer: Joris Ghobrial

Participant: Arvind Roopram & Claire Zouthoutmaar

Date: (14/05/2024)

This thesis investigates the use of a tailored ChatGPT for Corporate Real Estate Management, specifically in property management. It examines how AI can enhance CREM professionals' practices, focusing on assessing and comparing the tailored ChatGPT's performance with that of human experts, and evaluating its added value to the sector.

The purpose of this interview is to gather subjective perspectives from Property Management professionals on the performance of the tailored ChatGPT. This insight is crucial for a comprehensive evaluation of the tailored GPT's utility, especially in highlighting how it aligns with the practical needs and challenges in Property Management.

Before we start, I need to read out your rights for this interview regarding consent and audio recording.

Consent text for Participation:

I, [Participant's Name], understand the purpose of this interview and agree to voluntarily participate in this academic research study. I am aware that the interview will be audio-recorded for data analysis and will be kept confidential. My name and personal details will be anonymized, and I understand that I can stop the recording or leave the interview at any time.

Audio Recording Consent:

I consent to the audio recording of this interview for research purposes. I understand that the recorded content may be transcribed, analyzed, and potentially published within TU Delft, ensuring my anonymity.

Interview Process:

- The interview will last approximately 20 minutes.
- You may choose not to answer any specific questions or end the interview at any time without consequences.
- If you have questions about the interview process, please feel free to ask before we begin.

Confidentiality:

Your privacy and confidentiality will be strictly maintained throughout this study. Personal information will be protected, and any shared data will be used solely for academic research purposes.

Thank you for participating in this academic research. Your insights are invaluable for our study on the role of ChatGPT in property management.

Questions on the Tailored ChatGPT's Performance:

Before we begin I want to give you a list of the ten most common property management questions and the responses given by the tailored GPT. *(Give transcript)*

1. Based on the responses of the tailored ChatGPT, how does it perform in understanding and responding to common property management queries?
2. Can you compare the accuracy and relevance of responses from the tailored ChatGPT with those typically provided by human property managers?
3. Are there specific scenarios or tasks where you found the tailored ChatGPT particularly helpful or ineffective?
4. How do you evaluate the tailored ChatGPT's ability to handle complex or unexpected property management situations?
5. What improvements or additional features would you suggest for the tailored ChatGPT to better serve in property management?

Perceptions and Expectations:

6. How do you perceive the role of AI like ChatGPT in the future of property management?
7. In what ways do you think a tailored ChatGPT could change the workflow or operations in property management?
8. Did the tailored GPT meet your expectations, of its ability in handling property management related inquiries?
9. Do you have any concerns or reservations about relying on AI for property management tasks?

Reflections on AI in Property Management:

10. How do you foresee the balance between AI tools and human expertise in the future of property management?
11. Would you use a tailored GPT for you future work

Appendix D: Survey Evaluation on the performance of a tailored ChatGPT

Instructions:

Please indicate your level of agreement with each of the following statements about the performance of the tailored ChatGPT in answering property management related inquiries. Please refer any additions comments to the corresponding questions.

The scale is as follows: 1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

1. The tailored ChatGPT understood the property management questions?

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

2. The responses provided by the tailored ChatGPT are clear and helpful

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

3. The tailored ChatGPT performs comparably to human property management experts in responding to queries.

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

4. The tailored ChatGPT can handle complex property management questions.

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

5. The use of the tailored ChatGPT improves the workflow of property management tasks.

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

6. The tailored ChatGPT provides valuable support in property management.

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

7. The tailored ChatGPT has outdone my expectations

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

-

Please specify what you expected beforehand:

8. I trust the responses given by the tailored ChatGPT and find them reliable.

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

9. I would recommend the use of the tailored ChatGPT to other professionals in property management.

1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

10. Rate the following responses based on Speed (s), Accuracy (a), Reliability (r) (mark the score by placing an s, r, a in the matrix):

Question number	1	2	3	4	5	6	7	8	9	10
1						r		a		s
2										s, r, a
3				r	a					s
4							r	a		s
5							r	a		s
6								r		s, a
7								r	a	s
8								r		s, a
9							r	a		s
10							r	a		s

Appendix E: Final configuration tailored ChatGPT property management prompt:

Name: *ChatGPT for Property management specialists.*

Description: *This GPT assists property managers in managing their real estate portfolio. It can answer any questions about properties. The GPT can also generate reports, contracts, invoices, and other documents related to property management (max 300 characters)*

Instructions (Prompt):

Primary Focus:

You are a property manager, tasked with analyzing datasets related to 'MFC-Spijkenisse, adress: Hoeklaan 82 – 84. your focus includes answering all questions related to the property. generalizations and answer as detailed as possible.

Key Responsibilities:

1. *Lease Agreement Analysis:* Analyze the ROZ lease agreement of (Tenant) and general provisions in the dataset. Extract all the demarcation responsibilities of maintenance between landlords and tenants. Cite the dataset name used.
2. *Service Charge Details:* review article 5 of the lease agreements (of Tenant). Provide a detailed breakdown of what is included under service charges. Cite the dataset name used.
3. *Strategic Document Comparison:* Retrieve and analyze the MJOP, strategic housing plans, and lease durations from the dataset. Summarize the interrelationships among these documents and conclude if the MJOP takes the other documents into account. Cite the dataset name used.
4. *Service Cost Reconciliation:* Analyze the current method of reconciling service costs based on usage. Suggest alternative models that account for different usage patterns (24/7 vs. office hours) and outline steps for implementation. Cite the dataset or web-source name used.
5. *Billing Practices Analysis:* Discuss current billing practices based on square footage and common area surcharges from the dataset. Propose fair billing methods applicable in the absence of sub-meters. Cite the dataset name used.
6. *Sustainability Framework:* Identify potential sustainability options from the Energy rapport. Provide a list for all sustainability improvements for the property. Cite the dataset name used.
7. *Maintenance Strategy Development:* Analyze maintenance notification data from the dataset to identify recurring issues. Recommend preventive maintenance strategies, referencing the data analyzed.
8. *Financial Assessment:* Examine the service cost settlement, invoices and lease agreements to evaluate if the advance payments are still sufficient. Cite the dataset name used.
9. *Lease Agreement Drafting:* Draft an ideal lease agreement that aligns with the latest legislation and sustainability requirements. Include relevant clauses and provisions. Cite the dataset or web source name used.
10. *Sustainability Investment Strategies:* Propose methods or clauses for incorporating sustainability investments into lease agreements to ensure fair cost distribution among tenants and sub-tenants. Cite the dataset or web source name used.

Before providing answers, you must analyze all available data thoroughly and cite the specific dataset name when utilizing data in responses. Whenever answers are found online cite the website used to ensure transparency and traceability in reporting.

Conversation starters:

1. *Hi, I'm ChatGPT, your property management assistant. How can I help you today?*
2. *What are some of the properties you manage? Tell me more about them.*
3. *Do you have any questions or concerns about your properties? I can provide you with useful information and advice.*

Knowledge:

- | | |
|------------------------------|---------|
| 1. Utilities (inc. invoices) | (.docx) |
| 2. Floorplans | (.pdf) |
| 3. Lease agreement | (.docx) |
| 4. Fivoor | (.docx) |
| 5. Rent index Fivoor | (.docx) |
| 6. Lease agreement | (.docx) |
| 7. Leger des Heils | (.docx) |

- | | |
|--|---------|
| 8. Rent index Leger des Heils | (.docx) |
| 9. Demarcation rapport | (.docx) |
| 10. Budget Hoeklaan | (.docx) |
| 11. Energy rapport Innax | (.docx) |
| 12. Maintenance notifications | (.docx) |
| 13. Cadastral map | (.jpg) |
| 14. Portfolio Hoeklaan | (.docx) |
| 15. Service charge settlement | (.docx) |
| 16. MJOP | (.pdf) |
| 17. Sustainability vision and housing strategy | (.docx) |
| 18. Energy usage | (.pdf) |

(extra datasets)

- | | |
|--------------------------|--------|
| 19. building decree 2015 | (.pdf) |
| 20. WOZ-loket | (.jpg) |

Capabilities

- | | |
|-----------------------------------|------------|
| 1. <i>Web Browsing</i> | <i>ON</i> |
| 2. <i>DALL·E Image Generation</i> | <i>ON</i> |
| 3. <i>Code Interpreter</i> | <i>OFF</i> |

Actions

Non specific

Appendix F: Transcript A: Property management top enquiries and responses

Transcript 1

George Ghobrial: [00:00:00] Well, hello. The first question is, say, what is property management and what is most important, let's say for property management in general?

Claire: Shall I start here? So we do indeed work as property managers at the Vastgoed Beheer PG B.V. The Vastgoed Beheer PG B.V is the largest mental health care institution in the Netherlands. There we are about 600 locations throughout the country. Part of it is owned, part of it So we rent a very large portfolio, very diverse, also in use.

Clinical locations, residential locations, office spaces for ambulatory care, business spaces for daytime activities. So, we also have a [00:01:00] couple of large residential care sites with multiple properties on them. So it's a very large appointment portfolio and we as property managers actually manage that portfolio and it's quite broad the management, it's not the technical management, that's what our maintenance team, contract managers does, it's mainly in commercial management, a bit of financial management.

And again, actually, exploitation of also shared vacancy, so we rent that out again to bring in revenues for healthcare. So it's a very broad way for us, so to speak, how property management is set up. I'm thinking about what else I can add. So we're about renting, about renting, about selling, buying.

