

A study on automated property management in commercial real estate: a case of India

Commercial
real estate

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Abstract

Purpose – Property management in commercial real estate (CRE) is an important operational function that needs to be managed because it brings large cost implications to the organization. As India aspires to become a developed real estate market, analysis of the growing importance of automating property services and technology acceptance by stakeholders are two key concerns that need to be explicitly addressed. This study aims to examine the extent of property technology (PropTech) adoption in India and propose a technology-enabled stakeholder management model in Indian CRE.

Design/methodology/approach – The research is qualitative in nature and follows the grounded theory approach. Research data were collected by conducting a series of semi-structured interviews with 18 property management professionals from different prominent Indian companies using PropTech.

Findings – The findings suggested the nine most typical automated property management functions in Indian CRE. The result of this research is the automated property services model for stakeholder management in CRE. The model demonstrates the value of implementing technology in property services in India.

Practical implications – The study provides useful insights into how artificial intelligence (AI) in property management can be applied to address property-related challenges, various stakeholder needs and improve property performance in accordance with energy efficiency policies.

Originality/value – This paper attempts to add to the limited body of literature on technology in the property management domain. The model demonstrates how automated property services meet the needs of different stakeholders in CRE and provides remote working procedures within the COVID-19 pandemic context.

Keywords Automation, Property management, Workspace management, Stakeholder management

Paper type Research paper

1. Introduction

Real estate is evolving day by day due to advancements in the sector in terms of new and innovative technologies changing its phase from traditional to smart real estate (SRE) (Treleaven *et al.*, 2021). Globally, real estate has attracted huge financial investment recently. Since 2015, the amount invested in real estate technology-based companies worldwide is approximately US\$75.2 bn, and in India alone, the funding accounted for US\$ 6.5 bn Colliers (2020). According to the report of the National Real Estate Development Council (2021), India is estimated to be the fastest-growing economy in the world in terms of technology start-ups in the domain of real estate attracting funding at around US\$ 6.5 bn, growing at 7.3% in 2020 and projected to grow at 7.5% in 2021 and 2022. Shukla *et al.* (2019) stated that technology in real estate can be defined as the online platforms, hardware gadgets and software tools used by various stakeholders in the real estate sector, including real estate-focused investors, brokers, lenders, property owners and consumers, as well as the managers, to collect and disseminate data related to the realty market. Commercial real estate (CRE), part of the real estate portfolio, has seen a tremendous change in office design due to automation in various real estate functions (Saiz, 2020; Sanderson and Read, 2020). Artificial intelligence (AI) is the best innovation for assisting the management of the business in the cutting-edge world. Computer-based AI includes distinguishing routine undertakings done by people and subsequently joins them to decide, tackle issues and make analyses and decisions.

Findings of the past studies suggested that the ground of AI in the Indian CRE was being set way back before the COVID-19 outbreak; still it is at its nascent stage as there are very few



Indian real estate companies that are making use of technology to automate manpower requirements in the Indian CRE sector (Alhazmi, 2018; Lizieri, 2021; Mukherjee *et al.*, 2019). Studies suggest that there is limited literature available in the context of technological advancement patterns in the property management function of commercial office space, which is accounted as the largest spend and mainly focussed on enhancing tenant or customer satisfaction (Karvigh *et al.*, 2019; Mukherjee *et al.*, 2019). Also, numerous researchers have adopted the technology acceptance model (TAM) in a study related to the technology acceptance rate (Alzubi *et al.*, 2018; Thompson, 2015; Rauniar *et al.*, 2014). However, the usage of the TAM for automation in the property management function of commercial office space is under-researched.

Starr *et al.* (2021) stated that as the world is currently facing a serious mental and physical health challenge brought about by the pandemic COVID-19, AI has become the need of the hour in operational tasks of the CRE sector. AI can change the idea of office work and the way property information is exchanged between stakeholders of commercial office space by replacing the humans with robots and machine learning tools to perform the routine tasks and reducing manning requirements in different property management functions, like management of property data by online applications and software, virtual reality tool to permit forthcoming purchasers to take a virtual tour of the property through 3D videos, pictures and providing innovative technologies and solutions for precautionary interventions in the real estate industry. Studies in property technology (PropTech) adoption in office space have been undertaken in different parts of the world; however, such studies in India are limited due to the absence of reliable property information and data available online (Abankwa *et al.*, 2021; Alhazmi, 2018). Therefore, questions that need to be investigated are – what is the current level and scenario of PropTech adoption in Indian CRE? What is the stakeholder’s acceptance of PropTech in Indian CRE? And what do stakeholders perceive as benefits and detriments of using PropTech in Indian CRE? In conjunction with the above, this research also fulfills an identified need to study the present utilization of PropTech in the Indian office space. Also, this research investigates the stakeholder’s acceptance of PropTech in the Indian CRE market based on the need of automating their property management system, the software utilized by them, explores functional benefits, issues and challenges that they face in its implementation in Indian CRE.

In this study, an effort has been made to add to the existing body of literature on automated property management information in the Indian office space. This research study first focuses on the review of existing literature, and then an attempt to align the TAM framework with the technological advancement pattern in Indian CRE is made. Subsequently, the research methodology followed for data collection through the interviews with property professionals, and findings from the study are discussed. Finally, the practical implications and limitations of the study are presented in the summary section along with the future research direction.

2. Literature review

2.1 Theoretical framework

This study extensively surveys the literature to analyze the key determinants that impact the stakeholder’s choice of accepting and adopting new technology in the existing office layout. Davis (1989) presented the theory-based TAM on an information system that is aligned with the research topic of the study, which enlightens stakeholders about the utilization and acceptance of technologies in an existing system of technologies. Davis (1989) highlighted five key factors of TAM, namely, perceived usefulness, perceived ease of use, attitude toward using, behavioral intention to use and actual system use. As indicated by Fred, perceived usefulness is how much the utilization of a framework can increase the client’s business.

