Goal- Chatbots Selling Condos: Generative Artificial Intelligence in Real Estate

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Generative artificial intelligence (GenAI) has become a hallmark of the 21st century's technological revolution, allowing users to answer questions instantly through an automated conversation. Although GenAI has controlled news narratives and captivated technology companies, minimal academic research exists regarding GenAI's impact on the real estate industry. We interviewed 13 real estate professionals and completed a thematic analysis to understand how they use GenAI and their sentiment toward it. Professionals highlighted GenAI's ability to quickly create marketing materials as a catalyst for using the technology. Thematic analysis revealed sentiments regarding efficiency, human intervention, ethics, generational adoption, relational business, and GenAI's future development. This study forces real estate's veiled nature into the light by considering the potential impacts of new technology on longstanding industry practices.

Keywords: generative artificial intelligence, artificial intelligence, real estate, real estate marketing

INTRODUCTION

Artificial Intelligence (AI) has become an expression synonymous with a technological revolution in all walks of life. Some industries readily adopt new technology, but others are hesitant to change, prompting questions regarding AI's viability in the workplace. This paper addresses AI's role in the real estate industry. Although real estate is a tremendous wealth-building vehicle for investors, homeowners, and corporations, the industry is often characterized by archaic information distribution, valuation, and data standardization methods. Without industry evolution, dramatic shifts in consumer preferences may decommission an entire industry while it patches widening systemic cracks.

Artificial Intelligence Today

Generative Artificial Intelligence Description

Generative artificial intelligence (GenAI) has revolutionized industries by producing image, text, and musical outputs at the touch of a button. In recent years, companies have leveraged AI to provide pointed product recommendations to customers or to aid listeners' new music discoveries (Marr, 2023). To make accurate recommendations, systems must learn from input data. This data may include purchase history, customer profile information, or a user's watch history. AI determines the unnoticeable commonalities between these data inputs to make predictions.

GenAI furthers this process, allowing models to be trained on information and to create new data grounded by the existing dataset (Marr, 2023). If a GenAI tool is trained with image data depicting dogs, the system will learn which characteristics qualify an image to be considered a dog. It will then use the learned characteristics to create a new image of a dog when prompted by a user. This output depends on the data from which the system learns. GenAI will create improper outputs if the data is biased or coded incorrectly.

Current GenAI outputs include text data, images, coding, audio, and video (Marr, 2023). While other outputs may exist, these are the most common features used in consumer accessible GenAI technologies.

Current Technologies

Companies recently released consumer technologies leveraging these newly accessible GenAI features. Generative pre-trained transformers (GPTs) were introduced by OpenAI in 2018, and they marked the transition to accessible generative artificial intelligence outside the gates of Silicon Valley. GPT technology made AI language communication mirror humans' language processing abilities (Yenduri et al., 2023). Open AI is a prominent example, the creator of popular GenAI tools ChatGPT and Dall.E.

In July 2022, OpenAI announced the second beta of Dall.E, providing access to 1 million waitlisted users (Bajarin, 2022). Dall.E provided public GenAI access by generating new images based on user prompts. In November 2022, OpenAI revolutionized text based GenAI through ChatGPT's public release; this prompted significant public interest because of its user-friendly and powerful platform (Marr, 2023). By January 2023, the platform amassed 100 million active monthly users (Korn, 2023).

Other popular GenAI platforms include Google's Bard, Bing Chat, and Microsoft's Copilot. Integration into existing systems, like search engines and Microsoft's Office Suite, has become a popular implementation for new GenAI technologies. GenAI has quickly captured the attention of nearly every technology company, but the technology's development has been slow and steady rather than immediate.

The Path to Generative Artificial Intelligence

Foundational AI development

Artificial intelligence technologies have existed for decades, but numerous barriers have prevented their accessibility. Recent technological advancements have dramatically increased the utility of AI tools for consumers and workplaces. Because of these advancements, data analysis became the catalyst for AI development.

Machine Learning

AI has evolved to create an advanced, semi-autonomous technology by mirroring humans' methods of knowledge processing through machine learning. Machine learning (ML) is a subset of artificial intelligence that uses algorithms and statistical models to categorize data and recognize patterns without specific guidelines (Davenport, 2018). Machine learning models mirror the human information absorption processes, allowing the identification of this information in different contexts. ML models are trained to identify matching data in a random set.

ML data analysis technologies emerged in the 1930s with the dawn of computing, but ML became a recognized computing genre in the 1950s (McKinsey, 2024b). Until the 1970s, computers were too weak to leverage ML. The continual development of machine learning's predictive modeling process laid the foundation for AI by improving pattern recognition accuracy. Predictive models' categorization skills were

the pinnacle of ML until the recent development of new technologies enabled the processing of linguistic information.

Variational Autoencoders

Variational autoencoders (VAEs) took the first step toward adopting language and speech capabilities, underpinning much of AI and ML's recent development (Martineau, 2023). Kingma and Welling (2013) identified VAEs and their potential boon to AI development. VAEs benefitted AI development by condensing and reproducing data with changes when solicited (Martineau, 2023).

VAEs condense and report data with encoders and decoders. Encoders compress and record data, while decoders select from the set of encoded information. When selected, decoders build upon encoded information to deliver a new output. Accurate decoding has many hurdles because decoders must retain the data's critical information while creating a new output from the encoded information. Although retention of critical information is difficult, this process aids unsupervised learning processes. Unsupervised learning occurs without data labeled for model inputs (Wood, 2020). AI systems no longer need information coded in systems, allowing AI to learn from larger datasets. VAEs' development laid the foundation for GenAI to create new textual outputs that retain core information while reformulating it for a different output. Since VAEs must select critical information for an output, AI's consistency and reliability became developers' next focus.

Generative Adversarial Networks

Generative adversarial networks (GANs) use advanced models to compare AI generated information and actual information against one another; the model learns to select authentic information through this comparison process (Hansen, 2022). GANs were created in 2014 to improve the accuracy of existing generative models by working with two neural networks instead of one (Giles, 2018). This process uses a generator and discriminator to determine an input's authenticity through comparison. Generators produce a test from input data, and the discriminator seeks to determine data from the authentic set. As outputs improve through the learning process, it becomes more difficult for AI to determine which was artificially generated and which was pulled from the initial dataset. Comparison is highly beneficial for generative AI models that create images, allowing higher-quality image outputs than VAEs (Hansen, 2022). However, new technology revolutionized this process for textual data.

Transformers

Google released the *Transformer* in 2017 to select sentences' keywords that influence translations for homographs (Uszkoreit, 2017). Transformers have been applied to language generation for word and sentence relationship prediction (Martineau, 2023). Understanding relationships is crucial for unlabeled data requiring unsupervised learning; this is especially important for language processing.

Natural language processing (NLP) falls under the umbrella of AI and allows for immediate responses that generative artificial intelligence (GenAI) produces. GenAI allows NLP to be extended from textual analysis to a new output. GenAI and NLP leverage human-like reasoning processes when considering responses, allowing computers to parse word meaning from intent and tone. Chatbots, GPS, and language translation apps leverage NLP to provide relevant user feedback. The successes in language processing and an understanding of language relationships paved the path to GenAI development.

Generative Artificial Intelligence

GenAI and ML technology are categorized as subsets of artificial intelligence. GenAI creates new output, and ML internalizes information (McKinsey, 2024a). Before GenAI's development, models could recognize and characterize input information but could not create a new output. Part of the restriction occurred because early machine-learning models relied on *supervised* learning. Humans had to instruct models to search for characteristics in data so machines could apply the human-labeled information. Supervised learning has limitations because it relies on human constraints to process data and identify

coding baskets for the system to compare data against. Many current models rely on unsupervised learning practices, allowing machines to determine patterns alone.

Unsupervised learning does not provide an example of a model output to the system. Because of this, unsupervised learning technologies review such large quantities of information that they can predict future text in text-based AI models. These structures rely on significantly more information to make inferences than supervised learning models categorized by humans. As such, generative AI can produce written text, images, videos, and audio based on statistical probability (Martineau, 2023). This breakthrough opens the door to industrial GenAI applications by nearly instantaneously processing information and delivering an accurate result.

Industrial AI Use

Documented Industrial Uses of Artificial Intelligence

Although the application of AI technology varies across industries, rapid development in AI technology has broken barriers between consumer products and corporations. Davenport (2018) cited the foundation of *Analytics 4.0* as AI's business practice revolution compared to prior eras' mere data collection and analysis. Companies incorporate AI in physical and digital product offerings, business practice decisions, understanding customers' behaviors, and data processing.

In products, AI often uses sensor data or *digital twins* to mirror a product electronically. Behind the scenes, supply chain and manufacturing decisions benefit from predictive analytics' continual data analysis, resulting in improved decisions as the company collects more data (Waller & Fawcett, 2013). Companies also leverage AI to enhance a marketing campaign's influence on customers' decisions (Martínez-López & Casillas, 2013). AI may also automate simple analytical processes to redirect human capital to other organizational departments.