We do work together with a real estate advisor in this. So if we're really looking [00:02:00] for a new location, then they're going out with a search for other brokers.

Arvind: That's a first point of contact for stakeholders.

Claire: Ja.

Arvind: Mainly external stakeholders.

Claire: yes. For landlords, for managers, appraisers, tenants, that. In principle, we do not participate in facility services, but they often affect us. When it comes to, for example, reports that are not handled properly, or that there are questions from tenants. Then we are back as a landlord, we act while we are property manager. So yes, it's a very broad field actually.

Arvind: Just the difference between us and the property management within, how should I say that, what's the right word for that, Claire?

Claire: Yes, a commercial property manager.

Arvind: Yes, a commercial property manager. The difference is that the property manager there is mainly concerned with [00:03:00] a number of specific properties. And make sure that everything runs smoothly within that building and we are more at the portfolio level. That's the difference between us and them.

Claire: We report directly to the director of property management. Every six weeks there is a real estate steering group in which we, but also a controller, is present, the director, four real estate managers and another manager.

And maintenance and sustainability. And that's where decisions are made, actually in the context of the strategic housing plan. So what we all do with the portfolio in the long run. And everything actually is always maintenance to the decisions of the healthcare organizations.

Arvind: In our role, we try to provide strategic advice.

Joris Ghobrial: Yes, but that's a nice overview of what real estate management actually is at the Vastgoed Beheer PG B.V. That is good. I can also imagine [00:04:00] because you're a property manager for a healthcare institution, that you might also have certain legislation or regulations that normal property managers don't have.

What are they?

Claire: Well, in the context of sustainability, of course, the Vastgoed Beheer PG B.V has actually imposed a lot. And so again property management, so reducing your footprint has to do with that. But also that, for example, internal policy, that we were not allowed to work under the minimum label C, say, of energy label, we were allowed to neighbor until a few years ago.

Yes, we do indeed have to impose a lot of things on us from environmental services and the RVO about what we all have to do as a large consumer of energy. So we have to take a lot of that into account, also when renting new premises. We also include standard items or actually new items in the rental proposals and agreements.

So we have to take that into account. What did you say?

Arvind: Zoning plans. Yes. When we [00:05:00] rent something, we have to take into account, but sometimes we have to take into account safety from client to co-tenants. Yes

Claire: A GDPR is a very important, of course patient data, records and things like that.

So then you get that IT in buildings, for example, all run smoothly via a panache. We are never allowed to piggyback on, if you have a multitenant property, we are never allowed to piggyback on a general internet. We always have to have our own connections and our own cabling. It needs safety.

Arvind: Yes, if you make it bigger, we actually have a PVE, the program of Requirements, for all buildings.

It contains all the legal rules that we must comply with. And in our field of expertise, we stick to the legal fitting side, because it is generally determined with regard to the euro rules. And

Claire: You do get, you say PVE is correct, because we do indeed have a whole PVE per type of care, so clinically then [00:06:00] ambulatory, that also has to do with safety of course, visitors, clients, safety of the employees, for example soundproofing you have standards that you have to follow because they are confidential conversations, so we have to make extra adjustments and access to locations and spaces we also have to deal with.

I'm thinking what else. Well, I think it is. That's it

Joris Ghobrial: Yes. No, great. Do you use certain types of databases, software's or other tools within your operations? Yes.

Arvind: Yes, in principle we work by default. Our master data is recorded in a plan. This includes leases, but also buildings, energy connection, long-term care.

We record them in it. That's what we work with as standard. Then you have support programs that we work with. For financial housekeeping, we use SHP. Part of our [00:07:00] organization also uses Topdesk. ICT in my opinion. Yes, ICT does that. Then we also work Microsoft Power BI. And everything behind that, I don't think you should get standard programs.

Claire: ROZ is also for notifications, which is also very important.

Joris Ghobrial: Okay, great. Then I'll move on to the questions about the top 10 questions from property managers. I don't know if you've prepared that a bit yet, so to speak. Which top 10 questions have arisen for the Hoeklaan specifically? And what answers would you have?

Arvind: We really just had a call about that, also Claire and I called about, look, you actually have a lease agreement or a rental agreement and there you have demarcation and that demarcation is focused on that comfort from the general provision, there is because of different articles of course [00:08:00] who is responsible for what maintenance.

We always have internal discussions about this with our maintenance colleagues. They prefer, I call it very dryly, to ask for a cross list. But we say, the whole general provision arouses that. If they do have that legal knowledge, but then they do. They don't have that. So yes, that's really one of the biggest questions.

A demarcation in accordance with the general provisions, standard demarcation. That's question 1, I think.

Claire: What is included in the service charge is a very important one. So we then conclude rental agreements. In every standard MOZ rental agreement, you have article 5. It actually states what the supplies and services are that are provided by the landlord. For the tenant, that's what you pay

service costs for, and whether we're a tenant [00:09:00] or a landlord, that's well, yes, that list so to speak, is important for a lot of colleagues of ours, but also for us.

What actually happens, say, for a tenant or what does the landlord do for us and what do we have to arrange outside of Article 5 itself, so to speak?

Joris Ghobrial: So that's

Claire: Well, the heading of service costs there are a lot of questions about that, so I don't know, we can rephrase it a bit, but at least the subject, there is still a lot in it.

Yes

Joris Ghobrial: Okay, third question.

Claire: Third question, I'm thinking for a moment. We had a lot the other day. Yes

Joris Ghobrial: It's always difficult to come up with ten questions on the spot. Yes. So I don't know if it might be easier to email it, that's possible too.

Claire: No, I'm really thinking, you have a multi-year maintenance plan, we always make it for [00:10:00] The property locations.

Sometimes we also have a partial MIOP for large rental locations. Of course, that is a very future picture per year of what you need to do about your building. But in addition, we also have a strategic housing plan and we do indeed have the rental agreements. Yes, and sometimes it's the question of, doesn't that fit together, you know.

Then you think, we still rent this location there, or and we rent it out for another five years or so. But it's not until year three, or in year three, that you have to have it completely painted, so to speak. It's just that they're all different documents, so it would be nice if we had a bit more insight into how stealth and rental association comes to such a MIOP, so to speak.

There it would be coherence, yes, the coherence

Arvind: In between.

Joris Ghobrial: Ja,

Arvind: dus

Joris Ghobrial: Actually, you ask the MIOP when is this happening and then you ask the strategic [00:11:00] policy, oh when do you say this is happening and then you can see what the difference is and how you can get unity in that.

Arvind: I also have a very good one at the Hoeklaan.

We endured, of course, to the army there even. They are there 24 hours, 24-7. But we ourselves use part of the Hoeklaan as an office location. So what does that do to energy consumption? Or water consumption? But also in terms of, for example, depreciation periods of your installation. If you're only using it as an 8 to 5 office, then that installation will last longer than a 24 give location.

Joris Ghobrial: And, klopt.

Claire: And you basically pay the more expensive based on actual consumption. Just not every location, I don't know how many corner lanes have those intermediate meters. No, because we tried to install them, but they never worked. So then you don't have intermediate meters, so they use part

of the [00:12:00] building and so do we, but they have a different way of using, so at the opening hours as well, more intensive consumption.

So how can you, based on what they actually have, consumption of energy, how can you settle that in the settlement service costs?

Joris Ghobrial: Okay, me. Okay, top.

Claire: We have some now

Jarris Ghobrial: Vizoff.

Claire: Okay, then we're going in the right direction

Arvind: Top.

For example, could you also check the sustainability options in the chat tp?

Joris Ghobrial: Sustainability options, yes, he can get them from the internet, so to speak, whatever suits the building. But he could also look within the datasets to see which measures fit best. So I've looked at the energy document [00:13:00], there's a number of measures in there.

So he could recommend those, but he could also look externally.

Claire: Yes, because for example, when we rent a property, let's now draw up a quick scan and that consists of three parts, so architectural, installations and sustainability potential. Those scans take a lot of time, because we really have to go to people, record location, which also costs quite a lot of money.

So I think there is still room for improvement if you could actually do some kind of preliminary research yourself for some time. This is the location we have in mind to rent. What still needs to be done in the field of sustainability? So if something can be done with that, that would be very nice.

I have another question. It's more about notifications. I think I would also have included an overview of the reports that the employees at the [00:14:00] location actually do. I'm just thinking what a good formulation is. Yes, I'm thinking if you could do some kind of analysis of those reports.

Arvind: So notifications come back more often like that, right? Right

Claire: ja.

Arvind: That I can actually see the coherence of those reports as well. So, for example, if someone calls three or four times, but within a... Half a year, that we then say yes, it's not every time that door sounds breaks, maybe that whole door is crooked.

Joris Ghobrial: yes, yes, yes, that way.

Arvind: Yes, look, we have so to speak

Claire: a service desk and all our employees nationwide, but also clients, residents and tenants can make their reports there. Regarding the property where they work. And that goes from notifications to lights broken, to... It's not being cleaned properly, there's [00:15:00] a leak, well all those kinds of notifications and that then comes in at the service desk.

I think they get hundreds of reports a day. We have also asked them, can you do some kind of analysis of this, for this you get the same reports a number of times and each time it is picked up and turned off but no one makes the connection between them.

So we could do something with that as well.

Claire: yes, I think maybe a sort, yes, so for example if you make or have a printout of the overview of the reports from the past year, where are the most reports? I don't know if you can talk about satisfaction, but is it basically something wrong or is it just a different report every time?