Therefore, the stakeholder’s acceptance of technology depends on whether they perceive technology to be useful for their business and how much technology can meet their end user-specific needs (Abankwa *et al.*, 2021). Though the broad utilization of TAM exists in worldwide businesses, its application in the property management domain of commercial office space has not been completely revealed (Alzubi *et al.*, 2018; Alhazmi, 2018; Sepasgozaar *et al.*, 2017; Rauniar *et al.*, 2014). Table 1 discusses the application of the TAM framework through technology driven CRE, linking automation technology to assist the framework in commercial office space. The current study is based on six important extensions of TAM: three each for perceived ease of use and perceived usefulness. These are perceived enjoyment, playfulness and usability, quality of service for perceived ease of use, self-efficacy, quality of systems and quality of information for perceived usefulness. Marking the importance of reducing manning requirements amid the COVID-19 phase, an online framework is needed that can help in continuing the operations in commercial office space even during and after times of crisis (Ullah and Sepasgozar, 2020).

2.2 Automation in commercial real estate

In the commercial realty sector, the idea of a sustainable business turned into a quickening pattern of the smart office building in 2010, which was used to discuss sustainable use of water, waste and energy handling strategies through the framework of ICT, which was utilized to screen, control and upgrade activities focused on optimizing operations of the

Criteria	Definition	Technology management	Needs addressed
Quality of information	Consistent and reliable data that attract a client to utilize the framework	Accurate and updated information, information novelty, 3D models	Easing property buying, rent decisions, provide reliable property data
Systems quality	Ethical, productive and smooth frameworks for conveying and spreading data	Website design and evaluation, loading speed, page location, loading information structure	The property buying, selling platform to enlist all details in seconds matching with the needs of the customer
Self-efficacy	The completeness of a framework regarding more highlights, more choices and channels	Online search filters, maps, richness of content, data sorting	Providing online search and filters on property buying, selling platform
Service quality	Quick, productive, responsive and reliable services made accessible to the end client	Customization, hyperlinks, lesser response time, consistent and lucrative graphics	Services related to property buying and property management to be easily accessible to the end client
Playfulness and usability	Offering greater gaming attributes and an interesting graphical interface to make the client progressively involved in the usage of the framework and improve utilization of the framework by pulling in more clients	Easy to use navigation tools, easy return, learning the website, finding information	Providing virtual simulations and game-based attractions by allowing users to understand easily the property buying, selling process
Perceived enjoyment	The feeling of simplicity of services available at fingertips including neighborhood perspectives for a superior way of life	Virtual property tours, neighborhood insights and infrastructure, distance from amusement areas and parks, lesser crime rates	Potential property buyers can walk through an apartment and understand the future implications of their decision

Source(s): Authors’ compilation

Table 1.
Application of TAM
criteria through
technology driven CRE

building. This is known as SRE (Lecomte, 2019; Ullah *et al.*, 2018). Over time, the concept of the smart building was being replaced by the need for cognitive spaces, which are designed keeping in mind the future needs of occupiers in terms of efficiencies in utilization of energy along with improved space usage, making of adaptable models of renting, preemptive rather than preventive maintenance in facilities management in terms of controlling temperature and air quality for tenants dependent on changing needs of inhabitants (Warren, 2018; Mawed and Hajj, 2017). Creative innovations and their utilization are regular in smart cities and the industry of real estate. Innovation has consistently been a pointer of smartness. Smart urban areas need SRE and smarter administration to succeed (Thompson, 2015). In this manner, it is fundamental to build up an evaluation model for SRE to make properties smarter and data more transparent that make a city smarter. The key features of SRE are user-centeredness, sustainability and the use of innovative technologies in such a way as to attain holistic benefits that are otherwise not attainable (Warren, 2018). Therefore, real estate technology is considered essential for the developing economy of India for building SRE in the Indian commercial sector.

Lizieri (2021) and Wofford *et al.* (2021) stated that real estate technology has become the need of the hour for sustaining the operations in the commercial sector during COVID-19. Some of the key concepts, explanations and definitions used in the study related to CRE functions are listed below in Table 2.

2.3 Impact of AI on commercial real estate sector

About seven percent of the world's labor force is employed in capital projects and infrastructure, so real estate is a major sector of the world economy. Individuals and businesses spend \$10 trillion per year on tech-related activities in real estate capital projects (McKinsey, 2018). The system of organization is considered AI-enabled when it can manage complex business intelligent goals using natural language processing (NLP), machine learning, problem-solving and algorithms to automate routine business tasks, which were otherwise performed by humans. Intelligent property management and smart construction through AI (Techmergence software) predict customer trends, adapting the business model to the market. A builder using AI-enabled Propstack software can predict what combination of services is most attractive to a client. NLP processing gadgets, such as SIRI and Amazon Echo's Alexa, are working as individual partners, personal assistants to perform capacities of chatbots used in handling customer queries. Smart searching and smart engines using machine learning are progressively used by property managers while choosing service providers, vendors and investors. Ariba is one such software used in the procurement cycle by facility managers (Oliinyk and Kozmenko, 2019). Propstack and Ressex (powered by Liaises Foras) are utilizing data processing and analytics to provide much-needed transparency in prices and values of real estate space. Ewert *et al.* (2018) stated that usage of AI in the real estate industry has a transformational impact on business productivity through better interaction between humans and business. Gill and Chick (2019) identified that usage of AI for managing property improves the performance metrics of an organization, positively contributing towards the financial goals of an organization along with improved client satisfaction through energy-efficient solutions. Hence, the adoption of AI in property management is considered essential for enhancing the human experience at work and improving organizational efficiency through sustainable solutions to meet the current property management-related needs of stakeholders.

