

# Industry 4.0 Innovations for Indian SMEs in Real Estate Sector

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## Abstract

The advancement in technology reshaped the basic nature of real estate sector in India. There is a shift from traditional real estate to smart-technology based real estate sector. Smart technological innovation has resulted in change in the real estate sector. It has added lot of innovations in the real estate that offers better value to the consumers. The use of computers and automation has resulted in the autonomous systems that can control itself. These innovations are fueled by data and machine learning. These smart technological innovations can be in the form of automatic door with sensor or security systems or even conveniently aligned walls of the house or even robotic mason, that can built a wall on its own with little support human intervention. In this paper, industry 4.0 innovations like big data, artificial intelligence, augmented and virtual reality and real estate building technology and real estate operations automation are correlated with effect on the small and medium enterprises (SMEs) in real estate sector. This paper is an attempt to understand the innovations in the fourth industrial revolution on the real estate sector. Some regional examples representing effect of industry 4.0 on real estate are presented to provide better perspectives of the study. The paper is supported by three company specific examples from real estate sector. It concludes that industry 4.0 has started its flight in Indian real estate sector and small and medium enterprises can increase value additions from industry 4.0 innovations.

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## 1. Introduction

The next industrial revolution after industry 1.0, 2.0, 3.0 is industry 4.0. It is often described as smart manufacturing or industrial internet of things (IIOT), (Epicor, 2019).It is related to interconnectivity, automation, machine learning and real-time data. It heavily relies on innovative approach of digital technology. It combines the physical production with digital technology,(Epicor, 2019).Industry 4.0 has the capacity to modify behavior and adapt on its own in order to fit within environment. It may be

a database, web, wireless access, or sensors (IGI, 2019). Though computer, robots and automation has been in the business environment but internet and its application has extended their applications, (Monostori, 2014, Deloitte, 2015; Geissbauer,et. al. 2016).

There are different examples where use of digital technology can be seen, like in the plant pots where pots indicate the level of water required by the plant. It can be seen in the mobile phones that can sense wireless internet connection on its own. The smart technology relies on the use of internet to provide

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better connectivity. It may also be a combination of devices, internet and artificial intelligence. Industry 4.0 has provided smart systems providing better access to data and connectivity. There are smart classrooms that provide better and efficient education to students. The attendance of the students can be monitored with the sensors in an educational institute. Smart watch can not only tell time but it also allows the wearer to check emails or even click photographs. In the real estate sector, there are now smart houses and smart cities that are equipped with better technologies like sensors, automatic devices etc. to provide better housing service and overall, better quality. The focus of the study is to explore the industry 4.0 innovations SMEs in Indian real estate sector. SMEs are acting as support facilitators for big real estate developers.

The real estate sector is considered as a major source of employment generation. It also generates income in both the organized and unorganized sectors. The sector has become the preferred destination for investment (ibef, 2019). Smart technology aims at providing end-to-end connectivity in managing resources. In the words of Peter Williams, CEO, Deloitte Digital, said “Real estate agents will not be replaced by technology but by agents with technology”. People are likely to spend more on smart technology. Industry 4.0 provides benefits like increase in value of resources in which it is used, can attract more tenants or buyers or sellers, consumer has to spend less time in the market, and transform marketing real estate. This can also result in the emergence of new smart developments. Due to increase in economic and social changes, real estate sector will go through a transformation by 2020 as per a report by PwC, (2014). Consumers prefer comfort and security when they decide to buy home. There has been strong relation between lifestyle and real estate. Real estate and communities that intentionally put people’s health at the center of design, creation and redevelopment are the next

frontier in residential real estate, (Global Wellness Institute, 2017).

Technology has impacted our lives to a great extent and improved lifestyles as well. Now consumers don’t just want a home but they want a smart home. Innovations in smart technology has certainly created a revolution in real estate sector. Oyster (2018) in the study by ABI Research suggests that spending on smart home products will increase in future. This will be around \$123 billion by 2022. Due to potential growth in the smart home sector, many competitors are trying to gain early impact. The effect of industry 4.0 on real estate sector may be direct or indirect. This may be in the form of increase in value of property, increase in the sales, or improvement in the culture in itself or use of technology in constructing new structures.