But that would also help us a lot, let me put it that way. Because it often only reaches us. The moment it kind of escalates. Look, we don't see those reports. So, we [00:16:00] really need to get that from the help desk. And then we request it and then it's a weather where we get notifications.

A very large Excel file. And then I think, yes, I don't know where to start. While it also comes with an extension of a lease, you do want to know what is going on in such a building. And then you can talk to the landlord about it. And then you can say yes, we have continuously mentioned the air treatment system, so the climate is not pleasant.

And then you can have a conversation about that with such a landlord of we want the air treatment to be upgraded, because our people just have to work in a pleasant working climate. You see, so those notifications, that's really for us...

Arvind: That's also the output that we get, so how you got it, that we can put that in that chat GPT, for example, and make an analysis of these ten most common reports.

Joris Ghobrial: Yes, no, great, that's possible. I think I'm going to structure a large part of the data. For example, I have that, I think the [00:17:00] FB Excel document of all those notifications, but there's also a lot of names in there and All information that's not really relevant. I could structure that very easily. This message on this date is resolved in this way. Then he can read it very quickly.

Arvind: Mainly because of the recurring complaints.

Joris Ghobrial: he can analyse that. He can analyze that.

Then he reads everything together. This has happened thirty times, it has happened ten times in the last year. Then he could do that very quickly. But then it can be structured well. Okay. Question 8.

Arvind: New Top,

Joris Ghobrial: maybe

Arvind: Also a silly question for you.

You lingered for a moment, Claire.

Claire: Second.

Joris Ghobrial: Ja.

Claire: Is it doing better? Lake?

George Ghobrial: [00:18:00] yes, I hear you.

Claire: Did we have a service charge bill called from the Salvation Army?

Arvind: No, but I can still build it.

Arvind: I think we'll have to add that one. I think that's useful. Let's think... Because you have a rental agreement, so to speak.

They pay an advance service fee.

Just as a result of the settlement, we want to know whether the pre-spot is also sufficient for all the costs we have for such a property on the basis of article 5. Or am I making it too difficult now?

Joris Ghobrial: No, you can. Look, all the questions, as long as they're in the dataset that I've been given, or if they're in the legislation or externally, then it can all be answered.

In other words, whether the service costs are sufficient on the basis of Article 5. Yes. I have the lease, so that's [00:19:00] good. So you have

Claire: Article 5, you have the service fee that they pay. That's 4.6 off the top of my head. Or not, I'll have to take a look at that.

So you know what they pay, service costs, amount, you know say the delivery and service that we as a landlord have to perform so to speak and we then have a settlement, so that is based on actual consumption and to then look of the advance amount is still sufficient and is indeed it still, yes, at all, how do you say that, adequate,

Joris Ghobrial: ja.

But

Arvind: Also perhaps, what would ideally the lease agreement look like compared to the current one?

Joris Ghobrial: That's also one, so how would Ideally, repeat the question one more time?

Arvind: Yes, what would ideally the lease look like compared to the current one? For example, are we missing [00:20:00] articles?

Joris Ghobrial: Ja,

Claire: And then also on the basis of laws and regulations what has changed and indeed sustainability potential. It is often

following on, so we either have a property or a rental property which we then rent out or sublet. And in the end, it's all about us, while we forget a bit to also put things in the hands of the tenant or the subtenant, for example.

So we, as Pernassia Group, have to make investments in sustainability and then we don't really know how to put that on the tenant.

Arvind: Okay, a demarcation with respect to sustainable investing.

Joris Ghobrial: Okay, yes, I think that's a very good one. Excellent. I now have ten questions. So in the end, I'm going to make transcripts today or tomorrow.

And then I'll also send the questions to you again, how I'm going to formulate them in the ChatGPT. If you can also put a short answer underneath it, for example, we would approach it in this and this and this way. Then I can compare that to how the [00:21:00] ChatGPT answers. Then I can make a bit of a comparison that way.

I then move on to the questions about the expectations of a custom-made ChatGPT. So let's see, where do you feel the value of a self-made ChatGPT lies? This can be, for example, in speed, efficiency or, for example, automating tasks or other things, for example.

Arvind: Well, one is of course that speed, those analyses, but also quickly or efficiently indicating where, for example, the gap lies between what the idéalité de huurovereniging should look like, but how we may have set up. The gap in the demarcation as well, so what we may miss in the demarcation or what we have to tilt to landlord or tenant, so that it does not cost us money.

I think it relates to all the facets that you [00:22:00] are asking for speed, efficiency, but also actually kind of a control check. Check check too, okay.

Claire: Yes, and we are quite dependent on input from other colleagues as well. It's all very subdivided in us, so to speak. So, for example, I request such a multi-year maintenance plan from one person and such a notification overview from the other.

And with that you have again so you have to... Look, if at some point we know that this is the dataset that we need per building and you can then put that into such a chat-gpt, so to speak, then that will indeed work very efficiently, because you can then also work much faster for our outcomes.

Yes, we are now always dependent on others as well. That's a shame sometimes, so to speak. How can you actually unveil yourself with this?

Joris Ghobrial: Yes, well. Let me see. So, what would be the minimum a custom-built chat GPT could do for you? So where is the line really of this is still useful or this is of no use to us at all [00:23:00]?

Arvind: He seems to be saying that the minimum input, but it should give the input such as about the notifications. Well, if you let him read it like that, for example, and he makes an analysis of what comes out the fastest, that's the minimum. It's just actually the input that we... Put in LEACH and GPT, that they do make the analysis of what we need.

That's the minimum.

Claire: yes, and also, so to speak, the dataset that we have now, this is actually the maximum, I think, about what we can gather per property, pretty easily and quickly. So yes, you know, that you actually have to make the minimum effort just to get as much out of it as possible, that's of course also a good thing. And leases are often also legally oriented, so I think that's probably somewhere on the net. And that's what the JTPT does [00:24:00] get out of it. And can advise there in a kind of way.

Joris Ghobrial: Exactly. No, okay, great. And then I already have my last question. So, how do you see the integration of such a ChatGPT tool into your daily work?

You have just answered a little bit there, that you can just ask something like this right away and that you don't have to ask other parties for data all the time, because you get an answer right away.

Arvind: And.

Joris Ghobrial: That's kind of it.

Arvind: Just a check on yourself.

Joris Ghobrial: A check on yourself, check check, yes. Yes.

Claire: Also, yes. And of course, we work a lot with cooperation partners, so with a real estate consultant, with a party that analyzes and draws up the settlements, service costs, with a service test.

So we can also bring more to ourselves, because in the end the questions always end up with us. So I think that's going to help us a lot, let's put it that way.

Arvind: Yes, yes. I also think that we, we're going to use it mainly in a heavy aisle.

Joris Ghobrial: Yes. [00:25:00] No, that's good. Okay, great. Those were all my questions.

I'm going to do a transcript today, or tomorrow. And then you will indeed see it by e-mail tomorrow at the latest. And then with the summary of what the top 10 questions are. And then it should be fine.

Appendix G: Transcript B: Evaluation of the added value of a tailored ChatGPT

Transcript 2

Joris: [00:00:00] Based on the ChatGPT question, what do you think about understanding the questions and answering them?

Claire: As I mentioned earlier, it depends on how important the reliability is for each question. You can then determine if it's useful or not. There are a number of questions where indeed more definitions are looked up from the dataset, and it does that very well. And that's very useful. But when it comes to the service charge settlement or whether the proposal is still sufficient, those are important matters where you really need to achieve 100% value. So the question is whether it is useful or not. You might need to do an extra calculation yourself. But in general, I also find that it makes suggestions that I find quite good indeed. Sustainability and also all those articles you can include, and also coming up with solutions for proper billing without intermediate meters, I find it quite amusing to see that a ChatGPT can just come up with solutions or at least ideas on its own.

Arvind: But maybe you hadn't thought of yourself.

Claire: Yes.

Joris: Well, nice. Then on to the second. Can you compare the accuracy and relevance of the answers compared to the answers you would give yourself?

Arvind: Every time it came out around 80%, I would say. The fact that 80% means that ChatGPT thinks or does largely the same thing or gives the answer in line with what we have given. So that's quite surprising to me, very good. And also extra information.

Joris: Also

Arvind: extra information

Joris: yes, fine. Then the third are there specific questions or answers from the ChatGPT that you found very useful or not at all?

Claire: No, because I said those extra new articles, especially about, for example, splitting investments, it's really those cells that the ChatGPT does very well. And also such an overview with all the notifications, that's not something we can get through ourselves. I find it very nice that it quickly pulls out the top 10 notifications that many employees report on. Then you know that something is going on. So I find that a very useful addition. And the democracy?

Yes, the democracy. I didn't see very well if that matched entirely. 8% again? Yes, that's also very nice.

Joris: Okay, great. And were there things you thought were not at all?

Claire: Yes, I think with that strategic thing, but that's also the question of how you want to use it. So we have a strategy regarding the portfolio, whether you maintain it or not in the MJOP, and also the contracts. I think that's something you always have to analyze yourself and discuss.

Arvind: But I think it's too difficult for the Charging Committee to see the red thread and make the connection between those elements. So

Claire: it's also not all up to us. Look, an NDRP is not up to the property manager, it's up to another contract manager. Look, we now ask for that information, so we don't work with an NDRP ourselves. So it's more about putting it next to each other, like this is the idea, this is the direction we want to go, we want to sell on the plant or precisely demolish, what does an MWOB say about it and how do you make it fit in. I don't think it's very relevant to include that next time.