3. Data and methodology

3.1 Research design

The study is based on exploratory research design using the approach of grounded theory methodology introduced by Corbin and Strauss (2008). The purpose of using the grounded

Property management	Property management is the management of infrastructure and is also known as infrastructure management. In India, property management is considered management of a set of properties or a bunch of assets of the commercial or residential complex or manufacturing units owned by an organization (Thompson, 2015)
Facilities management	Facilities management is a professional discipline, which primarily works as a support function. According to international organization for standardization, facilities management is defined as the “organizational function which integrates people, place and process within the built environment to improve the quality of life of people and the productivity of the core business.” Technology is now added to the above definition. In India, facility management is considered management of the office (Mukherjee <i>et al.</i> , 2019)
Space management	It is managing the office space concerning minimizing cost through changing the office layout and planning the churn rate of office staff accordingly (Sanderson and Read, 2020)
Activity-based workplace	It is a concept within office space management that provides the freedom to workers to make independent decisions on where and how to do the best work. It is like providing an agile workplace with different curated spaces and flexible seating areas (Karvigh <i>et al.</i> , 2019)
Procurement	Procurement in real estate is defined as taking decisions related to purchasing of real estate asset either on buy or lease or sale and leaseback and managing the essential infrastructural needs through supply management via vendor selection (Tuomela <i>et al.</i> , 2015)
Big data in commercial real estate	In the commercial real estate sector, big data is used for mining the stored information, which is being generated by third-party sources, a new generation of firms focused on collecting and analyzing market data and by unstructured sources, such as social media. It means layering the facts and figures on top of a company’s enterprise accounting or transactional records and digging deeper to detect new trends and opportunities (Hashem <i>et al.</i> , 2015)

Source(s): Authors’ compilation

Table 2.
Explanation of key
functions in CRE

theory approach is to generate a theory that is grounded in data systematically gathered and analyzed. Therefore, this approach fits the research objective of this study, which is to develop a theoretical model of stakeholder’s acceptance of the technology-enabled property management model in commercial office space through qualitative research. Furthermore, grounded theory is suitable because the research data are based on relevant prior theory, literature and insights of professional experiences which serve as a reference for understanding the verified generic concepts (Corbin and Strauss, 2015). Following the approach used in a similar study, exploratory research design provides flexibility to conduct future exploration with limited available information; as in this case, there is little research available on the stakeholder’s perception of PropTech adoption in the Indian CRE market (Huang *et al.*, 2021).

The main method used in the research process is coding. The three-phase coding approach of grounded theory (Saldaña, 2013) followed in this study was applied to the research data collected through the interviews. First, the data were categorized in the open coding phase to find the general themes in the data before conducting the interviews and prepare for the qualitative aspects of interview questions in advance. The initial technology-enabled property management model was also built during this phase. Second, the typical features and patterns were extracted in the axial coding phase during the interview process to identify the existing use of technologies for property management at each company interviewed. The initial model served as an axis in this phase, and the research data were connected to general themes to refine the outcome of the axial coding. Lastly, a new concept was developed in the

form of a technology-enabled stakeholder management model in commercial office space linking the relationship between patterns and the findings from each interview in the selective coding phase. At this phase, the single elements were integrated to bind the relevant categories of stakeholder's acceptance of the technology-enabled property management model in commercial office space.

3.2 Data source and collection

The researcher collected data through scholastic writings, interviews and surveys conducted with stakeholders (clients) of property management companies. To study the impact of innovation, machine learning, AI and expert system ideas on property management in Indian commercial office space before and during the period of COVID-19 numerous published research studies were analyzed. Contextual analysis of the publications available online as research papers, articles, Ph.D. thesis on this field of study and reports published by teams of property experts of Deloitte, Techmergence and Propmodo for the period 2010 to 2020 was conducted before undertaking the interview round. The search strategy used for the research is listed in [Table 3](#). Also, the attempt was to find out the present smart applications and devices, which are being used for property management on the board, which gave important knowledge into the kinds of advancements and how they assist CRE professionals in the investment and decision-making language. The analyst has attempted to utilize basic layman language, staying away from the numerical models and technical language.

The research data for the study were collected from semi-structured interviews conducted with 18 property management professionals working as top executives, chief technical officers, information researchers, engineers, facilities management workers, different workers of technology firms and commercial realty firms of different sizes. [Corbin and Strauss \(2015\)](#), [Huang et al. \(2021\)](#) and [Saldaña \(2013\)](#) recommended the use of a smaller sample size (3–5 interviewees) in an exploratory study to explore the research question with in-depth expert interviews for conclusive studies, which may not follow a rigorous methodology. Therefore, this research rests on 18 face-to-face semi-structured in-depth expert interviews. The interviewees were purposively selected from 18 different companies in India with strong technological competencies making substantial investments in property management technology. These companies were selected based on their number of employees, main business associated with commercial property management services and investment in technological advances. Purposive selection increases the chances of capturing valid in-depth insights ([Huang et al., 2021](#)). Interviewees were selected for their expertise either in implementing or adopting the PropTech services in the management of their company property. Therefore, three interviews with chief technical officers and top managers responsible for implementing PropTech and 13 interviews with property professionals (facility managers, data managers, property managers) responsible for using (adopting) PropTech services at the company property were included to gain a detailed understanding of the extent of PropTech adoption in their company and the stakeholder's perceptions of benefits and detriments of using PropTech in Indian CRE. Each interview lasted 20–45 min and was conducted in the interviewee's company micro-environment. To ensure the reliability of the sample's representativeness, the interviewees (stakeholders of PropTech services) from public entities and developed office buildings which have standardized automated property management services in seven metropolitan cities of India: Bangalore, Hyderabad, Chennai, Delhi/NCR, Mumbai, Kolkata and Pune were selected as sampling units. [Table 4](#) provides detailed information on the companies selected. Also, the upper management staff, including top executives and chief technical officers of commercial property management, were included in the study. This shows that despite a relatively small sample size, a diverse group of stakeholders were involved in the study. Diversity in the