Industries

Multiple industries have leveraged GenAI's capabilities for many purposes. The retail industry has used GenAI's abilities to train human capital for effective job completion. Walmart released an internal AI tool to 50,000 employees for orientation and productivity, revealing a significant corporate investment in the technology (Korn, 2024a). In the consulting industry, companies have created searchable information sets. McKinsey released an AI tool to aggregate and search the firm's collective information. PwC took a different approach to embracing AI by licensing OpenAI's technology for company information searches. Corporate validation of consumer AI technology serves as a milestone in GenAI development.

Other industries have incorporated AI prior to the release of GenAI technology. The healthcare industry used AI for disease tracing and prevention during the Covid-19 pandemic (McCall, 2020). Chemical engineering companies have adopted AI for material analysis technology to select desirable chemical qualities for each application (Venkatasubramanian, 2018). Beyond scientific fields, the banking industry leverages AI for fraud analysis (Ryman-Tubb et al., 2018). AI's implementation in data-sensitive industries reveals potential for further workplace adoption.

97% of businesses attempting to incorporate GenAI in business operations believe that releasing consumer-oriented technologies like ChatGPT will benefit the business (Haan, 2023). Businesses aim to improve customer experiences by developing chatbots and email optimization technologies that incorporate AI. Even though informationally sensitive industries like health, chemical engineering, and banking leverage AI to better understand data trends, AI detractors often cite security as a reason to minimize its use.

Industrial AI Concerns

Inevitable corporate use resulted in responses from Fortune 500 companies because users from 80% of Fortune 500 companies registered for ChatGPT with a corporate email address in the first nine months of its public release (OpenAI, 2023). JPMorgan Chase, Apple, and Accenture have adopted internal bans against ChatGPT's use for business operations (Korn, 2023).

In July 2023, Microsoft revealed a business-centered AI tool powered by Bing's technology. Microsoft Copilot (formerly known as Bing Chat Enterprise) entered a new field focused on organizations' internal data protection rather than external distribution. This internal design contrasts many other consumer-oriented AI programs seeking to disperse information beyond an organization's boundaries. Some industries with highly sensitive consumer information have taken stances against the new technology, but many have invested in internal research committees to better understand the systems' business potential (Korn, 2023).

Technology companies seek to allay businesses' fears about GenAI introduction. IBM's strategy offers compensation for copyright infringement resulting from IBM AI technology (Lohr, 2023). However, current industry concerns stem from data sets' veiled nature; most developers hide the information training GenAI technology. IBM's incentive failed to address one of the main concerns with AI adoption by hiding generated information's sources. Businesses can only verify GenAI output accuracy if they use internal data. Even though GenAI tools spark industry debates, various data-collecting technologies have snuck into business over the years.

Technology in Real Estate

Property Technology

Real estate technologies have become commonplace for both industry professionals and property owners. Property technology (PropTech) involves all technology associated with real estate. This includes physical property maintenance, real estate-related finance, and real estate-related technologies (Baum, 2017; Braesemann & Baum, 2020; Starr et al., 2020). Physical devices, like keyless entry, video doorbells, and smart thermostats, fall into the PropTech category (Claffey, 2023). These physical technologies ensure effective property management to improve a property's longevity and provide convenience to owners. This also increases a resident's satisfaction and rental rates, positively impacting both landlords and lessees. Real estate technology has expanded beyond physical monitoring into the financial space.

Real Estate Financial Technology

Real estate FinTech leverages real estate-specific financial technologies to assist property transactions (Baum, 2017). Real estate FinTech often involves the trade or assignment of real estate. Blockchain technology was a significant introduction to the assignment of real estate because large companies have introduced blockchain technology to ensure effective property transfers (Claffey, 2023). Blockchain ensures secure ownership documentation by safely recording information across multiple computers to prevent tampering and scams (Malonson, 2022). These electronic documents increase the pace of transactions and aid in mitigating contractual errors and omissions. Although blockchain has the potential for market domination in the future, real estate currently relies on a trusted set of technologies. Adopting real estate-related technologies is increasing in geographic areas with strong economic climates (Braesemann & Baum, 2020).

Technologies Popular with Professionals

While professionals use many technologies in real estate, the most imperative include drones, the Internet of Things (IoT), clouds, software as a service (SaaS), 3D scanning, wearable technologies, virtual and augmented realities (VR and AR), and artificial intelligence (AI) (Ullah et al., 2018). These technologies often provide consumers with more information, helping to curb decision regret that has spiked in recent years (Chen et al., 2011). For example, IoT devices, or devices connected through the Internet, may provide maintenance reminders or facilitate household management. Physical technologies may entice customers to consider real estate, but technology assisting the real estate business has become essential to professionals' success.

Lewis (2022) discovered that real estate professionals use many technologies related to customer relations and marketing. Video development with editing capabilities, virtual meeting tools, and website development emerged as essential technologies in the real estate industry. Petermann (2021) highlights video technologies, social media marketing, and brand demarcation as essential real estate skills,

overlapping with trends in real estate technology. Over 40% of real estate professionals see potential for modern technology applications in real estate (Kania & Kmieć, 2022). However, only 4.23 % used artificial intelligence in real estate at the time of the survey.

Professionals see marketing as a critical driver for success, but large real estate companies have recently weakened their investment in real estate technology (Smith et al., 2023). Hardware costs are cited as the main reason for decreasing office-wide expenditures. New technology often requires expensive subscriptions, updates, and education to make the most of an investment.

Other reasons for shrinking technology budgets include data security and governmental regulations. Regulations spark company concerns when embracing new technology because enforcement agencies may subject companies to hefty fines for technology misuse. Although many companies have decreased technology investments, the benefits of increasing technology, especially in a slow-to-change industry, can better position a business for the future (Nemati, 2022). Considering that the real estate industry slowly adapts to new technologies, property valuation technologies have seen uncharacteristic development in recent years.

Artificial Intelligence in Real Estate

Current Uses

Existing literature highlights real estate property valuation as one of AI's successes in real estate (Rampini & Re Cecconi, 2021). Leveraging artificial intelligence with geographic information system (GIS) maps helps customers and professionals better understand a specific area's pricing. Cajias (2020) explains that AI can provide quantifiable scoring to location data, preventing skewed or biased purchasing. AI also provides a simple analysis of community development plans, crime statistics, and business records (Leeds, 2023). This may aid the purchasing process by addressing consumers' pain points when making critical investment decisions.

Data Gathering

Artificial intelligence technologies currently assist the real estate industry with data gathering, analytics, valuation, risk assessment, business processes, natural language processing, computer vision technology, 3D augmentation and space planning, and geospatial analysis (Conway, 2018). In addition to quantitative data methods, real estate organizations leverage natural language processing for data gathering. Natural language processing (NLP), a recurring theme for artificial intelligence usage in business, extracts information from datasets to obtain keywords, known as data scraping. Data scraping allows lease processing and standardization, aiding customer service chats in real estate business settings. Aggregating contract terms and NLP analysis may help professionals effectively price a property by considering market rate information (Viriato, 2019; Cajias, 2020). AI also sorts leases, mortgages, and liens, allowing companies to better understand an area's economic standing for investment analysis (Packer, 2021). Real estate professionals may leverage AI to find prospects in a farm area based on mortgage information, converting more leads to closings (Jorner, 2020).

Cajias (2020) also reveals how AI may assist in providing quantifiable rankings to currently indescribable characteristics like air quality, water quality, and building security. This reveals further potential of AI incorporated into the IoT (Viriato, 2019; Cajias, 2020; Starr et al., 2020).

Building Management

Property management and building operations currently utilize the majority of AI technology associated with real estate (Viriato, 2019). Owners of large real estate portfolios need to identify maintenance concerns before they occur (Leeds, 2023). In addition to naturally occurring maintenance, analysis of tenants' patterns and use of features may indicate mistreatment, allowing landlords to address concerns before they become maintenance issues. Automation through property-wide technology may decrease resource strain on landlords, via the effective use of power, water, and equipment.

Before a building is constructed or modified, AI can be used to model a space (Ramachandran, 2020) at a project's design and preconstruction phase, eliminating inefficiencies is essential to preventing

functional obsolescence. Real estate professionals may leverage visual AI technology to represent a space more tangibly than 2D plans. Providing more information to consumers allows for more concrete evaluations of one's alternatives.

Application AI

Apps like DealMachine leverage AI and data aggregation to search property in the United States. AI-powered property search allows for learning as users engage with search platforms (Lecko, 2024). Applications also assist real estate professionals with market statistics, customer data, and industry tips. AI-powered apps also recommend approaching owners and hone real estate sales presentations (Revell, 2023). AI improves lead generation by leveraging data to encourage agents to connect with potential customers while maintaining relationships by populating market statistics. AI also powers real estate agent marketing by converting existing images into video property visualizations (Revell, 2023).

Potential Concerns

While augmented images and marketing methods help customers better understand a space's potential, multiple listing service (MLS) guidelines require specific information to be disclosed or excluded on the platform. Violations of MLS protocol may result in fines and listing removal. MLS compliance is essential since listing platforms are at the core of the residential real estate business. Brokerages accessing AI tools have the power to review listings with AI to ensure that listings meet MLS standards (Rutzen, 2023). AI can complete routine business practices, like listing descriptions, but agents must ensure they comply with MLS rules. Listings with AI enhancement may highlight inconsistencies between MLS data and images. If a professional uses AI to edit contracts, checking contractual values and ensuring that each document matches one another prevents costly mistakes. AI technology in real estate has many potential applications, but understanding industry professionals' usage habits and attitudes will indicate the potential of real estate industry adoption.