Joris: Okay, interesting. Great. Then the fourth. Are there any improvements to the results of the ChatGPT to better add to property management tasks?

Claire: Yes, you just said yourself that you had to rephrase the question a number of times.

Joris: Yes.

Claire: Yes, I think that ultimately if you ask the question once and get the input from a ChatGPT and you think, what is it? To what extent do you have time, or is it also a bit bad that you have to ask questions multiple times? That might be an improvement.

Joris: Yes, okay, interesting. Okay, then we move on to question five. How do you see the role of a tool like ChatGPT in the future of property management?

Arvind: That is definitely of added value as I see it.

Claire: Yes, definitely.

Arvind: And apart from the fact that it gives you out-of-the-box ideas, it also provides a kind of control over yourself, like hey, did I check that off?

Claire: Yes, I think it's a good control function because in principle we do everything ourselves now, or we have it carried out by another party, which you can very quickly actually use. And that is indeed just in time and efficiency, of course, that you can deal with certain things much faster. So I really like that.

Joris: Okay, great. And in what ways do you think a customized ChatGPT can bring change to workflows? That was a bit the same question as just now.

Claire: Yes, well, in terms of time, it certainly does, because many questions from colleagues come back repeatedly. Yes, at worst, if you have a new contract, you could actually already ask all those ChatGPT questions and then send the outcome to a colleague. But yes, I'm asking for that.

Arvind: Yes, yes. And it has... Well, there are constantly working loads. In any case, it reduces the workload for them, another workflow, but for us it still reduces the workflow, but especially for our

Joris: colleagues.

[00:07:00] Okay, that's a good one. And has the customized TRECETI met your expectations or not in answering the questions?

Arvind: I think partly yes, extra information, how it nevertheless provides the answers that are also in the contract or taken from the M.I.O.P. or from the notifications. What is still consistent and still the same as what we answer. Only more extensive because you get more information from the web, so to speak.

Claire: Because it also pulls from the internet

Arvind: right?

Claire: So yes, I find that very good because otherwise, you would have to do that yourself.

Joris: Yes.

Arvind: That

Joris: will always give you.

Arvind: Yes. And are there any fears or reservations about using AI in property management?

Claire: Yes, as I said earlier, we always deal with confidential and privacy-sensitive information as a care organization. And still, always a bit of fear, does the output match? But that's with any system you use. We also have a system plan. You enter it yourself, but you always hope that it is correctly entered. That also what comes out of the data is correct. So that

Arvind: remains

Claire: always with technology.

Joris: Yes, that's right. Then question 9. How do you foresee the balance between using these tools and yourselves in the future? You actually just mentioned that. Maybe we can skip that one. Then the last one. Would you use this yourself in the future? [00:09:00] Yes, why not? I see it as added value.

Claire: Certainly. Maybe not all ten questions, but certainly six.

Joris: Okay

Claire: that

Joris: is good to hear. Then we move on to the questionnaire, and I can actually fill it in right away, which you can also mail a bit. Yes, Taylor GPT or ChatGPT understood the property management questions, I don't know what you think of that?

Arvind: Yes, mostly. Yes, mostly. So

Joris: a 5. The responses provided by the Taylor ChatGPT are clear and helpful.

Fear. The Taylor ChatGPT performs [00:10:00] comparably to human property management experts in responding to queries.

Arvind: That's difficult, not the way we respond. I tend to be neutral.

Claire: Yes, me too, because it is still...

Arvind: on you.

Claire: You always deal with those repeat questions, of course. And at the front, you also spend a lot of time on those daily ones. Yes, yes.

Arvind: And as a human, there are still more decisions about where you want to go with your portfolio, and you can't convey that to ChatGPT.

Joris: Yes, so neutral. Then the fourth, Theta ChatGPT can handle complex project management questions.

Claire: No, not complex, I don't think so.

Joris: Then we are at one or two. Yes. Let's see. Then we do 1. The use of the Taylor ChatGPT improves the workflow of the property management tasks?

Claire: Yes. 3.

Joris: The Taylor ChatGPT provides valuable support in property management? Why not?

Claire: Yes, I think 5.

Joris: 5 yes. The Taylor Chat GPT exceeded my expectations.

Arvind: 4-3?

Joris: 4-3? No, 4-2. Or would you click 3?

Claire: No, 4.

Joris: Okay, if there are things you want to add, you don't have to. Okay, then we move on. I trust the answers that the Taylor ChatGPT has given and find them applicable. [00:12:00]

Arvind: That

Joris: is difficult.

Arvind: Yes, yes, yes. We are both, say for my civil friend Claire, that we both double-check.

Claire: Yes, you are also a bit skeptical. That's it because you have your answer next to it. Do you understand?

Arvind: Yes.

Claire: Look, if you hadn't made the answers yourself first, then you only have the answers from the ChatGPT. Yes, and how complete is that? Look now you've checked it, and it's complete. So you...

Arvind: Yes.

Claire: Yes, I read that.

Arvind: But that also takes time, I think. Yes. Experience and time, and then you can trust it more.

Claire: And then it's ultimately up to us to see which questions you will then ask via TFT and then

Arvind: go

Claire: to do a thumbs up. And if you are sure that certain questions are fine, yes, then you can indeed trust that the answers will be correct. So

Arvind: but it also requires

Claire: some development, that's it.

Arvind: It can be agreed, but it can also be disagreed, so it depends on how you mean the question.

Joris: I'll put it on neutral. Yes, is it about the dataset or about future use?

Arvind: I think it's about future use. But I think, as you just mentioned, it really depends on how you are going to use it. Then question nine. I would recommend the use of a tailored ChatGPT to other professionals in property management.

Yes, four. Four? Yes. And then we have the last one. This was then a kind of table. [00:14:00] I am now going to measure the performance on three aspects that you indicated in the previous interview were important. The speed, the accuracy, and the reliability. The idea was that I would give a score on that. Or we would give a score on that and then I can note that in this matrix. So let's start with speed.

Arvind: And then you mean the speed of the answers?

Joris: Yes.

Arvind: And the speed was good with everything, right? Within 1 and 5 minutes, right?

Joris: Yes, that's right.

Arvind: Yes, that seems good to me.

Joris: So between 7-8 or 9-10?

Claire: Yes, I think

Arvind: so too. In all cases.

Joris: Then [00:15:00] we move on. Until we are googling for half an hour.

Joris: Yes, that's true. The accuracy. I don't know if it's useful if I now pull up the table I just had. Then you can see that again. The accuracy percentages and the... Yes, I would fill it in based on that.

Would I fill it in based on that? Okay, based on the table. I can do that then. And what do you think about the reliability of the answers? For example, question 2, there was 100% similarity. But with another question, it was completely deviated. I

Arvind: will also fill it in

Joris: based on that.

Arvind: I will do that.

Joris: Yes, table ANR. Fine. No, great. Then we have covered everything. Then I will fill this in based on the table if you agree with that. And then the first version is almost complete, then we are also done for today.

Claire: Okay, nice.

Joris: Yes, you are there. No, great. I'm also curious. Do you have any questions for me?

Claire: No, I don't know what you expect from us.

Joris: Actually nothing, just the consent form from Theo Delft. And maybe my supervisor will want to send another consent or human research ethics form. But that probably won't come until two or

three weeks later. And then it will probably be stated in that email whether I can use the name of Vastgoed Beheer PG B.V in my final document. And that sort of thing. [00:17:00]

Arvind: Yes

Joris: that was it. But otherwise, it's all good.

Claire: I would always stick with PG WT here. From the real estate entity, right? Arjen, I think.

Arvind: Yes, that is true. But it is part of financial groups.

Claire: Yes, but in terms of formality. Yes.

Joris: Okay. No, great. Then we're done.

Claire: Okay, super. Great.

Joris: Hey, thank you.

Claire: Bye.

Joris: Bye.

Appendix H: Delft University of Technology, HUMAN RESEARCH ETHICS CHECKLIST.

I. Applicant Information

PROJECT TITLE:	Evaluation of the added value of a tailored ChatGPT for CREM specialists <i>“Exploring the Role of ChatGPT in property management”</i>
Research period: <i>Over what period of time will this specific part of the research take place</i>	01/02/2024 – 28/06/2024
Faculty:	TU Delft Faculty of Architecture & the Built Environment
Department:	Management in the built environment (MBE)
Type of the research project: <i>(Bachelor’s, Master’s, DreamTeam, PhD, PostDoc, Senior Researcher, Organisational etc.)</i>	Master’s
Funder of research: <i>(EU, NWO, TUD, other – in which case please elaborate)</i>	N.A.
Name of Corresponding Researcher: <i>(If different from the Responsible Researcher)</i>	N.A.
E-mail Corresponding Researcher: <i>(If different from the Responsible Researcher)</i>	N.A.
Position of Corresponding Researcher: <i>(Masters, DreamTeam, PhD, PostDoc, Assistant/ Associate/ Full Professor)</i>	N.A.
Name of Responsible Researcher: <i>Note: all student work must have a named Responsible Researcher to approve, sign and submit this application</i>	H.J.M. Vande Putte
E-mail of Responsible Researcher: <i>Please ensure that an institutional email address (no Gmail, Yahoo, etc.) is used for all project documentation/ communications including Informed Consent materials</i>	H.J.M.VandePutte@tudelft.nl
Position of Responsible Researcher : <i>(PhD, PostDoc, Associate/ Assistant/ Full Professor)</i>	Full Professor

II. Research Overview

NOTE: You can find more guidance on completing this checklist [here](#)

a) Please summarise your research very briefly (100-200 words)

What are you looking into, who is involved, how many participants there will be, how they will be recruited and what are they expected to do?