Type	Filters and strings	Search engine	Sub-type	Total	Share (%)	Portion (%)
Journals, Conference papers	TOPIC: Real Estate Tech OR Real Estate Technology OR Smart Real Estate OR Disruptive Technology in Real Estate OR Information dissemination OR Real Estate Technology Acceptance OR Big data OR Apps for dissemination OR AI and Robotics OR Networking tools like Cloud, SaaS, IoT and Drones, Chatbots OR 3D scanning used for data collection OR Property management Or Automation in document Storage Or Technology in Facilities Management Or Technology in office space managementPeriod: 2010-2020	Google Scholar, Web of Science, Scopus, Taylor and Francis, Emerald Insight, Science Direct, ASCE Library, SAGE, SaS, Harvard Business Review, IEEE Explore, Wiley	Technology-based Journals (DOCUMENT TYPE: Article OR Abstract OR Proceedings Paper)	85	37	58
			Case Studies	37	16	
			Review Papers	12	5	
Online Sources	TOPIC: Real Estate Tech OR Real Estate Technology OR Smart Real Estate OR Disruptive Technology in Real Estate OR Information dissemination OR Real Estate Technology Acceptance OR Web-Based dissemination OR Big data OR Apps for dissemination OR AI and Robotics OR Property management OR Automation in document Storage OR Technology in Facilities Management OR Technology in office space management Period: 2015-2020	Knight Frank, Deloitte, Prop Tech Propmodo, Techmergence, CRE Tech, Leverton Quora, TechCrunch, ProQuest	Research Reports	17	8	36
			Webpages	35	15	
			Blogs	30	13	

(continued)

Table 3.
Search strategy – a list of research publications and online sources

Type	Filters and strings	Search engine	Sub-type	Total	Share (%)	Portion (%)
Others	TOPIC: Real Estate Tech OR Real Estate technology OR Facilities Management – a professional guide OR Big data in Real Estate OR AI Current applications in real estate Period: 2015-2020	Walden University Scholar Works OR Online Digital repository OR Shodhganga	Theses	6	3	6
		Google Books, Web of Science, Scopus, Taylor and Francis, Science Direct	Book Chapters	6	3	

Note(s): In the above table, the percentage of sub-type of publication is reflected in the “share” column and the percentage on the type of publication is reflected in the “proportion” column

Table 3.

sample is recommended in qualitative studies as it provides insightful rigorous data to observe the existing pattern in the field, confirm the findings and make them more generalizable to verify the applicability of the model (Corbin and Strauss, 2015).

The stakeholders were encouraged to offer qualitative comments about the need of automating their property management system, software used, functional benefits and any issues they face following the system implementation in Indian CRE. The stakeholder classification was based on the association of the industry with property management services. It is important to note that the number of employees of the stakeholder company includes total employees working at all locations except for public agencies where the sample of Indian employees is considered to study the stakeholder company size. Some of the interviewees requested to remain anonymous and not to disclose their responses; it was therefore decided to apply the same rule and use code for the industries instead of actual company names.

4. Results and discussion

This section presents the interview results in the order in which they were discussed. This section discusses the current usage pattern of automated property management in the Indian CRE with direct quotes from the interviews. Second, it discusses the growing significance of the automated property management model. It can therefore be asserted that the usage of different AI technologies in Indian CRE has provided an energy-efficient solution for various property-related challenges related to property maintenance. Also, PropTech has reduced the manpower requirement in real estate functions, helped in following the protocol of social distancing and providing remote working procedures during the coronavirus outbreak. The results show the existence of ten automated property management areas, which are generally accepted by stakeholders in Indian CRE.

- (1) *Property management through building automation system:* The employees and management of companies interviewed have stressed that AI that allows cloud-based building management system through Energy Plus and Archibus programming used in property management functions is helping the facility managers in tracking the utility and energy consumption pattern, getting regular reminders on the maintenance of equipment and through sensors, IoT and relating

Stakeholder company	Stakeholder classification	Number of employees	Interviewee identifier	Interviewee job title
IT company	Consumer industry	Large (>95,000)	C1	Chief technical officer
IT company	Consumer industry	Medium (50,000–95,000)	C2	Facility manager
BPO consulting company	Consumer industry	Small (<50,000)	C3	Data manager
KPO consulting company	Consumer industry	Small (<50,000)	C4	Property manager
Telecommunication company	Consumer industry	Large (>95,000)	C5	Facility manager
Production company (oil and gas)	Consumer industry	Large (>95,000)	C6	Facility manager
Production company (Utilities)	Consumer industry	Large (>95,000)	C7	Property manager
Production company (steel)	Consumer industry	Medium (50,000–95,000)	C8	Property manager
Real estate consulting company	Property professional industry	Medium (50,000–95,000)	P1	Facility manager
Developer company	Property professional industry	Large (>95,000)	P2	Chief technical officer
Real estate consulting company	Property professional industry	Medium (50,000–95,000)	P3	Data manager
Bank	Complementary industry	Medium (50,000–95,000)	R1	Property manager
Financial institution	Complementary industry	Large (>95,000)	R2	Property manager
Insurance company	Complementary industry	Medium (50,000–95,000)	R3	Data manager
Engineering and design consulting company	Complementary industry	Small (<50,000)	R4	Chief technical officer
Legal consultant company	Complementary industry	Large (>95,000)	R5	Data manager
Public agency	Government, regulatory authority	Large (>95,000)	G1	Facility manager
Public agency	Government, regulatory authority	Medium (50,000–95,000)	G2	Facility manager

Note(s): IT: Information technology; BPO: Business process outsourcing firm; KPO: Knowledge process outsourcing firm

Table 4.
Stakeholders interviewed

interface programming. C7 claimed that being a large production-based company with properties located across the globe, “utilization of Archibus programming has coordinated all the properties of their organization structure onto a singular programming interface, and this enables integrated workplace management helping property management or facilities management employees to track maintenance of equipment, manage workspace requirements and building maintenance with ease”.