Gaps in Real Estate Artificial Intelligence Research

Most research addresses the novelty of artificial intelligence technology, focusing on reviews to document existing progress. These reviews often highlight the limited availability of experimental research related to the technology. Since minimal experimental research exists, a significant portion of artificial intelligence understanding is filtered through news outlets and blogs. Because of this, professional impacts of artificial intelligence technology in real estate have not been documented, preventing cross-industry context regarding technological adoption.

Real estate industry analysis exhibits a landscape of tested technologies and the introduction of artificial intelligence-powered valuation tools. However, few documentations of GenAI technologies in real estate exist. Workplace technologies are increasing, and GenAI's skills in developing images and textual content can potentially influence the job tasks of many real estate professionals.

However, more experimental research on GenAI and GenAI in the real estate industry is needed to ensure further analysis of the real estate industry's technological adoption. Understanding the industry's technological trajectory is nearly impossible without documentation of real estate professionals' GenAI usage. The real estate industry offers researchers an excellent case for artificial intelligence research because real estate brokerages have undefined boundaries with little technological restriction. Each brokerage has relative autonomy, choosing to set internal protocols. Determining real estate professionals' sentiment toward GenAI is crucial to understanding real estate industry adoption of both GenAI and future intelligence technologies.

To understand the impacts of new GenAI technology on the real estate industry, we aim to answer the following:

RQ_1: *How do real estate professionals use generative artificial intelligence, and what are their reservations?*

RQ₂: *What are the feelings that generative artificial intelligence evokes in real estate professionals?*

METHODS

Participant Information

Licensed real estate professionals were invited to participate in this study on artificial intelligence and were interviewed to achieve a broad understanding of agents' sentiments and experiences. This technique allows respondents to provide as much information as they see fit, helping investigators better understand the context of their responses. Before interviewing, the principal researcher assured participants that their artificial intelligence experience level would not influence their ability to participate in the interview process.

Thirteen real estate professionals, seven men and six women (*M* age = 44.46, *SD* = 12.96), were interviewed. Interviewees' industry experience ranged from 1 year to 45 years, with an average of 14.92 years (*SD* = 12.43). During their career as a real estate agent, interviewees worked for an average of 2.23 brokerages (*SD* = .*93*). Participants provided an estimate of their completed transactions while working for a broker. Participants' transaction history ranged from 2 transactions to an estimated 800 (M = 218.46, SD = 229.75).

Participants also provided information regarding their role within the industry. All participants indicated they worked directly with customers rather than as personal assistants for most of their careers. Only one interviewee worked as an assistant to another professional for over a year.

Participants also described their concentration and operational structure in the industry. Respondents indicated that they worked in the sale or lease of residential property only (*n* = 10), in the sale or lease of commercial and residential property (*n* = 1), or the sale or lease of commercial property only (*n* = 2). Some interviewees indicated they worked on a team within their brokerage (*n* = 5), but most did not (*n* = 8) (see Appendix A). Nearly all interviewed agents worked within the markets of Central or Southwest Florida (*n* = 12), with only one working out of state (*n* = 1).

Before beginning interviews, ethical clearance was obtained from the principal investigator's institution. After obtaining the IRB approval, we recruited participants through email and did not offer compensation for participating in this study. The principal researcher contacted email respondents for scheduling and provided a link to a consent form over the DocuSign platform. Each interviewee was asked to indicate their recording preferences on the Docusign form. The principal investigator provided a Microsoft Teams link to respondents when scheduling an interview, but some chose to be interviewed over Zoom or phone (*n*=3).

Each participant provided oral consent before the interview's commencement and confirmed their recording preferences. All interview participants allowed the interview to be recorded via their respective platforms.

Interview Questions

Each participant answered questions related to their industry experience, age, and transaction history before generative artificial intelligence questions. Participants were then asked to indicate whether they had heard the term *generative artificial intelligence* and to provide their understanding of the term. They were also asked about their ability to operate a computer for real estate-related tasks and their perceived difficulty with generative artificial intelligence interactions. The principal investigator also asked participants, "When considering the real estate industry, do you feel that generative artificial intelligence could impact job performance?" and "Do you feel like you could complete a real estate-related task using generative artificial intelligence?" Participants also answered, "Has anyone in your brokerage mentioned using or is using generative artificial intelligence in their real estate career?" If they answered affirmatively, participants were asked, "What is their role in the organization?" The principal investigator also asked participants for their opinions on the output quality of generative artificial intelligence, if they believed they could use it in their daily work, and the possible ways other agents may use it in their real estate careers. Lastly, they were asked, "How do you feel generative artificial intelligence may impact the creation of real estate listings?"

and “Is there anything else that you have thought about regarding generative artificial intelligence that you think I should know?” These conversations’ lengths ranged from 11 minutes to 30 minutes, lasting an average of 18 minutes and 49 seconds.

Analysis

Considering the depth of information we sought from interviews, a thematic analysis offered the most logical method to digest information while retaining respondents’ sentiments. Thematic analysis best serves textual data when researchers aim to determine high-level themes. Alternatives to this approach include content analysis and grounded theory analysis, but both misalign with this study’s goals. Content analysis is often applied to visual or textual data to analyze the presence of specific wording. Because we sought to understand broad sentiments in recorded data, thematic analysis was best applied to the data.

Before beginning thematic analysis, we considered grounded theory analysis’ application to the data. Grounded theory analysis is another method of review using survey data to support a theory. Due to the inherently experimental nature of this study, the data would not adequately support a theory. After determining the best analysis method, the principal researcher began thematic analysis’ typical data analysis pattern.

Initially, the principal investigator reviewed the transcripts to note emerging interview themes. The themes that surfaced during this initial review included *offloading time-consuming tasks* (reported as *GenAI promotes efficiency*), *human input to perfect outputs* (reported as *required human intervention*), and *potential for future development* (reported as *future* development) when considering artificial intelligence. *Word choice flamboyance and disdain for noticeable intervention* emerged but are reported under the broader theme of *required human intervention* after contextual consideration. Another semi-related theme that emerged relative to artificial intelligence is that *real estate is a relational business.* The following section explores these themes in detail.

After considering emerging themes noted by the principal investigator, Open AI’s ChatGPT-4 was used for thematic analysis to determine additional themes in the data. Because this technology excels in textual analysis based on its design, it provides an additional check to validate researcher-documented themes. GenAI’s ability to support this research demonstrates the strength of the technology. The principal investigator copied each transcript into ChatGPT-4 and asked it to identify themes in each interview for qualitative analysis. This step ensures the reliability of investigator-noted themes while enhancing the analysis by determining additional themes.

To protect the study’s validity, the principal investigator only read the results of the ChatGPT-4 analysis after the thematic analysis was complete. ChatGPT-4-identified themes include *ethical and legal considerations, barriers and limitations, awareness of AI, future implications and expectations, educational gaps, AI’s role in streamlining processes, adoption and integration of AI tools, generational differences in technology adoption, and AI as a tool, not a replacement.* The principal investigator had to independently identify ChatGPT-4 themes through the coding process to be reported in *findings.*

Thirdly, the principal investigator inductively coded interview data with NVivo. The inductive coding method requires themes to emerge naturally from respondents’ repeated information. This method compares to deductive coding, which requires themes to be chosen in advance; the researcher later applies data to themes. The inductive coding method does not prescribe themes for analysis before coding, reducing the chance of thematic misalignment. NVivo offers digital thematic notation and provides additional organization for qualitative data. The principal investigator identified 110 codes across the 13 interviews, grouping responses with the same information into their respective codes.

Since the researchers sought to learn if real estate agents are using generative artificial intelligence technology, RQ1 is presented first. Themes emerged to answer RQ_2 and are provided following RQ_1.

TABLE 1
THEMATIC COMMONALITIES BETWEEN CHAT GPT-4 AND PRINCIPAL RESEARCHER

Chat GPT 4 Identified Themes	Principal Researcher Identified Themes
Awareness of AI	Familiarity with AI technology
Adoption and Integration of AI Tools	Generative AI use
Ethical & Legal Considerations	Ethical Restlessness
Barriers & Limitations	Required Human Intervention
Future Implications & Expectations	Potential for Future Development
Educational Gaps	(Recorded Under *Required Human Intervention*)
AI's Role in Streamlining Processes	GenAI Promotes Efficiency
Generational Differences in Technology Adoption	Generational Adoption Gap

TABLE 2
RQ2 THEMATIC DEFINITIONS AS INTERPRETED BY PRINCIPAL RESEARCHER

Theme	Interpretation
Ethical Restlessness	Internal conflict regarding the morality of publishing AI-created content
Required Human Intervention	Editing of AI input or output by the user to achieve the intended result
Potential for Future Development	Honing GenAI technology will result in more desirable features and a greater number of applications
GenAI Promotes Efficiency	Secondary tasks can be offloaded to generative artificial intelligence faster than human completion without AI input
Generational Adoption Gap	Younger real estate professionals will have an interest and the required skills to use GenAI in the workplace
Real Estate is a Relational Business	Ultimate success of real estate professionals is defined by relationship cultivation between customers and external parties that AI cannot replace at this time

FINDINGS

Findings extrapolated from interviews include comments paraphrased by the principal investigator. These comments were paraphrased to support findings while protecting respondents' identities. These comments have been edited to exclude any identifiable personal information while retaining the sentiment and content of the response.