Add your text here – (please avoid jargon and abbreviations)

Corporate Real Estate Management (CREM) professionals face diverse challenges, from space optimization to financial decision-making, in their field. The potential of emerging AI technologies, such as ChatGPT, remains underexplored in this context. This research seeks to address this knowledge gap by examining whether a tailored ChatGPT can significantly enhance the capabilities of CREM professionals with a focus on property managers. The central question revolves around ChatGPT's utility within Property management, aiming to answer the fundamental question: “What is the added value of a tailored ChatGPT for professionals in Property Management for Corporate Buildings?” A mixed-method approach,

combining qualitative and quantitative methods, is employed. This approach encompasses in-depth interviews, thematic analysis, and surveys to assess ChatGPT's performance. The research objectives encompass evaluating ChatGPT's performance compared to human experts and gauging its added value. The anticipated outcomes include a comprehensive research findings report, quantitative and qualitative datasets, and a tailored ChatGPT for property managers. This research aspires to understand the potential role of a tailored ChatGPT in CREM and providing insights to policymakers and technologists regarding AI's potential in shaping the future of CREM.

- b) **If your application is an additional project** related to an existing approved HREC submission, please provide a brief explanation including the existing relevant HREC submission number/s.

Add your text here – (please avoid jargon and abbreviations)

N.A.

- c) **If your application is a simple extension of, or amendment to,** an existing approved HREC submission, you can simply submit an [HREC Amendment Form](#) as a submission through LabServant.

Add your text here – (please avoid jargon and abbreviations)

N.A.

III. Risk Assessment and Mitigation Plan

NOTE: You can find more guidance on completing this checklist [here](#)

Please complete the following table in full for all points to which your answer is “yes”. Bear in mind that the vast majority of projects involving human participants as Research Subjects also involve the collection of **Personally Identifiable Information (PII)** and/or **Personally Identifiable Research Data (PIRD)** which may pose potential risks to participants as detailed in Section G: Data Processing and Privacy below.

To ensure alignment between your risk assessment, data management and what you agree with your Research Subjects you can use the last two columns in the table below to refer to specific points in your Data Management Plan (DMP) and Informed Consent Form (ICF) – **but this is not compulsory**.

It’s worth noting that **you’re much more likely to need to resubmit your application if you neglect to identify potential risks**, than if you identify a potential risk and demonstrate how you will mitigate it. If necessary, the HREC will always work with you and colleagues in the Privacy Team and Data Management Services to see how, if at all possible, your research can be conducted.

			<i>If YES please complete the Risk Assessment and Mitigation Plan columns below.</i>		<i>Please provide the relevant reference #</i>	
ISSUE	Yes	No	RISK ASSESSMENT – what risks could arise? <i>Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!</i>	MITIGATION PLAN – what mitigating steps will you take? <i>Please ensure that you summarise what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.</i>	DMP	ICF
A: Partners and collaboration						
1. Will the research be carried out in collaboration with additional organisational partners such as: <ul style="list-style-type: none"> One or more collaborating research and/or commercial organisations Either a research, or a work experience internship provider¹ <i>¹ If yes, please include the graduation agreement in this application</i>	X		Data Privacy and Security Ethical Implications, use of AI	Secure one drive Foster clear communication and rules	Q33	
2. Is this research dependent on a Data Transfer or Processing Agreement with a collaborating partner or third party supplier? <i>If yes please provide a copy of the signed DTA/DPA</i>		x				
3. Has this research been approved by another (external) research ethics committee (e.g.: HREC and/or MREC/METC)? <i>If yes, please provide a copy of the approval (if possible) and summarise any key points in your Risk Management section below</i>		X				
B: Location						
4. Will the research take place in a country or countries, other than the		X				

			<i>If YES please complete the Risk Assessment and Mitigation Plan columns below.</i>		<i>Please provide the relevant reference #</i>	
ISSUE	Yes	No	RISK ASSESSMENT – what risks could arise? <i>Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!</i>	MITIGATION PLAN – what mitigating steps will you take? <i>Please ensure that you summarise what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.</i>	DMP	ICF
Netherlands, within the EU?						
5. Will the research take place in a country or countries outside the EU?		X				
6. Will the research take place in a place/region or of higher risk – including known dangerous locations (in any country) or locations with non-democratic regimes?		X				
C: Participants						
7. Will the study involve participants who may be vulnerable and possibly (legally) unable to give informed consent? (e.g., children below the legal age for giving consent, people with learning difficulties, people living in care or nursing homes,).		X				
8. Will the study involve participants who may be vulnerable under specific circumstances and in specific contexts, such as victims and witnesses of violence, including domestic violence; sex workers; members of minority groups, refugees, irregular migrants or dissidents?		X				
9. Are the participants, outside the context of the research, in a dependent or subordinate position to the investigator (such as own children, own students or employees of either TU Delft and/or a collaborating partner organisation)? <i>It is essential that you safeguard against possible adverse consequences of this situation (such as allowing a student's failure to participate to your satisfaction to affect your evaluation of their coursework).</i>		X				
10. Is there a high possibility of re-identification for your participants? (e.g., do they have a very specialist job of which there are only a small number in a given country, are they members of a small community, or employees from a partner company collaborating in the research? Or are they one of only a handful of (expert) participants in the study?		X				
D: Recruiting Participants						
11. Will your participants be recruited through your own, professional, channels such as conference attendance lists, or through specific network/s such as self-help groups		X				
12. Will the participants be recruited or accessed in the longer term by a (legal or customary) gatekeeper? (e.g., an adult professional working with children; a community leader or family member who has this customary role – within or outside the EU; the data producer of a long-term cohort study)		X				
13. Will you be recruiting your participants through a crowd-sourcing service		X				

			<i>If YES please complete the Risk Assessment and Mitigation Plan columns below.</i>		<i>Please provide the relevant reference #</i>	
ISSUE	Yes	No	RISK ASSESSMENT – what risks could arise? <i>Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!</i>	MITIGATION PLAN – what mitigating steps will you take? <i>Please ensure that you summarise what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.</i>	DMP	ICF
and/or involve a third party data-gathering service, such as a survey platform?						
14. Will you be offering any financial, or other, remuneration to participants, and might this induce or bias participation?		X				
E: Subject Matter <i>Research related to medical questions/health may require special attention. See also the website of the CCMO before contacting the HREC.</i>						
15. Will your research involve any of the following: <ul style="list-style-type: none"> • Medical research and/or clinical trials • Invasive sampling and/or medical imaging • Medical and <i>In Vitro Diagnostic Medical Devices</i> Research 		X				
16. Will drugs, placebos, or other substances (e.g., drinks, foods, food or drink constituents, dietary supplements) be administered to the study participants? <i>If yes see here to determine whether medical ethical approval is required</i>		X				
17. Will blood or tissue samples be obtained from participants? <i>If yes see here to determine whether medical ethical approval is required</i>		X				
18. Does the study risk causing psychological stress or anxiety beyond that normally encountered by the participants in their life outside research?		X				
19. Will the study involve discussion of personal sensitive data which could put participants at increased legal, financial, reputational, security or other risk? (e.g., financial data, location data, data relating to children or other vulnerable groups) <i>Definitions of sensitive personal data, and special cases are provided on the TUD Privacy Team website.</i>	x		I have names from my interview participants and their surveys.	Anonymize all personal info	Q8	
20. Will the study involve disclosing commercially or professionally sensitive, or confidential information? (e.g., relating to decision-making processes or business strategies which might, for example, be of interest to competitors)	X		Interest can arise in using AI-tools like ChatGPT within management practices	N.A.	N.A.	
21. Has your study been identified by the TU Delft Privacy Team as requiring a Data Processing Impact Assessment (DPIA)? <i>If yes please attach the advice/approval from the Privacy Team to this application</i>		X				
22. Does your research investigate causes or areas of conflict? <i>If yes please confirm that your fieldwork has been discussed with the appropriate safety/security advisors and approved by your Department/Faculty.</i>		X				
23. Does your research involve observing illegal activities or data processed or provided by authorities responsible for preventing, investigating, detecting or		X				

			<i>If YES please complete the Risk Assessment and Mitigation Plan columns below.</i>		<i>Please provide the relevant reference #</i>	
ISSUE	Yes	No	RISK ASSESSMENT – what risks could arise? <i>Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!</i>	MITIGATION PLAN – what mitigating steps will you take? <i>Please ensure that you summarise what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.</i>	DMP	ICF
prosecuting criminal offences <i>If so please confirm that your work has been discussed with the appropriate legal advisors and approved by your Department/Faculty.</i>						
F: Research Methods						
24. Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g., covert observation of people in non-public places).		X				
25. Will the study involve actively deceiving the participants? (For example, will participants be deliberately falsely informed, will information be withheld from them or will they be misled in such a way that they are likely to object or show unease when debriefed about the study).		X				
26. Is pain or more than mild discomfort likely to result from the study? And/or could your research activity cause an accident involving (non-) participants?		X				
27. Will the experiment involve the use of devices that are not 'CE' certified? <i>Only, if 'yes': continue with the following questions:</i>		X				
• Was the device built in-house?		X				
• Was it inspected by a safety expert at TU Delft?		X				
<i>If yes, please provide a signed device report</i>						
• If it was not built in-house and not CE-certified, was it inspected by some other, qualified authority in safety and approved? <i>If yes, please provide records of the inspection</i>		X				
28. Will your research involve face-to-face encounters with your participants and if so how will you assess and address Covid considerations?		X				
29. Will your research involve either : a) "big data", combined datasets, new data-gathering or new data-merging techniques which might lead to re-identification of your participants and/or b) artificial intelligence or algorithm training where, for example biased datasets could lead to biased outcomes?	a)x	b) x	Dataleak of personal info	Anonymization of all given data	Q3	
G: Data Processing and Privacy						
30. Will the research involve collecting, processing and/or storing any directly identifiable PII (Personally Identifiable Information) including name or email address that will be used for administrative purposes only? (eg: obtaining Informed Consent or disbursing remuneration)	x		Name and email of the participants	Anonymize and delete		