C8 emphasized that “Archibus helps them track the performance of the equipment, levels of staffing and following move management, track performance of facility staff, consistence in compliance records, management of leasing documents and forecasting expansion of the portfolio”.

- (2) *Chatbots utilized in taking care of client inquiries:* It is observed that in the field of facilities management, chatbots help in improving customer or occupants’ needs, upgrade the experience and help negotiate or close the deal. P2 noted that chatbots used in office spaces help fill in the gap of assistants required to perform just administrative tasks for sending messages, planning gatherings, give the computerized data on demand, take renting recommendations or proposals on leasing, answers for routine requests, questions and give general information. P1 added that “chatbots urges clients to find the perfect property without managing a real face-to-face interaction required with a broker or property financial specialist”. Studies analyzed those applications helping in the concerned field in Indian CRE are Apartment Ocean, Zestimate and Automabots (Saiz, 2020; Shukla *et al.*, 2019; Warren, 2018).
- (3) *Automation in storing the document:* The legal consultant company (R5) noted that the AI-based Techmergence program helps in storing, highlighting important points and grouping the documents and find information as required through cloud-based data storage. R5 and P2 claimed to use Broker Savant’s Property Index as software for automating data management in an organization that uses profound figuring out how to scan through property flyers, data analyzing based on important information. P1 emphasized that automation in document storage “helps in identifying pertinent property information which is going to be useful in the Realty market; however, automation of reliable property information in CRE is one of the key concerns to address”.
- (4) *Deal coordinating and matching the desired requirements of investors:* P2 stated that as real estate investment trusts and private equity are making propels into the Indian Realty Market, investors started using AI-driven programming for setting up their criteria which helps in deal negotiation. Platforms, like Servus Connect, Accruent, Real Scout and Automabots, provide these services in foreign countries. Also, C1 emphasized the trend in realty market dealers to scan for the property that matches the tenant criteria (lease, area, security, the grade of building grade, terms of rent, the period of lock-in) and help take them decisions regarding extension or move out to another new space. The interviewers observed that in India, Propstack software and Zenplace offer comparable types of assistance.
- (5) *Image scanning used as identity:* The companies interviewed have identified security as an important arena of property management. It is also observed that all stakeholders interviewed have automated the security that uses picture scanning and image recognition for electronic access in the organization. C1 and C3, being an IT company, stated the use of “iris-based access to critical systems and rooms and face recognition access for all employees”. C6 explained that image scanning “has helped decrease human requirements in security”. From a public agency point of view, image scanning used as identity has helped in the “reduction of risks posed to the assets of an organization” by removing human blunders in security. The chief technical officers in the interview suggested the applications used in this field are bio connect and face value technologies in Indian CRE.

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- (6) *Reducing manning requirements in services of housekeeping*: “Cleaning administrations are a necessary piece in facilities management”, P4 explained. G1 claimed that “AI is transforming routine cleaning into automated cleaning” through mechanized sweepers, scrubbers, vacuum cleaners and burnishers. R2 noted that “automated housekeeping has become the need of the hour, especially in the case of large offices,” which require the heavy staff employed just in cleaning services. Findings from the interviews suggest Avid Bot is a robot used for cleaning in Indian CRE.
 - (7) *Automating the tasks of facilities management concerning mechanical, electrical and plumbing (MEP) services*: “International property consultants are grasping AI to give better organization administrations in Indian CRE for equipment services through Risk Exposure Mitigation and Intelligence (REMI)” as explained by C8 because MEP automation depends on company size and involves large expenses on software installation. However, interviews with chief technical officers (C1 and R6) stated that “the portfolio handled by them has been fully automated for MEP services” of facilities manager to recognize mechanical, electrical foundation and ecological conditions updates on the single server and empowers predictive maintenance centrally for 800 offices.
 - (8) *Management of space through the evolvement of concept “Activity-based workplace”*: “Numerous associations by and large determinedly resize their CRE necessities for changing the need for physical office space”, C5 explained. Consulting companies (C4, C5 and R6) with small company size emphasized that collaborative workspaces in terms of “Activity-based workplace in Indian CRE have now become a hot trend” as it helps in decreasing the carbon footprint and flexible working raises workplace productivity.
 - (9) *A savvy answer for managing Big Data*: P2 stated that “large information is reforming the space of savvy proposals” as it is used to follow human exercises, get inclinations, organize the RE market and along these lines make shrewd recommendations and suggestions, helping in deal-making in a better way, improve customer satisfaction and occupier experience. Interviews with property professional companies suggested AI-based customer relationship software, and Descartes Labs record perusing NLP used for data management. However, interviews with data managers and chief technical officers noted that in the Indian realty market, there is a large chunk of information that is unstructured.
 - (10) *Assistance in procurement and management of portfolio*: The interviews implied that procurement is the second largest spent after salaries in any organization. Analogically, it was observed that AI states the list of vendors that matches the inquiry and choice of the site if the purchaser wishes to know the best utilization of land, underutilized property and getting ready for the development of land resources for the portfolio, dealing with the limited available property information through Ariba software.

4.1 Growing significance of automation in commercial office space

The discussion explores the significance of automation in commercial office space during the current turbulent times. The study uncovers that AI is effectively used in the Indian commercial realty sector in different ways during the phase of COVID-19, abiding by the protocol of social distancing and helping in remote working procedures to the corporates.