***RQ$_1$**: How do Real Estate Professionals use Generative Artificial Intelligence, and What are Their Reservations?*

Familiarity with AI Technology

All participants were familiar with artificial intelligence technology and indicated they were comfortable using computers for real estate tasks. Participants had either heard about the technology, read it from a news source, or used it.

Generative Artificial Intelligence Use

Eight of the thirteen participants indicated that they use GenAI technology in their business dealings. Respondents who used AI for their business worked in residential real estate or residential and commercial real estate. However, both respondents working solely in commercial real estate indicated that they feel GenAI does not have a place in their business right now. Consequently, they do not use it in commercial real estate deals. Other respondents who do not use AI cited that they do not see a fit in their business right now or are not interested in the technology. However, one respondent mentioned that they would use the technology if someone showed them how it would assist them with their job tasks.

Respondents' Uses

Seven of the eight respondents who use GenAI indicated that they use GenAI for property description assistance and listing information on MLSs. Additionally, the eighth respondent explained that they use GenAI for lead generation and for minor grammatical editing in marketing materials. Real estate agents include property descriptions with the listing information on MLS platforms and typically describe a property's features. All real estate professionals who mentioned using GenAI for listing descriptions indicated they used Open AI's Chat GPT to assist their composition at some point during their experience with GenAI-assisted property descriptions.

Five of the thirteen respondents indicated they used internal company GenAI resources, either licensed technology or internally designed platforms, for marketing materials. Interviewees indicated that they used these technologies to compose print marketing materials (flyers, brochures), develop e-marketing materials (mass emails, social media posts), and personalized customer relationship management messages. Respondents' uses ranged from grammatical correctness to inputting basic property information and allowing GenAI to create content.

Respondents who claimed their brokerage leveraged a company-designed platform indicated that these platforms catered to individualized marketing materials and company-specific information responses (company marketing). Multiple respondents explained that customer relationship management (CRM) systems provided customized messages for customer distribution. These GenAI systems draft unique email messages to update customers on an area's pricing and find homes that may meet their needs based on brokerage history.

Of the three national or international brokerages represented by respondents, interviewees of two brokerages mentioned using internally developed GenAI tools. Professionals working for the third brokerage did not discuss platform development but disclosed their awareness of GenAI use at the company. Even though each brokerage did not leverage GenAI tools, respondents working for all three national or international brokerages mentioned internal training or encouragement from organizational superiors.

Two respondents described GenAI training experiences outside their brokerage, and those agents have used GenAI for valuation and property descriptions. GenAI training was not the only catalyst for its office use. Two of the three respondents whose brokers informally supported GenAI's use without offering training or a developing a company platform use GenAI. Brokers may informally support GenAI's use by mentioning it positively or expressing that they have used GenAI in their business dealings.

***RQ$_2$:** What are the Feelings that Generative Artificial Intelligence Evokes in Real Estate Professionals?*

The principal researcher identified themes to understand agents' attitudes toward artificial intelligence in the real estate business. Interviewees heavily focused on GenAI writing tools in their responses.

GenAI Promotes Efficiency

One of the most common responses from interviewees included GenAI's potential to save time when completing work-related tasks. Respondents explained that GenAI could complete emails, scheduling, phone calls, and customer relationship management tasks typically handled by assistants. Because of these abilities, many interviewees noted that assistants may become unnecessary with GenAI marketing developments. Participant D specifically explained that many non-client-facing jobs could be eliminated in the office, and Participant B mentioned that GenAI completes marketing tasks that their assistant usually oversees. In addition to explaining that GenAI may reduce the need for assistants, participants alluded that real estate professionals could now complete these tasks without an assistant entirely. Because of this, GenAI adoption may impact the availability of real estate assistant jobs. However, interviewees never described GenAI taking over primary job tasks.

Secondary job tasks. Interviewees described marketing tasks as secondary to main client-facing job tasks like meeting with clients, developing proposals, and closing transactions. According to respondents, these job tasks are essential to a transaction. Every participant who leveraged AI in the real estate business cited efficiency in secondary job tasks as the reason for using a GenAI tool. Participant F explained that creation of marketing materials requires significant time and attention. While these tasks are beneficial to cultivating a real estate business, interviewees explained that they consume a significant portion of time that may be directed to immediate *paid* activities. Participants explained that managing relationships was the most crucial aspect of their business and could not be replaced. Considering the industry's payment structure, interviewees' distinction between essential and non-essential business activities is unsurprising. In real estate service, it is crucial to foster solid relationships and completing transactions. While marketing activities may support future business, immediate transaction maintenance will likely yield sales commissions. Because of this, real estate professionals may offload non-paid tasks to a GenAI program faster than paid activities. In addition, AI technologies have eliminated careless mistakes that may occur when quickly completing non-essential tasks.

Marketing campaigns leveraging AI technology have improved the efficiency of marketing operations in several industries (Haleem et al., 2022). Efficiency occurs because AI involvement in marketing campaigns eliminates human errors by uncovering insights ignored by professionals. As a result, campaign performance and customer experience have improved, and AI has assisted sales professionals by processing data and enabling quick decision-making. The interviewees' statements aligned with prior findings on AI efficiencies in marketing for sales professionals.

In addition to this, AI-assisted content generation also decreases the time it takes for writers to complete an argumentative writing task (Li et al., 2024). Similarly, respondents explained that GenAI assisted persuasive writing took less time than human-composed work. Overall, interviewees' adoption of GenAI to quickly complete secondary job tasks aligns with the industry's structure. Prior research supports AI's power to provide more robust outputs than unfocused professionals, indicating positive client and non-client-facing work outcomes. However, even though respondents believe GenAI improves efficiency, they noted gaps in its abilities.

GenAI Requires Human Intervention.

Participants mentioned that using GenAI effectively in real estate requires human intervention to create desirable outputs. Respondents described GenAI outputs as generic, making the style and organization of textual outputs read similarly. Existing GenAI research explains that GenAI reduces content diversity when producing content instead of merely editing it (Li et al., 2024). Respondents explained that reviewing property descriptions with GenAI-like wording and structure left negative feelings. In many cases, respondents explained that they felt the professional did not take adequate time to edit a description to make it seem human-generated. This compositional misalignment misses a point of connection between readers and the real estate professional. Interviewees who used GenAI to draft property descriptions acknowledged

the need for editing after the system delivered content, reinforcing the association between written descriptions that mimic the characteristics of GenAI-composed ones.

Market consideration. Textual GenAI platforms can provide strong outputs, but in many cases, these require editing to address the users' needs accurately. A GenAI output may focus on parts of a property that are not crucial to buyers or lessees. Listing descriptions are more art than science, requiring specific inputs based on market experience. Because each market has different criteria, generalizing desirable features may not paint a property in the best light. For example, highlighting a new dryer may benefit a buyer at a lower price point but not a buyer at a seven-figure price point. GenAI users have multiple options to address this problem, and prompt alterations help to emphasize key points in real estate marketing materials.

GenAI prompt engineering. Interviewees acknowledged that GenAI education, formally or through platform experimentation, resulted in the desired outcomes. Respondents noticed that tonal consideration is essential when creating a GenAI prompt by experimenting with GenAI platforms. According to respondents, specifying the audience and characteristics of the output assists platforms in achieving the desired result. Participant F claimed that their initial GenAI attempts were unsuccessful because they did not understand the level of specificity that ChatGPT requires. GenAI use helped the respondents achieve desired outcomes once they realized that the program heavily relies on a user's input. Characteristically, GenAI responses often incorporate advanced language and dramatically described features. Sometimes, the descriptions may mislead readers because of their overtly positive outlook.

Wording. Participants noted incongruent property representation as one of GenAI's primary weaknesses that require editing. Flamboyant word choice that makes features seem incomparable concerned respondents because of the potential misrepresentation to customers. Mismatches between user needs, intentions, and styles stem from the large datasets GenAI is trained on (Li et al., 2024). The data training may emphasize positivity in real estate descriptions, but the system may stretch positivity beyond the listing's bounds. Participants routinely described seeing examples of descriptions that did not match their photos. Participant F provided a MLS listing example with exaggerated language inconsistent with a property's photos. This example dramatically described the property's features even though they were typical for the area. According to interviewees, seeing inappropriate comparisons in other agents' descriptions makes the agent seem lazy or incompetent rather than highlighting the property.

While respondents never directly described trust in other professionals' abilities, they seemed frustrated with noticeable GenAI use. Respondents often connected noticeable AI use with incompetence or an inability to complete the task effectively. In a relationship-oriented business, colleague mistrust may result in a bruised reputation. Professionals who do not trust another's abilities may refuse to work with them or provide referral business. Because real estate has many variables, professionals must be able to use both quantitative and qualitative information to provide relevant information to customers.