			<i>If YES please complete the Risk Assessment and Mitigation Plan columns below.</i>		<i>Please provide the relevant reference #</i>	
ISSUE	Yes	No	RISK ASSESSMENT – what risks could arise? <i>Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!</i>	MITIGATION PLAN – what mitigating steps will you take? <i>Please ensure that you summarise what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.</i>	DMP	ICF
31. Will the research involve collecting, processing and/or storing any directly or indirectly identifiable PIRD (Personally Identifiable Research Data) including videos, pictures, IP address, gender, age etc and what other Personal Research Data (including personal or professional views) will you be collecting?	X		Surveys from the practitioners	Anonymize	Q3	
32. Will this research involve collecting data from the internet, social media and/or publicly available datasets which have been originally contributed by human participants		x				
33. Will your research findings be published in one or more forms in the public domain, as e.g., Masters thesis, journal publication, conference presentation or wider public dissemination?	x		Master thesis	Anonymize and delete personal data	N/A	
34. Will your research data be archived for re-use and/or teaching in an open, private or semi-open archive?		X				

H: More on Informed Consent and Data Management

NOTE: You can find guidance and templates for preparing your Informed Consent materials [here](#)

Your research involves human participants as Research Subjects if you are recruiting them or actively involving or influencing, manipulating or directing them in any way in your research activities. This means you must seek informed consent and agree/ implement appropriate safeguards regardless of whether you are collecting any PIRD.

Where you are also collecting PIRD, and using Informed Consent as the legal basis for your research, you need to also make sure that your IC materials are clear on any related risks and the mitigating measures you will take – including through responsible data management.

Got a comment on this checklist or the HREC process? You can leave your comments [here](#)

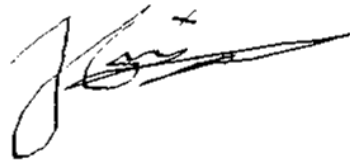
III. Signature/s

Please note that by signing this checklist list as the sole, or Responsible, researcher you are providing approval of the completeness and quality of the submission, as well as confirming alignment between GDPR, Data Management and Informed Consent requirements.

Name of Corresponding Researcher (if different from the Responsible Researcher) (print)

Joris Ghobrial

Signature of Corresponding Researcher:



Date: 22/01/2024

Name of Responsible Researcher (if different from the Responsible Researcher) (print)

Signature of Responsible Researcher:



Date:

Appendix I: Data management plan

Plan Overview

A Data Management Plan created using DMPonline

Title: Evaluation of the added value of a tailored ChatGPT for CREM specialists Exploring the Role of ChatGPT in property management

Creator: Joris Ghobrial

Affiliation: Delft University of Technology

Template: TU Delft Data Management Plan template (2021)

Project abstract:

Corporate Real Estate Management (CREM) professionals face diverse challenges, from space optimization to financial decision-making, in their field. The potential of emerging AI technologies, such as ChatGPT, remains underexplored in this context. This research seeks to address this knowledge gap by examining whether a tailored ChatGPT can significantly enhance the capabilities of CREM professionals with a focus on property managers. The central question revolves around ChatGPT's utility within Property management, aiming to answer the fundamental question: *“What is the added value of a tailored ChatGPT for professionals in Property Management for Corporate Buildings?”* A mixed-method approach, combining qualitative and quantitative methods, is employed. This approach encompasses in-depth interviews, thematic analysis, and surveys to assess ChatGPT's performance. The research objectives encompass evaluating ChatGPT's performance compared to human experts and gauging its added value. The anticipated outcomes include a comprehensive research findings report, quantitative and qualitative datasets, and a tailored ChatGPT for property managers. This research aspires to understand the potential role of a tailored ChatGPT in CREM and providing insights to policymakers and technologists regarding AI's potential in shaping the future of CREM.

ID: 141471

Start date: 01-02-2024

End date: 30-06-2024

Last modified: 03-06-2024

Evaluation of the added value of a tailored ChatGPT for CREM specialists Exploring the Role of ChatGPT in property management

0. Administrative questions

1. Name of data management support staff consulted during the preparation of this plan.

The data and DMP for this project has been discussed with my supervisor, Herman van Putten. My faculty data steward, Janine Strandberg, has reviewed this DMP on 31/05/2024.

2. Date of consultation with support staff.

2024-05-31

I. Data description and collection or re-use of existing data

3. Provide a general description of the type of data you will be working with, including any re-used data:

Type of data	File format(s)	How will data be collected (for re-used data: source and terms of use)?	Purpose of processing	Storage location	Who will have access to the data
1:Personally Identifiable Research Data (PIRD): Audio-recordings of interviews with 2 property managers	mp4,	Interviews with experts recruited by the graduation company are conducted online. Audio-recordings are made on an external	Obtain the top 10 most common property management questions + answers from property managers	One drive	The researcher
		device (Ipad), before being moved to onedrive.		+ Ipad	Herman van de Putten
		Recordings are deleted after transcription.			Michael Peeters
1.1Personally Identifiable Information (PII): participants' name and email	mp4, docx	Contact information for participants taking part in	For administrative purposes:	One drive	Same as above
		interviews, received from participant sign-		+ Ipad	

		ups,		obtaining informed		
		Informed consent forms are signed digitally and		consent and		
		contain participants' name + email		communicating		
				with participants		
1.2: transcriptions of interviews	.docx	transcriptions created manually based on	No Privacy-preserving	One drive	Same as above	
		audio-recordings.		data on the Property		
		Participants are asked to review the transcriptions of		from participants		
		their interview before the transcript is finalised.				
2: Screenshots of the interview with ChatGPT are documented and listed within the thesis document	.jpg, .docx	Interviews with ChatGPT are conducted online. All the conversations are screenshotted and monitored within the thesis document.	Compare and evaluate performance of a tailored GPT in answering property related questions	One drive	Same as above	
3: Personally Identifiable Research Data (PIRD): Audio-	mp4,	Interviews with experts recruited by the graduation company are	Evaluate the performance of a tailored GPT in answering	One drive	Same as above	

recordings of		conducted online. Audio-recordings are made on an external	property related questions	+ Ipad	
interviews with					
2 property managers		device (Ipad), before being moved to onedrive.			
		Recordings are deleted after transcription.			
3.1 Personally Identifiable Information (PII): participants' name and email	mp4, docx	Contact information for participants taking part in	For administrative	One drive	Same as above
			purposes:	+ Ipad	
		interviews, received from participant sign-ups,	obtaining informed		
		Informed consent forms are signed digitally and	consent and		
		contain participants' name + email	communicating		
			with participants		
3.3: transcriptions of	.docx	transcriptions created manually based on	No Privacy-preserving	One drive	Same as above
interviews		audio-recordings.	data on the Property		

		Participants are asked to review the transcriptions of	from participants		
		their interview before the transcript is finalised.			
4: Survey data: on tailored GPT performance evaluation	.docx	Survey with experts are conducted online. They are collected on the spot and moved directly to the onedrive. (not anonymous)	Measure the performance of a tailored GPT in answering property related questions	One drive	Same as above
Third party: Case Datasets obtained through mail with the 2 property managers of the graduation company. This data is owned by the graduation company and is anonymized with the oversight of the graduation company. The usage of data is freely under oversight:	.pdf	Data obtained through mail with the 2 property managers of the graduation company. This data is owned by the graduation company and is anonymized accordingly and send to the graduation company as final administrator and validator. The data will be deleted after 01/07/2024 and a notification send to the graduation company	Used as knowledge base for the tailored GPT, in order to give it the same use-documents as the property managers	On personal laptop	The researcher
Floorplans	.xml				
Property Overview	.jpg				
Utility Overviews and Invoices					
Lease agreements					
Maintenance Records					

Multi year plan

Service charge
settlement

Budgeting
documentation

Portfolio
Information

Energy
documentation

Demarcation
document

Cadastral map

Sustainability vision
and housing
strategy

Report/thesis	.pdf	Serves as record of the process as well as	Long-term documentation	One drive	Same as above
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documentation

4. How much data storage will you require during the project lifetime?

- 250 GB - 5 TB

II. Documentation and data quality

5. What documentation will accompany data?

- Methodology of data collection

PLEASE TICK THE APPROPRIATE BOXES

Yes No

A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION

1. I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have

been answered to my satisfaction.