The interviewers made qualitative comments on the current status and future evolution in property management, which are recorded as observations:

- (1) AI would altogether be able to diminish manual works, highlight fundamental issues, point out oversights and improve the organizing of reports, documentation of leases, agreements, contracts.
- (2) Streamlining the answers automatically for regular issues experienced in the case of property and facilities management.
- (3) Estimation of cost quotes depends on recently recorded data, current market circumstances and contingencies.
- (4) Automation in preparation of report would outline important areas of data reports and help to prepare summary sheets for projects with minimal time.

P2 has highlighted how AI is known as a “powerful tool in the Indian commercial realty sector” to spur real estate investments. R1 and G1 stated that although the impact of the deadly virus is obscure, most organizations have started using remote working systems; “AI in property management has become the need of the hour for every organization” as it can help in anticipating deals, boosting sales incomes, ensure worker commitment, help to design new office layout maintaining six feet space between employees in office floor and allow flexible work options to support virtual working.

5. Findings

The result findings suggested the use of AI in the property management domain of the commercial office space, the need of automating their property management system, software used, functional benefits and any issues they face following the system implementation in Indian CRE. The findings obtained through axial coding to sort out the relationship between each concept are mapped in [Table 5](#) that discusses the who, what and how analysis determining the use of AI in the property management domain of the commercial office space through various software addressing the needs of different stakeholders.

The stakeholders which require property information and are connected with the property management domain in commercial office space are consumers; property professionals engaged in property business (real estate brokers, developers and associations); complementary industries who indirectly facilitate the functions of property management (banks, law firms, lenders, contractors and other real estate industries) and government or regulatory authorities and their needs, such as property buying or selling or taking it on a rental basis; generating business and profits through real estate activities; investment or generating revenues through the transaction in the property market; protecting the rights of citizens and imposing taxes on the property transaction. To meet the different needs of the key real estate stakeholders, a technology-enabled stakeholder management model in commercial office space is essential which focuses more on the storage and dissemination of property information online through websites, social media and mobile applications using AI technologies India. [Figure 1](#) illustrates the estimated technology-enabled stakeholder management model in Indian CRE as per the findings from selective coding. [Figure 1](#) shows the growing relevance of property information in the Indian commercial office space to handle property management affairs along with meeting the needs of stakeholders. The figure shows that data management, a part of property management, has become extremely important in continuing the operations in commercial office space even during and after times of crisis.

What Tasks	Who Stakeholders affected	How Needs addressed	Software
Property management	Property managers	Automated building maintenance	Archibus
	Tenants and landlord	Tracking utility and energy consumption	
	Complementary industries Government authorities	Consistency in compliance records Taxes	
Deal closing	Property Buyers, sellers	Deal negotiation	Chatbots, applications, like Zestimate
	Real estate brokers	Automated renting recommendations	
	Facilities management	Reporting on maintenance requests Automated leasing proposals	
	Complementary industries Government authorities	Public information on profits and taxes	
Document storage	Tenants and landlord Property managers	Automated leasing documents Highlighting important information in leasing document	Broker savant property index
	Investors and complementary industries Government authorities	Predictions on cost, profit, and expansion of portfolio in future Highlights information about taxes	
	Real estate brokers and private equity firms Associations	Deal negotiation matching their suitability for risk Portfolio management and plans for expansion	
Investment management	Government or regulatory authorities	Highlights information about subsidy, taxes to attract foreign direct investment	Propstack, Zenplace
	Property managers	Decrease human requirements in security	
Security	Tenants and landlord	Improved security of employees and assets	Iris-based security applications
	Association	Reduction of risks posed to the assets	
	Facilities management	Automated cleaning of office space	
Housekeeping	Tenants and landlord Association Government authorities	Improved brand image Improved brand image Improved health and sanitization of staff	Robots used for cleaning like Avid Bots

Table 5.
Stakeholder
management model on
usage of automated
property management
(continued)

What Tasks	Who Stakeholders affected	How Needs addressed	Software
MEP services	Facilities management	Reporting on equipment maintenance	Risk exposure mitigation and intelligence (REMI)
	Complementary industries Association	Minimizing cost for vendor supply chain Minimizing cost on MEP services	
Space management	Association	Reducing physical space requirements	Flexible and activity-based office layout
	Complementary industries Government authorities	Enhances the role of knowledge processing outsourcing Reducing carbon footprint	
Big data	Tenants, real estate brokers, developers	Property buying or selling	Customer relationship software and natural language processing
	Associations Complementary industries Government authorities	Profits Business management and profits Taxes	

Table 5. Note(s): The source is the authors' analysis from the interview database

6. Conclusion

Analyzing the need for an automated property management model in Indian CRE through interviews with stakeholders from various industries provided the opportunity to observe this phenomenon in a homogeneous context. Companies that regard property management as a core to their business and have a large company portfolio are better aware of property-related risks and therefore have fully automated the property management functions to eliminate weaknesses and take advantage of opportunities. Nevertheless, all respondents have recognized that automation in property management is an increasingly important area for organization efficiency as the interviews implied that real estate is the second largest spent after salaries in any organization. Therefore, if real estate is managed well in an organization, it can bring huge cost savings. The findings show that AI has positively impacted the way property management is currently practiced in Indian CRE by providing a set of technological tools (software) that are used to address and anticipate many property-related challenges varying from property predictive maintenance, efficiencies in utilization of energy along with improved space usage, making possible adaptable models of renting, meet stakeholders needs and improve inhabitant satisfaction through energy-efficient solutions.