Humanity. Participants noticed a loss of humanity in GenAI-assisted work that misses the complexities of a characteristically qualitative business. In most cases, real estate requires the evaluation of many variables to make informed decisions. While GenAI may draw from an extensive dataset, old data may provide useless insights in quickly changing markets. Property valuation tools have used AI for years, attempting to provide accurate valuations based on various sources. While appraisals and neighborhood market statistics help to provide a data-bound valuation, it is nearly impossible to value property because of remodeling, particular finishes, and property condition. Because of this, respondents explained problems with GenAI valuation tools.

When considering property valuation tools, respondents felt gaps between the reported information and human-perceived information may create an inhumane response. Online information reporting problems, like old data or unreported information, may result in obscured or inaccurate information without the careful review of an agent. Participant E worried about GenAI's potential gaps in local knowledge when using it for marketing and informational purposes. Local real estate professionals can access industry networks and stay updated on information that may impact the market. Without constantly updating GenAI data training, this is nearly impossible. Additionally, information may not be published or finalized, so allowing potentially inaccurate information into a GenAI program may result in skewed user outputs. Real estate professionals can weigh the quality of information against its likelihood to determine future directions.

Access to proven systems may dissuade real estate professionals from taking risks associated with GenAI adoption.

Generational Adoption Gap

Throughout the interview, respondents indicated that they either learned about GenAI from younger people or perceived that they use it in the industry. Generally, interviewees' GenAI use reflected this belief. Respondent J mentioned that they overheard younger real estate professionals discussing their use of the technology, so they began investigating how they could use it. Younger respondents sought to understand technologies when they heard others discussing them. At the same time, interviewees questioned older generations' abilities to adapt to new technologies and leverage them to see workplace benefits. Consistent performance without the use of GenAI may discourage industry veterans from adapting to new technologies. However, those who grew up in the shadow of the technological revolution may have a stronger motivation to explore it in the workplace.

Inherent understanding. Respondents assumed that younger people would inherently understand how to use GenAI technologies in the workplace. Much of this assumption stemmed from the belief that Millennial and Generation Z professionals have accessed technology for most of their lives. Respondent I explained that they believe younger generations will use GenAI technology to promote their brand. Interviewees routinely described GenAI's potential marketing impacts while emphasizing the generational gaps in technology adoption. When respondents considered GenAI's best uses, they mentioned that younger professionals would likely use it the most strategically because of their experience with technology.

Noah and Sethumadhavan (2019) found that one's generation impacts the level of trust in AI technology. Gen Z participants were more trusting of technology than Gen X participants. Younger people immediately discussed technology use on social media and in educational settings, requiring new policies. GenAI regulations created by large companies indicate quick diffusion into professional settings. However, limited peer-reviewed research exists regarding the organizational adoption of AI technology, so trust in technology provides the strongest basis for supporting participants' claims. Even though users may trust a technology to deliver a reliable result, GenAI's ethically ambiguous nature may result in a slower industry diffusion.

Ethical Restlessness

Participants described the idea of plagiarism when considering content publication created by a computer program. Even though the user creates prompts, and a computer drafts the response, GenAI programs pull information from data sources. Without knowing where the information originates, questions regarding its ethics emerged. Providing information without knowledge of its source may result in inaccurate or biased information. Respondents worried that GenAI information use without attribution may be immoral or illegal. One interviewee likened the direct use of AI content to copying someone else's work in an educational context. Overall, interviewees expressed concerns regarding the source of GenAI information and its proper attribution. Without GenAI citations, problems may emerge.

Legality issues. In addition to ethics, respondents questioned the legal ramifications of posting computer-generated content to the public. Examples of GenAI creating content with other authors' exact wording have been noted. Using this information on public websites may result in legal issues. Participants worried about public displays of generated content and future repercussions as the technology develops. Additionally, local boards may enact regulations toward AI use, requiring professionals to remove and replace GenAI information. GenAI research has documented similar concerns in other industries.

Customers' interests. Interviewees also mentioned customers' interests when considering the ethical implications of GenAI writing platforms. Respondents described feelings of dishonesty to the customer when considering GenAI use because customers pay agents for expertise. Many respondents felt that the agent *should* create the content that sells a property as their duty to a customer. Interviewees separated GenAI writing tools from other AI assistance tools like property valuation and customer relationship management platforms when considering moral correctness. Multiple respondents condemned using

written GenAI responses but used AI-generated information for pricing or lead generation. GenAI property valuation tools were never mentioned in combination with ethical questions.

Similar concerns with text-based AI platforms have emerged in educational contexts. Chan and Hu (2023) document students' ethical and policy concerns about AI's use. Al Sawi and Alaa (2024) noted similar concerns regarding GenAI content by professional editors and proofreaders. Industrial adoption of GenAI technology requires information transparency to allay fears regarding ethical and legal repercussions. Additionally, industry norms have not developed because of GenAI's novelty. Industries do not have codified rules and regulations related to GenAI. Although some organizations have prohibited its internal use, industry-wide practices have not been defined. Ethical concerns have emerged because of GenAI's informational opacity and novelty. Because of respondents' many unaddressed concerns, they feel that human connection provides customers significant value.

Real Estate is a Relational Business

Respondents described technology replacing some careers but refuted the possibility of AI controlling the relational aspects of the real estate industry. Real estate professionals establish long-term relationships with clients built on trust. Throughout the process, professionals learn customers' transactional goals and achieve them. Customers provide real estate professionals with sensitive financial information and rely on them to provide industry contacts and while acting with discretion. Common transaction issues often require the input of professionals to maintain contractional obligations. Although people outside the real estate industry see property valuation and tours as the bulk of the industry's work, most of the real estate professional's time is spent behind the scenes. Respondent K mentioned that they know people who worry about new technologies changing the industry, but they strongly disagree with that sentiment because they know the importance of relationships.

When transactional issues inevitably arise, respondents believed that real estate professionals have the industry knowledge and tools to solve them. Geographic norms must be considered when handling transaction specifics, so GenAI may struggle to deliver effective solutions. Legal missteps usually result in fines, so a customer must trust their representative. GenAI would not effectively provide a recommendation for solving the issue. Another mentioned that customers build trust with a professional as part of the relationship. Because GenAI platforms only have access to existing published data, systems may fail to provide timely information. According to respondents, without the constant renewal of aggregated industry knowledge, GenAI could not provide enough information to lead a transaction. Understanding the process provides value to customers, and real estate professionals fill the gap between reality and a customer's desired outcome.

Respondents clarified that the relational aspect of the real estate business was the most crucial for both the agent and the customer. A strong relationship with trust allows the customer to lean on the professional when needed. Real estate professionals lend a listening ear to customers' problems, which is essential to developing a business relationship. Respondent B mentioned that people tend to reveal positive and negative life events to them since they have become deeply involved in their customers' lives. They explained that technologies cannot replicate this bond.

Emotional management. Emotions became a central theme in every interview when considering residential real estate transactions involving personal occupancy. Commercial real estate and real estate investment properties purely rely on financial consideration. Multiple interviewees working in residential real estate likened their role to a counselor, psychologist or even psychiatrist at points in a transaction. Another consideration for interviewees was translating information from a buyer to a seller. A real estate professional's job relies on emotional management between both parties in a real estate transaction.

Because real estate is a significant financial and emotional investment, transactional representatives must respectfully trade information between buyers and sellers. Additionally, they must be able to solve transactional problems legally and quickly. Customers must trust their representatives because they have so much at stake. While GenAI can effectively analyze information, transaction mediation requires care and consideration to deliver difficult news effectively. Additionally, real estate professional replacement is

unlikely because unique problems must be solved in each transaction. Because GenAI relies on a dataset, providing accurate information for each transaction is nearly impossible.

Future Development

Current GenAI technology relies on limited datasets and is updated infrequently. In addition to this, the veiled nature of GenAI's data poses problems for industrial users. Right now, users often struggle to get desired results from GenAI programs. However, this technology can quickly provide accurate information in seconds. Employees have already begun using GenAI in the workplace, but respondents felt that GenAI will become more beneficial to the real estate industry with future development.

Since current valuation, customer relationship management, and writing platforms offer tools to assist real estate professionals with marketing tasks partially, potential GenAI autonomy is exciting. Respondent B mentioned that GenAI will continue to provide better quality outputs and complete more professional tasks. New data inputs and further use will enhance the system's output and allow GenAI to work on various tasks. Additionally, companies have invested in industry-specific technology that will be more helpful to real estate. Even those who do not currently use GenAI believe it will assist them with their job tasks in the future because of its current development and industrial applications. Brokers at conferences have discussed GenAI's potential impact on the future workplace.

Beyond the real estate industry, Al Sawi and Alaa (2024) noted that the proofreading business saw GenAI's potential to impact the future industry. However, they felt that current technologies had gaps preventing their implementation. Real estate professionals mirror this sentiment. While the technology aids marketing materials right now, it cannot be relied upon. Many unanswered concerns may impact one's professional reputation if used the wrong way. However, real estate professionals see a potential for GenAI to help the industry become more client-centered, avoiding time-consuming work that occurs behind the scenes.