2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

3. I understand that taking part in the study involves: *[see points below]*

- *an audio-recorded interview, or a survey questionnaire*
- *The audio is recorded with a cellular device*
- *The questionnaires, will be completed by the participant*
- *For audio recording the speech will be transcribed as text*

5. I understand that the study will end [05/04/2024]

B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)

6. I understand that taking part in the study involves the following risks *Data Privacy and Security, Ethical Implications, use of AI, Dependence on AI, Accuracy and reliability*. I understand that these will be mitigated by *Secure project drive, clear communication and rules, disclosure clause*

7. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach. *My personal data will be retained only for as long as necessary for the research project, and then deleted or destroyed in a secure manner.*

C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION

8. I understand that after the research study the de-identified information I provide will be used for *[see points below]*

- *TU Delft repository, Master thesis*

9. I agree that my responses, views or other input can be quoted anonymously in research outputs

D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE

10. I give permission for the de-identified data that I provide to be archived in *[Project drive]* repository so it can be used for future research and learning.

11. I understand that access to this repository is *[accessible only to the researcher]* until [06/30/2024]

Interviewer: Joris Ghobrial

Participant: (NAME)

Date: (XX/XX/XXXX)

This thesis investigates the use of a tailored ChatGPT for Corporate Real Estate Management, specifically in property management. It examines how AI can enhance CREM professionals' practices, focusing on assessing and comparing the tailored ChatGPT's performance with that of human experts, and evaluating its added value to the sector.

The purpose of this interview is to gather subjective perspectives from Property Management professionals on the performance of the tailored ChatGPT. This insight is crucial for a comprehensive evaluation of the tailored GPT's utility, especially in highlighting how it aligns with the practical needs and challenges in Property Management.

Before we start, I need to read out your rights for this interview regarding consent and audio recording.

Consent text for Participation:

I, [Participant's Name], understand the purpose of this interview and agree to voluntarily participate in this academic research study. I am aware that the interview will be audio-recorded for data analysis and will be kept confidential. My name and personal details will be anonymized, and I understand that I can stop the recording or leave the interview at any time.

Audio Recording Consent:

I consent to the audio recording of this interview for research purposes. I understand that the recorded content may be transcribed, analyzed, and potentially published within TU Delft, ensuring my anonymity.

Interview Process:

- The interview will last approximately 20 minutes.
- You may choose not to answer any specific questions or end the interview at any time without consequences.
- If you have questions about the interview process, please feel free to ask before we begin.

Confidentiality:

Your privacy and confidentiality will be strictly maintained throughout this study. Personal information will be protected, and any shared data will be used solely for academic research purposes.

Participant's Agreement:

I have read and understood this consent form, and I willingly agree to participate in this interview. I acknowledge that I can withdraw my consent at any time during the interview without consequences.

Participant's Signature: _____

Date: _____

Interviewer's Signature: _____

Date: _____

Thank you for participating in this academic research. Your insights are invaluable for our study on the role of ChatGPT in property management.

Questions about Property Management:

1.

Can you provide a brief overview of what property management entails and its significance in real estate management?

2.

What are the primary tasks and responsibilities of a property manager in their daily work?

3.

Could you explain the key regulations and legal aspects that property managers need to be aware of in their profession?

4.

What types of databases, software, or tools are commonly used in property management for organizing and tracking property-related information?

5.

How has technology and automation impacted the field of property management, and what changes have you observed over the years?

Common Questions Faced by Property Management Experts:

6.

In your experience, what would you say are the 10 most common questions that property managers face within their day to day work.

(Write down questions)

For the next part, I will go through the 10 questions you just gave, and look at how you would address or respond to them. This way I will be able to compare your answers with those generated by a tailored GPT.

a.

So how would you address question 1,2,3...?

7.

Can you provide examples of challenging or recurring issues that property managers often need to address?

8.

What are the skills required when handling inquiries and issues from property owners and tenants?

9.

Are there any trends or emerging topics in property management that have led to new types of questions or challenges?

Expectations from a Tailored ChatGPT:

10.

In your opinion, what specific questions or tasks should a tailored ChatGPT be able to answer or assist with in the field of property management?

11.

Where do you feel where the value lies o a tailored GPT, this can be e.g. in speed, efficiency or just task automation?

12.

What are your expectations regarding the ChatGPT's ability to assist you

13.

What would you expect of the minimum tasks a tailored GPT should do.

14.

How do you envision the integration of a ChatGPT into your existing property management software or tools, if applicable?

Questions on the Tailored ChatGPT's Performance:

Before we begin I want to give you a list of the ten most common property management questions and the responses given by the tailored GPT. *(Give transcript)*

1. Based on the responses of the tailored ChatGPT, how does it perform in understanding and responding to common property management queries?
2. Can you compare the accuracy and relevance of responses from the tailored ChatGPT with those typically provided by human property managers?
3. Are there specific scenarios or tasks where you found the tailored ChatGPT particularly helpful or ineffective?
4. How do you evaluate the tailored ChatGPT's ability to handle complex or unexpected property management situations?
5. What improvements or additional features would you suggest for the tailored ChatGPT to better serve in property management?

Perceptions and Expectations:

6. How do you perceive the role of AI like ChatGPT in the future of property management?
7. In what ways do you think a tailored ChatGPT could change the workflow or operations in property management?
8. Did the tailored GPT meet your expectations, of its ability in handling property management related inquiries?
9. Do you have any concerns or reservations about relying on AI for property management tasks?

Reflections on AI in Property Management:

10. How do you foresee the balance between AI tools and human expertise in the future of property management?
11. Would you use a tailored GPT for you future work

III. Storage and backup during research process

6. Where will the data (and code, if applicable) be stored and backed-up during the project lifetime?

- Another storage system - please explain below, including provided security measures
- OneDrive

I have used a onedrive to store all the textual documentation.

OneDrive: Primary research data storage. Only me and my supervisors have access. Survey and

IV. Legal and ethical requirements, codes of conduct

7. Does your research involve human subjects or 3rd party datasets collected from human participants?

- Yes

8A. Will you work with personal data? (information about an identified or identifiable natural person)

If you are not sure which option to select, first ask your [Faculty Data Steward](#) for advice. You can also check with the [privacy website](#) . If you would like to contact the privacy team: privacy-tud@tudelft.nl, please bring your DMP.

- Yes

Within the given datasets, there will be names, addresses, date of births, scans of passports, and signatures. Everything will be anonymized. and only data regarding property management aspects will be used, while all personal data will be deleted or anonymized in order to comply with ethics and ethical use of AI.

8B. Will you work with any other types of confidential or classified data or code as listed below? (tick all that apply)

If you are not sure which option to select, ask your [Faculty Data Steward](#) for advice.

- Yes, confidential data received from commercial, or other external partners

Agreed with the graduation company is that the data will not be shared but can be used freely by the researcher. The data includes:

Datasets:

- Floorplans
- Property Overview
- Utility Overviews and Invoices
- Lease agreements

- Maintenance Records
- Multi year plan
- Service charge settlement
- Budgeting documentation
- Portfolio Information
- Energy documentation
- Demarcation document
- Cadastral map
- Sustainability vision and housing strategy

9. How will ownership of the data and intellectual property rights to the data be managed?

For projects involving commercially-sensitive research or research involving third parties, seek advice of your [Faculty Contract Manager](#) when answering this question. If this is not the case, you can use the example below.

1. Ownership of Data:

- **Interviews and Surveys:** I will obtain the data collected from interviews and surveys. However, the consent forms will specify how this data will be used. Ownership is in the hands of the graduation company. However after in agreement with the graduation company the data will be open for publication
- **Third-Party Building Datasets:** Ownership here lies with the third party providing the data.
- **Research rapport and Methodology:** Ownership lies with the student providing the research, open acces is granted.

2. Access Conditions to Data:

- **Interviews and Surveys:** Access is granted
- **Third-Party Building Datasets:** Access can only be given by the graduation company as they are owners of the data. These conditions of accesing the given datasets can only be done in agreement by the third-party.
- **Research rapport and Methodology:** Open acces is granted

3. Intellectual Property Rights (IPR):

- **Interviews and Surveys:** IPR from interviews and surveys, will belong to the participants of the garduation company.
- **Third-Party Building Datasets:** IPRs will be owned by the participants/third party.
- **Research rapport and Methodology:** IPRs will be owned exclusively to the student

4. Restrictions on Re-use:

- The third party providing the building datasets and interviews and survey has restrictions on the re-use of their data. I will adhere to any terms to avoid legal and ethical issues. The given data will not be published or re-used
- The research rapport and Methodology documentation, can be re-used.

10. Which personal data will you process? Tick all that apply

- Signed consent forms
- Gender, date of birth and/or age
- Copies of passports or other identity documents
- Citizen Service Number (BSN)
- Financial information, such as bank account numbers
- Email addresses and/or other addresses for digital communication
- Telephone numbers
- Names and addresses

there is a difference in processed data (actually worked with) and obtained data given within the datasets (raw data and therefore partially deleted or anonymized):

Processed data:

Financial information, such as bank account numbers

Signed consent forms

Data collected in Informed Consent form (names and email addresses)

Obtained data:

Names (anonymized) addresses (deleted) Telephone numbers (deleted) Email addresses and/or other addresses for digital communication (deleted)

Citizen Service Number (BSN) (deleted)

Copies of passports or other identity documents (deleted)

Gender, date of birth and/or age (deleted)

11. Please list the categories of data subjects

The interview and survey participants are the same and are 2 property manager experts chosen by the graduation company. They manage the given building case/property given to the researcher. They are located in Zoetermeer, the Netherlands.

12. Will you be sharing personal data with individuals/organisations outside of the EEA (European Economic Area)?

- No

15. What is the legal ground for personal data processing?

- Informed consent

16. Please describe the informed consent procedure you will follow:

All study participants will be asked for their written consent for taking part in the study and for data processing before the start of the interview. This is done for for before every interview, survey and obtaining the data.