The results indicate the changing nature of the workplace to adapt technology extensions of TAM in the property management domain. However, the quality of information is still observed as an issue in Indian CRE. Though the ground of AI in the Indian commercial office space was being set way back before the COVID-19 outbreak, it is still at its nascent stage as there are very few Indian real estate companies that are making use of the technologies to automate real estate functions (Shukla *et al.*, 2019, Mukherjee *et al.*, 2019; Lizieri, 2021). But, now due to a sudden pandemic global healthcare issue raised by the deadly virus, it has become the need of the hour, which can help in reducing manpower requirements in the Indian CRE sector. Data analysis is assuming an indispensable job in the effect of COVID-19 around the globe. Associations are utilizing data from the board and AI in this episode to upgrade ordinary activities (Treleven *et al.*, 2021). The division has a ton of information, yet

Technology-Enabled Stakeholder Management Model in Commercial Office Space

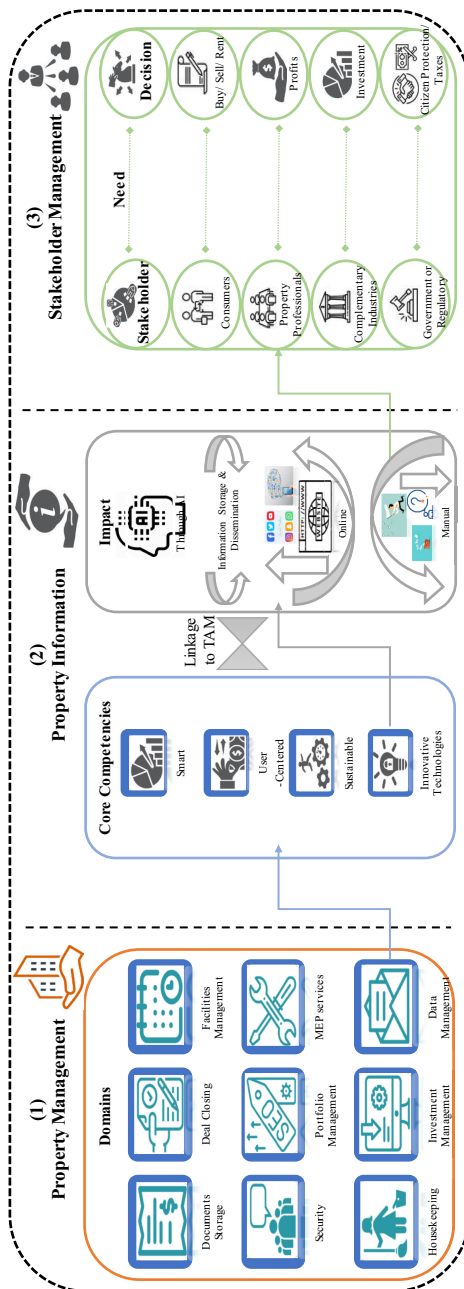


Figure 1.
Technology-enabled
stakeholder
management model in
commercial office space

there is a genuine deficiency of “valuable and transparent information” in the Indian CRE sector, which is one of the essentials for AI (Warren, 2018). Automation in the property management domain highly requires property information to be available online for different property management functions allowing the operations of office space not to get affected during turbulent times. For PropTech adoption in India, the real estate industry will need more consistency and transparency in standards to be followed for smarter technology adoption to make data more transparent and properties smarter as technologies become end-user specific.

6.1 Implications

This research has a deep managerial practical implication and practitioners in property management domain indicating the automation in data management, a part of property management, has become extremely important in continuing the operations in commercial office space even during and after the times of crisis. Property management is recognized as a significant factor in CRE development globally because of the essence of managing operations within the cost budget of an organization. Property management firms are people-aware and engage them in everything they do. When technology has a high maturity level in an organization, it allows better communication and engagement of stakeholders. Moreover, advanced technology usually involves communication, sustainability, organization and society. The generic technology-enabled stakeholder management model in CRE consists of the nine most typical automated property management functions that were identified in 18 interview sessions with property professionals in India. This model provides a holistic approach to automated property management practices that can be used as a benchmark for the companies that have started their journey towards automation in property management. Additional practical implications include active communication with the stakeholder needs through automated property management in Indian CRE.

6.2 Limitations and suggestions for future research

This study was focused on the automation of property information in nine major functions of property management. However, the property management domain is subject to wider scope with different operational functions of the organization included in it as per the convenience of tenant satisfaction. Second, the applications or software available to automate the property management domain are stated in the Indian context, and they can vary across different organizations within India with the inception of new technology in the sector and can vary across the globe.

This study is purely based on a qualitative research design describing the current usage of automation in the property management domain of Indian CRE. Therefore, quantitatively assessing the efficiency studies of adopting AI in property management is another topic of interest. Additionally, this study indicated that companies with small portfolios have not fully automated property management services. For this reason, it would be beneficial to conduct further research on the affordable technologies for automating property management in developing countries.

References

- Abankwa, D.A., Li, R.Y.M., Rowlinson, S. and Li, Y. (2021), “Exploring individual adaptability as a prerequisite for adjusting to technological changes in construction”, in Ahmed, S.M., Hampton, P., Azhar, S. and Saul, A.D. (Eds), *CITC 2019: Advances in Science, Technology and Innovation*, Springer, Cham, pp. 601-605.