DISCUSSION

Theoretical Contributions & Practical Implications

Theoretical Contributions

This study contributes to a timely understanding of real estate professionals' GenAI use by interviewing those closest to the industry. Prior to conducting this study, real estate related literature failed to determine GenAI's application to the real estate industry. Previous real estate technology research used literature reviews to communicate the industry's technological adoption. Literature reviews addressing real estate technology mention many platforms without focusing on the specific impacts of GenAI. Much of this research mentions AI as a technology that real estate professionals use, but it fails to provide instances of industry adoption. Beyond AI adoption, GenAI's recent release creates a wider gap with unexplored text and image GenAI technology. This study leverages interviews to understand real estate professionals' GenAI usage habits and their sentiments toward the technology. Interviews provide respondents room to elaborate without requiring the substantial time investment associated with completing a written survey. Because of this, researchers and respondents can explore conversational tangents to understand the topic completely. Comprehensive interview data analysis opened the door to further research by highlighting professionals' most common feelings toward GenAI.

In addition to providing data on GenAI in the real estate industry, this research primes the exploration of other industries' GenAI adoption. This study has established a new thematic methodology by leveraging ChatGPT-4 to analyze interview data. Repeated use of this methodology will aid interviewer consistency in textual review with ChatGPT-4's unbiased analysis. In multi-coder projects, ChatGPT-4 will reduce the potential coder bias from influencing the final thematic analysis by reviewing data in one style. This method may assist future research in other industries.

Continuing industry adoption research is essential because the real estate industry, which has been slow to adopt technology previously, appears to be considering GenAI use now (Nemati, 2022). Technology costs real estate companies significant amounts of money, requiring a substantial return to make an

investment viable. A prohibitive cost and insufficient implementation understanding resulted in the industry's rejection of new technology in the past. Other industries may have similar adoption patterns with GenAI.

This research also opens the door to future research on GenAI-assisted marketing methods. Although interview data provided instances of GenAI in marketing, the research did not reveal its effectiveness compared to traditional marketing methods. Even though industries may quickly adapt to GenAI, ensuring it yields desirable results is essential to its long-term viability.

Practical Implications

Since GenAI technology was released to the public in the last two years, it has extreme potential for future development. Developers have not added new features or seriously improved GenAI models since they were released. Even though text based GenAI was not intended for industry application and remains relatively unchanged, employees use it in business. This study included an extensive age range of participants with differing experience levels. Most participants have already explored this technology's potential business application. Because of this, industries need to begin exploring GenAI's capabilities before technologies improve and they fall behind.

However, based on interviewees' experiences, the real estate industry appears to consider adopting new technologies already. Although the industry has been slow in accepting new technologies in the past, real estate changed due to the COVID-19 pandemic. Virtual showings and sight-unseen purchases have become more popular, requiring real estate professionals to use new technologies for customer connection. GenAI's recent release likely received attention because of increased technological exploration. In addition to a need from the real estate industry, this research highlights benefits to real estate professionals. GenAI reduces the time one spends developing marketing materials while freeing time for customer-facing activities. Even though concerns regarding AI's accuracy and style emerged, time-saving measures provide extreme value to professionals.

Documentation of GenAI use by real estate professionals may indicate a need for legislation and internal industry regulation. Without further investigation into consumer oriented GenAI technologies' data sources, professionals will not have any information regarding their content's source. This drastically increases the chance of misrepresentation and false information fed to consumers. Industry regulation regarding publicized information may result in local boards restricting GenAI use for customer protection. MLS rules may provide additional guidelines to professionals for property marketing, hindering the industry adoption of GenAI as currently used. In recent years, MLSs have restricted the use of digitally altered images. GenAI further blurs the line between reality and technological influence.

As such, GenAI adoption may require time to realize the most benefit. Without industry standards controlling the labeling and citation of sources, professionals may hurt themselves and their customers. GenAI platforms may also need time to improve outputs so that professionals no longer notice their use. To accomplish this, Industries may invest in training to realize the benefits of GenAI in the workplace. Even though the technology might not control most work tasks, getting acquainted with basic features may prove helpful in the future. Right now, the introduction of GenAI is clunky, revealing areas for future improvement. This research provides evidence of real estate professionals seeking GenAI to remain competitive. Real estate professionals who have not leveraged GenAI for business dealings may consider exploring the technology. Since respondents indicated that GenAI requires education to perform well, real estate professionals may begin experimenting before the topic becomes widely discussed. Subsets of the real estate industry may consider GenAI adoption to understand a potential investment's profitability.

Short-term investors seeking profits on properties may use GenAI to consider which characteristics yield the most return. Because GenAI has the power to analyze complex data, isolating value driving features may provide insight into which investments have the most profit potential. Additionally, investing in proper design decisions based on a particular geographic location may assist investors in making rationally bound decisions in an inherently emotional area. Minimal interviewee resistance to valuation technologies presents potential for GenAI assisted recommendations based on market data. Generative image platforms may also arm investors with information to sell a property before a completed renovation.

In many cases, customers want to visualize their purchase. Complex analysis may entice investors to scale projects or provide surety that emerging investors need to begin purchasing property.

LIMITATIONS, FUTURE DIRECTIONS, AND CONCLUSION

Limitations

Generalizability may be impacted because of the limited pool of interviewees working in a similar real estate environment. These interviewees primarily work in Central and Southwest Florida, so a national pool of real estate professionals was not interviewed. Florida law assumes that all real estate professionals act as transaction brokers unless established in writing, so professionals may have different relationships with their customers in areas where fiduciary relationships are the norm. Although the relatively small sample of 13 agents limits generalizability to a larger population, the diverse characteristics of each agent, including age, industry experience, and artificial intelligence experience, represent a wide group of real estate professionals. Attitudes and experiences may change based on the culture of the area in which an agent works. While agents from various age groups were interviewed, forty- to fifty-year-old agents were the primary age group included in this study. A more balanced age group may yield different outcomes. While this study focused on the direct impacts of real estate professionals' job tasks, the interview's design emphasized the role of a transaction's listing broker.

Categorizing respondents by their real estate specialty, including commercial and residential real estate, failed to consider the potential impact of a professional's role in a transaction. For example, a transaction broker whose customer is the buyer may perceive GenAI differently because of the relationship they have with the buyer. Minimal experimental research on the real estate industry resulted in imprecise question formation**.** Because of this, we could not discern how GenAI may impact a buyer or how transaction brokers' perceptions differ when working with customers in different positions. While respondents described GenAI marketing tools that may aid either professional in a transaction, no question or respondent explicitly described the buyers' perception of GenAI marketing in a transaction. Future studies may consider a broader group of respondents with different transactional roles.

Future Directions

Because this research provided rich information, allowing for a thorough analysis, future research may be conducted to understand real estate professionals' attitudes better. A quantitative study to understand real estate professionals' sentiments toward GenAI would provide specific information to supplement this research. This research pinpointed feelings and uses of GenAI by real estate professionals, so a quantitative survey could focus on these critical sentiments to determine why someone chooses to use GenAI. GenAI's impact on professionals working with buyers should be included in this survey. Quantitative research also allows a larger sample size, gathering more information and strengthening results. The Technology Acceptance Model establishes a model to explain the pathway of user adoption of new technologies (Davis, 1989). This model would support future research to define catalysts of GenAI adoption. Interviewees noted the influence of others in their decision to use Gen AI, which opens up the potential of exploring the applicability of social comparison models of adoption (e.g., Feylessoufi et al., 2024). In addition to determining why professionals adopt GenAI, professionals must understand the effectiveness of GenAI marketing on customers.

Nearly all professionals using GenAI in this study indicated using it for property description development. Because of this, future research should leverage a controlled experiment to test customers' description preferences. This study design may include a human-written description, a GenAI-edited description, and a GenAI-composed description to understand how a lay audience reacts when considering their intention to view. Even though GenAI may enhance marketing efficiency, reduced effectiveness could counteract any gain from efficiency. To understand how property descriptions influence value, future research may attempt to link perceived value with multiple description types.

A three-pronged experimental design incorporating a GenAI-composed description, a GenAI-assisted description, and a human-written description for test listings may help to determine GenAI's value in the

real estate industry. By asking respondents to attach monetary values to the properties based on their description, researchers will determine the effectiveness of GenAI descriptions in communicating value to customers. Even though efficiency has motivated AI's adoption, value creation would begin an even more pivotal shift toward GenAI.

Researchers may launch a second study to determine which characteristics should be emphasized in listing descriptions. Asking respondents to identify value drivers in descriptions may help to identify critical property features. Human or GenAI composed descriptions may be used depending on the prior study's results. Pairing value deriving composition structures and characteristics will potentially yield a description with the highest perceived value.

CONCLUSION

Generative artificial intelligence's public release has changed personal and professional lives by offering instant solutions to pressing problems. Even though the real estate industry has slowly adopted technologies in the past, GenAI has quickly impacted the industry. In the last decade, AI has become central to property valuation tools. In most cases, professionals do not understand the algorithmic components of property pricing. By abandoning traditional valuation methods, professionals have acquainted themselves with information provided by technology. The shift toward technological trust is a catalyst to GenAI's transition into the real estate industry because professionals have parted with the control of manual resource development. GenAI technology takes this further than some may be comfortable with, but it also saves crucial time.