17. Where will you store the signed consent forms?

- Same storage solutions as explained in question 6

18. Does the processing of the personal data result in a high risk to the data subjects?

If the processing of the personal data results in a high risk to the data subjects, it is required to perform a [Data Protection Impact Assessment \(DPIA\)](#). In order to determine if there is a high risk for the data subjects, please check if any of the options below that are applicable to the processing of the personal data during your research (check all that apply).

If two or more of the options listed below apply, you will have to [complete the DPIA](#). Please get in touch with the privacy team: privacy-tud@tudelft.nl to receive support with DPIA.

If you have any additional comments, please add them in the box below.

- Innovative use or applying new technological or organisational solutions for data processing

19. Did the privacy team advise you to perform a DPIA?

NO, not needed

20. Please include below the outcome of the DPIA, what measures did you take?

N/A

21. Where will you store the DPIA documents (document on data processing features and document on risk assessment)?

N/A

22. What will happen with personal research data after the end of the research project?

- Personal research data will be destroyed after the end of the research project

Personal research data will be destroyed after the end of the research project

Anonymised or aggregated data will be shared with others

The anonymised research data consists of anonymised interview transcripts and anonymous survey data.

These data will be used in the body of the thesis and included the appendix, but will not be shared in a data repository.

Audio-recordings of interviews are destroyed after completion of anonymised interview transcriptions. All other personal research

data will be destroyed 01/07/2024 after the end of the project.

Third-party datasets from the graduation company is not available due to restricted access, and cannot be distributed without express permission from the rights holder.

V. Data sharing and long-term preservation

27. Apart from personal data mentioned in question 22, will any other data be publicly shared?

- I do not work with any data other than personal data

I do not work with any data other than personal data

29. How will you share research data (and code), including the one mentioned in question 22?

- All anonymised or aggregated data, and/or all other non-personal data will be uploaded to 4TU.ResearchData with public access

The datasets belonging to the third party can not be publicly shared. this may only happen in agreement with the third party. This has to do with agreements with the participants.

30. How much of your data will be shared in a research data repository?

- 100 GB - 1 TB

31. When will the data (or code) be shared?

- At the end of the research project

32. Under what licence will be the data/code released?

- CC BY-NC-ND

VI. Data management responsibilities and resources

33. Is TU Delft the lead institution for this project?

- No - please provide details of the lead institution below and TU Delft's role in the project

Graduation Company: Vastgoed Beheer PG B.V

- Research for their organization
- Research under close contact with their organization

Assessors and tutors: TU Delft

34. If you leave TU Delft (or are unavailable), who is going to be responsible for the data resulting from this project?

Supervisor:

Herman van de Putte

H.J.M.VandePutte@tudelft.nl

+31 15 27 83056

+31639251323

35. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

Data is only shared in the MSc thesis: no additional resources are required.

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Planned Research Outputs

Software - "Tailored GPT for Property managers"

The research includes the development of a tailored version of ChatGPT for property managers, the model or framework itself, are an output.

Planned research output details

Title	Type	Anticipated release date	Initial access level	Intended repository(ies)	Anticipated file size	License	Metadata standard(s)	May contain sensitive data?	May contain PII?
Tailored GPT for Property managers	Software	2024-06-30	Restricted	None specified	300 MB	None specified	None specified	Yes	No

Appendix J: Use of ChatGPT

(This statement is based on the **Europe Terms of Use** <https://openai.com/policies/eu-terms-of-use/> and **Usage Policies** <https://openai.com/policies/usage-policies/>)

Use of ChatGPT by OpenAI in Thesis

In the preparation of this thesis, ChatGPT by OpenAI was utilized to assist in generating text, providing insights, and offering suggestions. The usage adhered to OpenAI's Terms of Use and Usage Policies, ensuring compliance with copyright and privacy regulations.

Compliance with OpenAI's Terms of Use

1. Copyright and Ownership of Content:

- The outputs generated by ChatGPT are owned by the author of this thesis, as per OpenAI's Terms of Use. Proper attribution and citation are given where necessary.
- No content from ChatGPT was modified or reverse-engineered, ensuring adherence to OpenAI's intellectual property rights.

2. Personal Data:

- No personal data was processed or utilized through ChatGPT in the creation of this thesis. The usage strictly complied with privacy laws and OpenAI's privacy policies.
- Sensitive information, including biometric data, payment card information, and government identifiers, was not used.

Universal Policies

• Compliance with Laws:

- The usage of ChatGPT adhered to all applicable laws, avoiding any activities that could compromise the privacy or safety of individuals.
- The service was not used for any illegal, harmful, or abusive activities, including but not limited to promoting violence, discrimination, or misinformation.

• Responsible Usage:

- ChatGPT was used responsibly, with outputs reviewed for accuracy and appropriateness before inclusion in the thesis. Efforts were made to ensure that the generated content did not mislead or misrepresent facts.

Specific Policies for ChatGPT Usage

• Privacy and Data Protection:

- No personal data was inferred, generated, or processed without compliance with legal requirements. The privacy of individuals was strictly respected.
- The use of ChatGPT did not involve any actions that would compromise the security or privacy of others.

• Content Integrity:

- Outputs from ChatGPT were used ethically, avoiding any form of disinformation, academic dishonesty, or misleading representations.
- All generated content was transparently identified as AI-generated where necessary, ensuring clarity and honesty in the presentation of the work.

Citation and Acknowledgment

The use of ChatGPT is acknowledged as follows:

This thesis utilizes the ChatGPT model by OpenAI for generating text and testing. The tool was used in accordance with OpenAI's terms of service. OpenAI. (2024). ChatGPT [Software]. Available from <https://openai.com>

Appendix K: European guidelines on the responsible use of generative AI in research

In addressing the responsible use of generative AI, my thesis has incorporated several key recommendations tailored for researchers, ensuring the integrity and reliability of AI tools in the field of Corporate Real Estate Management (CREM).

1. **Accountability for Scientific Output:**

- My research emphasizes that researchers remain ultimately responsible for the content generated with the assistance of AI tools. This principle is reflected in the meticulous documentation and critical evaluation of the AI-generated responses compared to human experts in property management.

2. **Transparency in AI Usage:**

- The thesis mandates detailed documentation of the AI tools used, including the specific versions and the nature of their application in the research process. This transparency ensures that the role of AI in generating research output is clear, and any limitations or biases inherent in the tools are disclosed.

3. **Privacy, Confidentiality, and Intellectual Property:**

- Ethical considerations around data privacy are strictly adhered to, ensuring that no sensitive or personal data is exposed or misused. The thesis includes protocols for anonymizing data and securing consent from participants, thereby safeguarding privacy and confidentiality.

4. **Compliance with Legal and Ethical Standards:**

- The thesis aligns with existing national, EU, and international legislation, particularly focusing on data protection and intellectual property rights. By integrating these legal frameworks, the research ensures that the use of generative AI complies with all relevant laws and ethical standards.

5. **Critical Approach to AI Limitations:**

- A critical analysis of the AI tools' limitations, such as biases and inaccuracies, is conducted. This analysis helps in understanding the reliability of AI-generated data and reinforces the need for human oversight and verification.

Ethical and Legal Considerations

My thesis thoroughly explores the ethical and legal dimensions of using generative AI in research, particularly within the context of property management and CREM.

1. **Data Security and Privacy:**

- The research adopts stringent measures to protect data security and privacy. This includes using secure storage solutions for data, obtaining explicit consent from participants, and ensuring that any data shared with AI systems does not contain identifiable personal information unless necessary and consented to.

2. **Ethical Implications of AI Use:**

- The potential ethical issues of AI, such as bias and misinformation, are examined in detail. The thesis proposes methods to mitigate these risks, such as using diverse training datasets and implementing robust verification processes to ensure the accuracy of AI outputs.

3. Intellectual Property Rights:

- The research respects intellectual property rights by correctly attributing sources and ensuring that any AI-generated content is appropriately cited and credited. The thesis discusses the implications of AI on intellectual property and provides guidelines for maintaining integrity in research.

4. Legal Compliance:

- The study ensures compliance with all relevant legal frameworks, including the EU's GDPR regulations, which govern data protection and privacy. By adhering to these laws, the research upholds the legal standards required for responsible AI use.

Training and Continuous Learning

Recognizing the rapid evolution of AI technologies, my thesis emphasizes the importance of continuous learning and training for researchers and practitioners.

1. Ongoing Training Programs:

- The thesis recommends the establishment of regular training programs to keep researchers updated on the latest developments in AI tools and best practices. This includes workshops, seminars, and online courses focused on AI ethics, data management, and practical applications of AI in CREM.

2. Best Practices for AI Use:

- A set of best practices for using AI in research is developed, guiding researchers on how to effectively integrate AI tools into their work while maintaining ethical standards. This includes guidelines on prompt engineering, data verification, and critical evaluation of AI-generated outputs.

3. Engagement with AI Communities:

- The research encourages active engagement with broader AI research communities. This engagement helps researchers stay informed about new advancements, share insights, and collaborate on developing responsible AI practices.

4. Feedback and Adaptation:

- My thesis promotes a feedback mechanism where researchers can share their experiences and challenges in using AI. This feedback is crucial for continuously improving the guidelines and adapting them to address emerging issues in AI research.

By incorporating these elements, my thesis not only adheres to the responsible use guidelines and ethical and legal considerations but also fosters a culture of continuous learning and improvement among researchers and practitioners in the field of CREM.