- Alhazmi, N. (2018), "A theoretical framework for physical asset management practices", *Facilities*, Vol. 36 Nos 3/4, pp. 135-150.
- Alzubi, M., Aldubai, M. and Farea, M.M. (2018), "Using the technology acceptance model in understanding citizens' behavioural intention to use m-marketing among Jordanian citizen", *Journal of Business and Retail Management Research*, Vol. 12 No. 2, pp. 224-231.
- Colliers (2020), "Institutional investments in Indian real estate", available at: <https://www.colliers.com/en-in/news/capital-markets-and-industrial-outlook> (accessed 10 January 2021).
- Corbin, J. and Strauss, A. (2008), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 3rd ed., Sage Publications, Thousand Oaks, CA.
- Corbin, J. and Strauss, A. (2015), *Basics of Qualitative Research*, 4th ed., Sage Publications, Newbury Park, CA.
- Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly: Management Information Systems*, Vol. 13 No. 3, pp. 319-339.
- Ewert, M., Brodowicz, D.P. and Pospieszny, P. (2018), "Artificial intelligence and machines: a curse or blessing for corporate real estate?", *Corporate Real Estate*, Vol. 7 No. 4, pp. 98-115.
- Gill, T. and Chick, E. (2019), "A corporate real estate practitioner's guide to establishing a sustainable AI programme", *Corporate Real Estate*, Vol. 9 No. 2, pp. 144-158.
- Hashem, I.A.T., Yaqoob, I., Anuar, N.B., Mokhtar, S., Gani, A. and Ullah Khan, S. (2015), "The rise of 'big data' on cloud computing: review and open research issues", *Information Systems*, Vol. 47 No. 3, pp. 337-351.
- Huang, T., Nie, R. and Zhao, Y. (2021), "Archival knowledge in the field of personal archiving: an exploratory study based on grounded theory", *Journal of Documentation*, Vol. 77 No. 1, pp. 19-40.
- Karvigh, A.S., Becerik-Gerber, B. and Soibelman, L. (2019), "Intelligent adaptive automation: a framework for an activity-driven and user-centered building automation", *Energy and Buildings*, Vols 188/189 No. 4, pp. 184-199.
- Lecomte, P. (2019), "New boundaries: conceptual framework for the analysis of commercial real estate in smart cities", *Journal of Property Investment and Finance*, Vol. 37 No. 1, pp. 118-135.
- Lizieri, C. (2021), "Maestros and mythologies: some lockdown reflections", *Journal of Property Investment and Finance*, Vol. 39 No. 1, pp. 38-43.
- Mawed, M. and Hajj, A. (2017), "Using big data to improve the performance management: a case study from the UAE FM industry", *Facilities*, Vol. 35 Nos 13/14, pp. 746-765.
- McKinsey (2018), "The potential in real estate analytics", available at: <http://www.mckinsey.com/industries/the-potential-in-real-estate-analytics/capital-projects-and-infrastructure> (accessed 10 January 2021).
- Mukherjee, K.K., Iyer, K.C. and Sawhney, A. (2019), "Sector-level objectives and associated inhibiting and enabling factors for the Indian real estate sector from a process standardisation perspective", *Property Management*, Vol. 37 No. 3, pp. 367-389.
- National Real Estate Development Council (2021), "2021 India real estate outlook: a new growth cycle", available at: <http://www.naredco.in/notification/pdfs/jll-2021-india-real-estate-outlook-a-new-growth-cycle.pdf> (accessed 10 May 2021).
- Oliinyk, V. and Kozmenko, O. (2019), "Optimization of investment portfolio management", *Serbian Journal of Management*, Vol. 14 No. 2, pp. 373-387.
- Rauniar, R., Rawski, G., Yang, J. and Johnson, B. (2014), "Technology acceptance model (TAM) and social media usage: an empirical study on Facebook", *Journal of Enterprise Information Management*, Vol. 27 No. 1, pp. 6-30.
- Saiz, A. (2020), "Bricks, mortar, and Proptech: the economics of IT in brokerage, space utilization and commercial real estate finance", *Journal of Property Investment and Finance*, Vol. 38 No. 4, pp. 327-347.

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- Saldaña, J. (2013), *The Coding Manual for Qualitative Researchers*, 2nd ed., Sage Publications, Los Angeles, CA.
- Sanderson, D.C. and Read, D.C. (2020), "Recognizing and realizing the value of customer-focused property management", *Property Management*, Vol. 38 No. 5, pp. 749-764.
- Sepasgozaar, S.M.E., Shirowzhan, S. and Wang, C. (2017), "A scanner technology acceptance model for construction projects", *Procedia Engineering*, Vol. 180 No. 5, pp. 1237-1246.
- Shukla, A.K., Janmajaya, M., Abraham, A. and Muhuri, P.K. (2019), "Engineering applications of artificial intelligence: a bibliometric analysis of 30 years (1988-2018)", *Engineering Applications of Artificial Intelligence*, Vol. 85 No. 3, pp. 517-532.
- Starr, C.W., Saginor, J. and Worzala, E. (2021), "The rise of PropTech: emerging industrial technologies and their impact on real estate", *Journal of Property Investment and Finance*, Vol. 39 No. 2, pp. 157-169.
- Thompson, B. (2015), "Innovation in property management", *Journal of Property Investment and Finance*, Vol. 33 No. 5, pp. 436-445.
- Treleven, P., Barnett, J., Knight, A. and Serrano, W. (2021), "Real estate data marketplace", *AI Ethics*, Vol. 1 No. 4, pp. 3-21.
- Tuomela, P.M., Aaltonen, K. and Haapasalo, H. (2015), "Procurement in the real estate and construction sector (reecs) – preliminary context-specific attributes", *Procedia Economics and Finance*, Vol. 21 No. 4, pp. 264-270.
- Ullah, F. and Sepasgozar, S.M.E. (2020), "Key factors influencing purchase or rent decisions in smart real estate investments: a system dynamics approach using online forum thread data", *Sustainability*, Vol. 12 No. 11, pp. 1-36.
- Ullah, F., Sepasgozar, S.M.E. and 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*, Vol. 10 No. 9, pp. 31-42.
- Warren, C.M.J. (2018), "Global property market update", *Property Management*, Vol. 36 No. 2, pp. 134-136.
- Wofford, L.E., Wyman, D. and Starr, C.W. (2021), "Innovation and the ambidextrous mindset in commercial real estate: a paradox management approach", *Journal of Property Investment and Finance*, Vol. 39 No. 2, pp. 144-156.

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