GenAI diffusion. The real estate industry's compensation structure likely influences the quick diffusion of GenAI. Real estate professionals receive compensation when successfully completing primary selling tasks including negotiations and showings. In many cases, time is spent on marketing with the aim of drawing future business. Although this is a worthy cause, it does not immediately contribute to selling a property or finding a buyer. GenAI may help develop marketing materials intended to sell a property, like flyers or mailers, but most buyers find their home through the Internet. Property descriptions have become less imperative since websites and applications readily share pictures with customers. Real estate professionals may ensure they have high-quality photos rather than investing time in property descriptions that support the photos. Considering types of real estate professionals, residential real estate professionals have more opportunities to engage customers emotionally with advanced photography and well-worded descriptions than commercial real estate professionals. This is because commercial properties are typically purchased as a cash producing investment tailored to the purchaser's financial needs. The purchase is solely based on financials and basic property information. GenAI typically provides satisfactory results in simple descriptions, allowing professionals to focus on more imperative tasks.

Some of real estate professionals' most crucial skills include contract preparation and the adequate handling of customers' financial information. Additionally, professionals must foster a social relationship with their customer to reduce the relational uncertainty. Since real estate transactions require immense vulnerability from a customer, divulging information on finances, personal preferences, and family, customers seek to understand their real estate professional by creating a social relationship built on trust. Customers learn more about the professional, preventing an imbalanced relationship. Even though relationship building is not required in the real estate industry, to provide excellent service, a professional must work to build trust.

GenAI brokerage investment. Because national and international brokerages heavily invest in GenAI, they may feel that the technology will deliver superior performance. Significant investments may increase real estate professional retention by making existing agents more effective. As brokerages adopt GenAI technology, the current real estate industry structure may shift.

Currently, the real estate industry is relatively commoditized, with professionals seeking to differentiate themselves through marketing and competitive pricing. However, mass GenAI adoption may force professionals to incorporate GenAI to provide cutting-edge customer service. Professionals who fail to learn the technology may conduct less business and leave the industry. Without computer skills today, real estate

professionals could not meet industry demands. In the future, GenAI may become as pertinent to understand. Large brokerages who invest in GenAI may provide real estate professionals more value through differentiation. Customers who believe brokerages' technology will yield profitability may choose a brokerage based on their investment in GenAI.

In addition to premium investments from brokerages, a wider base of low-tier brokerages may emerge to provide less-personal service driven by GenAI. Since GenAI can provide compelling results today, future technology will likely handle multiple aspects of a transaction. For sellers unconcerned with personal relationships, low-cost listings may provide superior value. Beyond real estate professionals, investment groups may leverage GenAI to compare properties and select for desired characteristics.

Technologies are incorporating quantifiable data measures for a variety of property factors beyond market inclusion, and GenAI may be able to utilize such data to provide investment decisions for a specific market (Cajias, 2020). Developers and investors may leverage AI to pick locations based on desirable criteria in a local area. Beyond location criteria, GenAI may assist investors through data scraping to pull images and text from previous sales and determine which factors yield higher sales. Isolating specific features may assist investors in making risky decisions by grounding choices in data. Simple choices like cabinet color, flooring type, and interior style may cost investors thousands if chosen improperly. As GenAI continues to expand, navigating the industry structure to best serve real estate professionals will ensure the technology's longevity.

Industry shifts. The real estate industry's structure has come into question in recent months following the National Association of Realtors® proposed settlement concerning antitrust violations. Currently, in Florida, sellers pay buyers' brokers' commissions, inspiring allegiance to the seller. Even though Florida presumes transaction broker status with limited customer representation, compensational motivation to work toward the sellers' interests may negatively impact a transaction's buyer. GenAI may help to mediate some of the problems associated with this by informing buyers of an area's transaction norms and home prices. However, to correct conflicts of interest, the National Association of Realtors® proposed settlement requires buyers to sign a contract and register with their real estate professional (National Association of Realtors, 2024). Additionally, buyers will pay their professional instead of sellers. While the settlement is not final, this shift may result in significant industry changes.

Potential implications of the change may encourage buyers to resort to GenAI programs to find properties since they will likely have to pay their professional's commission. The industry's structure may further shift, requiring professionals to deliver superior customer service beyond the current standard. Because of this, the industry may become more dichotomous, accommodating low cost and concierge services only.

As GenAI technology becomes more accessible and improves, professionals may improve their ability to provide higher-level service, earning certifications and handling more of the transaction to provide a concierge experience. GenAI may become an equalizer that forces brokerages to carve a niche into a commoditized industry. For example, targeting customers' needs with compelling investment solutions that link investors may provide superior value to traditional real estate professionals. Since relationships promote current industry stability, leveraging social connections to provide value may continue justifying a real estate professional's role.

Exploring GenAI in the real estate context indicates that many real estate professionals consider the tool when developing marketing materials. According to respondents, the technology serves as a key to efficiency but comes at the cost of ethical dilemmas and quality concerns. Findings reveal that participants believe younger generations will champion the introduction of GenAI to the workplace and that GenAI requires human intervention until future developments ensure seamless results. Although respondents cited efficiency and productivity as highlights of generative artificial intelligence, they explained that serving customers' relational needs is the most crucial part of the job. GenAI's strengths may help real estate professionals eliminate the burden of daily work tasks and allow them to focus on the most essential part of their business: looking after the customer.

REFERENCES

Al Sawi, I., & Alaa, A. (2024). Navigating the impact: A study of editors' and proofreaders' perceptions of AI tools in editing and proofreading. *Discover Artificial Intelligence*, *4*(1). https://doi.org/10.1007/s44163-024-00116-5

Bajarin, T. (2022, December 28). 2022- The year AI took center stage. *Forbes*. Retrieved from https://www.forbes.com/sites/timbajarin/2022/12/28/2022the-year-ai-took-center-stage/?sh=6f6f6bde7f03

Baum, A. (2017). *PropTech 3.0: The future of real estate.* University of Oxford SAID Business School. Retrieved from https://www.sbs.ox.ac.uk/sites/default/files/2018-07/PropTech3.0.pdf

Braesemann, F., & Baum, A. (2020, April 16). PropTech: Turning real estate into a data-driven market? Papers.ssrn.com. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3607238

Cajias, M. (2020). Artificial intelligence and real estate - not just an evolution, a real game changer! *Journal of Property Investment & Finance*, *39*(1), 15–18. https://doi.org/10.1108/jpif-06-2020-0063

Chan, C.K.Y., & Hu, W. (2023). Students' voices on generative AI: Perceptions, benefits, and challenges in higher education. *International Journal of Educational Technology in Higher Education*, *20*(1), 1–18. https://doi.org/10.1186/s41239-023-00411-8

Chen, J., Hui, E. C. M., & Wang, Z. (2011). Perceived risk, anticipated regret and post-purchase experience in the real estate market: The case of China. *Housing Studies*, *26*(3), 385–402. https://doi.org/10.1080/02673037.2011.542098

Claffey, C. (2023, May 1). Why the real estate industry must start embracing technology. *Entrepreneur*. Retrieved from https://www.entrepreneur.com/starting-a-business/why-the-real-estate-industry-must-start-embracing-technology/450076

Conway, J. (2018). *Artificial intelligence and machine learning: Current applications in real estate.* [Masters thesis, Massachusetts Institute of Technology]. Retrieved from https://dspace.mit.edu/handle/1721.1/120609

Davenport, T.H. (2018). From analytics to artificial intelligence. *Journal of Business Analytics*, *1*(2), 1–8. https://doi.org/10.1080/2573234x.2018.1543535

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Feylessoufi, A., Kavadias, S., & Ralph, D. (2024). Behavioral Microfoundations of New Practice Adoption: The Effects of Rewards, Training and Population Dynamics. *Management Science*, *70*(10), 6685–6703. https://doi.org/10.1287/mnsc.2022.00305

Giles, M. (2018, February 21). The GANfather: The man who's given machines the gift of imagination. *MIT Technology Review*. Retrieved from https://www.technologyreview.com/2018/02/21/145289/the-ganfather-the-man-whos-given-machines-the-gift-of-imagination/

Haan, K. (2023, April 24). How businesses are using artificial intelligence in 2023. *Forbes Advisor*. Retrieved from https://www.forbes.com/advisor/business/software/ai-in-business/

Haleem, A., Javaid, M., Qadri, M.A., Singh, R.P., & Suman, R. (2022). Artificial intelligence (AI) applications for marketing: A literature-based study. *International Journal of Intelligent Networks*, *3*(3), 119–132. https://doi.org/10.1016/j.ijin.2022.08.005

Hansen, C. (2022, July 21). *Generative adversarial networks explained*. IBM Developer. Retrieved from https://developer.ibm.com/articles/generative-adversarial-networks-explained/

Jorner, J. (2020, December 17). Want to make more money in real estate development? Use AI. *Entrepreneur*. Retrieved from https://www.entrepreneur.com/starting-a-business/want-to-make-more-money-in-real-estate-development-use-ai/360915

Kania, K., & Kmieć, Ł. (2022). The Impact of Covid-19 on the Use of Modern Technologies By Real Estate Brokers. *Real Estate Management and Valuation*, *30*(2), 73–83. https://doi.org/10.2478/remav-2022-0015

Kingma, D.P., & Welling, M. (2013). *Auto-Encoding Variational Bayes* (arXiv:1312.6114). ArXiv. https://doi.org/10.48550/arXiv.1312.6114
Korn, J. (2023, September 22). How companies are embracing generative AI for employees...or not. *CNN Business*. Retrieved from https://www.cnn.com/2023/09/22/tech/generative-ai-corporate-policy/index.html
Lecko, D. (2024, October 1). The Complete Guide to AI in Real Estate. *DealMachine*. Retrieved from https://www.dealmachine.com/blog/ai-real-estate
Leeds, S. (2023, February 16). How AI Will Transform the Real Estate Market. *Entrepreneur*. Retrieved from https://www.entrepreneur.com/science-technology/how-will-artificial-intelligence-influence-real-estate/444213
Lewis, E.J. (2022). Technology Marketing: The Shift of Marketing Through Critical Technology Explained in the Real Estate Industry. *International Journal of Smart Education and Urban Society (IJSEUS)*, *13*(1), 1-47. https://doi.org/10.4018/IJSEUS.297073
Li, Z., Liang, C., Peng, J., & Yin, M. (2024, March 18). *The Value, Benefits, and Concerns of Generative AI-Powered Assistance in Writing* (arXiv:2403.12004). arXiv. https://doi.org/10.48550/arXiv.2403.12004
Lohr, S. (2023, September 28). IBM Tries to Ease Customers' Qualms About Using Generative AI. *The New York Times*. Retrieved from https://www.nytimes.com/2023/09/28/business/ibm-ai-data.html
Malonson, J. (2022, May 19). Blockchain Technology is Revolutionizing the Real Estate Industry. *Entrepreneur*. Retrieved from https://www.entrepreneur.com/money-finance/blockchain-technology-is-revolutionizing-the-real-estate/424715
Marr, B. (2023, September 19). What Is Generative AI: A Super-Simple Explanation Anyone Can Understand. *Forbes*. Retrieved from https://www.forbes.com/sites/bernardmarr/2023/09/19/what-is-generative-ai-a-super-simple-explanation-anyone-can-understand/?sh=6b1098e633e2
Martineau, K. (2023, April 20). What is generative AI? *IBM Research*. Retrieved from https://research.ibm.com/blog/what-is-generative-AI
Martínez-López, F.J., & Casillas, J. (2013). Artificial intelligence-based systems applied in industrial marketing: An historical overview, current and future insights. *Industrial Marketing Management*, *42*(4), 489–495. https://doi.org/10.1016/j.indmarman.2013.03.001
McCall, B. (2020). COVID-19 and artificial intelligence: Protecting healthcare workers and curbing the spread. *The Lancet Digital Health*, *2*(4). https://doi.org/10.1016/s2589-7500(20)30054-6
McKinsey & Company. (2024a, April 2). *What is generative AI?* McKinsey & Company. Retrieved from https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-generative-ai
McKinsey & Company. (2024b, April 30). *What is machine learning?* McKinsey & Company. Retrieved from https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-machine-learning
National Association of Realtors. (2024). *NAR Settlement Overview*. National Association of Realtors. Retrieved from https://cdn.nar.realtor/sites/default/files/documents/nar-settlement-overview-slides.pdf?_gl=1
Nemati, A. (2022, December 19). Why The Real Estate Industry Lags Behind in Technology—And How To Get Ahead. *Forbes Technology Council*. Retrieved from https://www.forbes.com/sites/forbestechcouncil/2022/12/19/why-the-real-estate-industry-lags-behind-in-technology-and-how-to-get-ahead/?sh=7bf2eecd2069
Noah, B., & Sethumadhavan, A. (2019). Generational differences in trust in digital assistants. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *63*(1), 206–210. https://doi.org/10.1177/1071181319631029
OpenAI. (2023, August 28). *Introducing ChatGPT Enterprise*. Openai.com. Retrieved from https://openai.com/blog/introducing-chatgpt-enterprise
Packer, B. (2021, December 7). How AI Will Transform the Housing-Market Consumer Experience. *Entrepreneur*. Retrieved from https://www.entrepreneur.com/living/how-ai-will-transform-the-housing-market-consumer-experience/398730

Petermann, J. (2021). Development of Real Estate Marketing – Trends for the Future. *Marketing Science & Inspirations*, *16*(4), 10–19. https://doi.org/10.46286/msi.2021.16.4.2

Ramachandran, P. (2020, March 12). *How Visual AI Will Empower Real Estate Industry*. Entrepreneur. Retrieved from https://www.entrepreneur.com/en-in/technology/application-of-visual-ai-in-real-estate-industry/347500

Rampini, L., & Re Cecconi, F. (2021, December 7). Artificial intelligence algorithms to predict Italian real estate market prices. *Journal of Property Investment & Finance*. https://doi.org/10.1108/jpif-08-2021-0073

Revell, E. (2023, October 2). AI playing 'transformative' role in reshaping the real estate industry. *FOXBusiness*. Retrieved from https://www.foxbusiness.com/technology/ai-playing-transformative-role-reshaping-real-estate-industry

Rutzen, M. (2023, June 20). AI in real estate: Where to start. *Forbes Technology Council*. Retrieved from https://www.forbes.com/sites/forbestechcouncil/2023/06/20/ai-in-real-estate-where-to-start/?sh=4bb56704a7fc

Ryman-Tubb, N.F., Krause, P., & Garn, W. (2018). How artificial intelligence and machine learning research impacts payment card fraud detection: A survey and industry benchmark. *Engineering Applications of Artificial Intelligence*, *76*, 130–157. https://doi.org/10.1016/j.engappai.2018.07.008

Smith, J., Feucht, K., Burns, R., & Coy, T. (2023). 2024 commercial real estate outlook: Finding terra firma. *Deloitte Center for Financial Services*. Retrieved from https://www2.deloitte.com/content/dam/insights/articles/us176319_cfs_fsi-outlook-commercial-real-estate/DI_2024-commercial-real-estate-outlook.pdf

Starr, C.W., Saginor, J., & Worzala, E. (2020). The rise of PropTech: Emerging industrial technologies and their impact on real estate. *Journal of Property Investment & Finance*, *39*(2), 157–169. https://doi.org/10.1108/jpif-08-2020-0090

Thomas Wood. (2020, August 13). Unsupervised Learning. *DeepAI*. Retrieved from https://deepai.org/machine-learning-glossary-and-terms/unsupervised-learning

Ullah, F., Sepasgozar, S., & Wang, C. (2018). A Systematic Review of Smart Real Estate Technology: Drivers of, and Barriers to, the Use of Digital Disruptive Technologies and Online Platforms. *Sustainability*, *10*(9), 3142. https://doi.org/10.3390/su10093142

Uszkoreit, J. (2017, August 31). *Transformer: A Novel Neural Network Architecture for Language Understanding*. Google Research. Retrieved from https://blog.research.google/2017/08/transformer-novel-neural-network.html

Venkatasubramanian, V. (2018, December 2). The promise of artificial intelligence in chemical engineering: Is it here, finally? *AIChE Journal*, *65*(2), 466–478. https://doi.org/10.1002/aic.16489

Viriato, J.C. (2019). AI and Machine Learning in Real Estate Investment. *The Journal of Portfolio Management*, *45*(7), 43–54. https://doi.org/10.3905/jpm.2019.45.7.043

Waller, M.A., & Fawcett, S.E. (2013, June 11). Data Science, Predictive Analytics, and Big Data: A Revolution That Will Transform Supply Chain Design and Management. *Journal of Business Logistics*, *34*(2), 77–84. https://doi.org/10.1111/jbl.12010

Yenduri, G., M, R., G, C.S., Y, S., Srivastava, G., Maddikunta, P.K.R., … Gadekallu, T.R. (2023, May 21). *Generative Pre-trained Transformer: A Comprehensive Review on Enabling Technologies, Potential Applications, Emerging Challenges, and Future Directions* (arXiv:2305.10435). arXiv. https://doi.org/10.48550/arXiv.2305.10435

APPENDIX

TABLE 1
PARTICIPANT INFORMATION

Participant	Interview Time	Age (Years)	Experience (Years)	Brokerages (#)	Transactions (#)	Team	GenAI User
A	19:43	38	1.5	1	23	Yes	Yes
B	25:51	43	20	3	300	Yes	Yes
C	17:09	31	10	2	500	No	No
D	30:03	33	14	3	100	No	No
E	14:30	50	17	2	255	No	No
F	12:53	50	28	2	100	Yes	Yes
G	16:25	21	1.5	2	12	No	Yes
H	27:25	26	1	1	2	No	Yes
I	19:41	68	15	4	115	No	No
J	17:35	50	24	1	288	Yes	Yes
K	18:04	36	10	3	300	Yes	Yes
L	14:30	75	45	3	800	No	No
M	10:57	57	7	2	45	No	Yes