The paper starts with the brief introduction about the topic. This is followed by methodology to be followed in the paper. Next part of the paper is the analysis which includes extensive literature review to answer the issues in the study. This further helps in industry 4.0 innovations that SMEs in the real estate sector can use. This is followed by discussion. This part discusses the findings and analyses the paper. The second last section concludes the study and is followed by limitations and future scope of the research study.

## **2. Methodology**

This section outlines the research methodology used in the study. It starts with an evaluation of literature on the topic. The analysis of the literature provides a systemic review of the industry 4.0 innovations in Indian SMEs in the real estate sector. Globally, real estate sector is one of the most recognized sectors. It is expected that contribution of real estate sector to country's GDP will be 13% and market size will be US \$ one trillion by 2030

(ibef, 2019). The industry 4.0 technologies are studied in categories –big data, artificial learning, the internet of things, building technology, augmented/ virtual reality and real estate operations automations. These innovations can be used by Indian SMEs in the real estate sector.

The study explores industry 4.0 innovations for Indian SMEs in the real estate sector. They have potential to result in better value of property or increase in sales or better overall culture. In the past research studies, previous industry revolutions i.e. industry 1.0, 2.0 3.0 have been studied. But there is paucity in the study of industry 4.0 innovations in the Indian SMEs in the real estate sector. The paper is an attempt to address the research gaps through literature review relating the dependent and independent variables through some specific regional examples. Apart from literature review and specific examples from Indian real estate market are also considered for better analysis of the paper. Few informal interviews are conducted with real estate property developers and property dealers in order to understand the importance of industry 4.0 for SMEs on the real estate sector. The selected sample for interview is from New Delhi, NCR. The time period for the interview is from July 2019 to Nov 2019.

The selection of the literature is on the basis on time period and topic analyzed in the paper. The time period of the research papers studied is in the range 2014 to 2019. Conscious decision is made to analyze recent papers in order to have current research perspectives. The research papers are selected from journals from the area of real estate technology, industry 4.0 and its attributes, effect of industry 4.0 on the real estate sector.

### 3. Analysis

The study is an attempt to explore relation of

industry 4.0 attributes on the real estate sector. This part has two sections, the first section presents literature review on the topic and the second section presents the region specific examples from Indian real estate market. At the end, section also presents three specific examples of real estate sector companies and their views on effects of industry 4.0 on real estate sector.

#### 3.1 Literature Review

There will be increase in demand for new types of warehousing, especially the ones that are closer to the customer. There will be willingness to use smart data for adding value. Smart technology can be used to verify and monitor information regarding tenant. This will help property owners make better decisions. Moreover, the advance technologies have potential to contribute towards greener buildings, (PwC, 2014). In case of Kenya, developers are promoting internet ready homes. In future, it is also estimated that internet of things (IoT) will be used in home searches. In India, internet of things has enabled consumers to search home as per convenience. Websites like magicbricks.com, 99acres.com and many more are providing easy mode of search, buy and sell options to the prospective consumers. Voice-driven applications that are embedded on phones will allow automatic communication with the buyers and sellers. The future certainly belongs to low-cost, sustainable and environment friendly housing. In Kenya, real estate developers are focusing on innovative ways of building houses. Companies like BlackRhino VR in Kenya are commercializing the potential of virtual reality. The customer can experience the property through the power of virtual reality. In 2014, 3D printed house was pioneered by Winsun, a company based in China. It resulted in 80% construction cost and 60 % labour cost, (Cytonn Technologies, 2019). This is because of increase in housing cost globally. House Affordability

has declined due to rising housing cost in comparison to the income level. The other factors include supply of houses, shortage of land, change in the demographics, population growth, ageing and change in house hold composition, (World economic forum, 2019).

Alhawaish, (2015) has investigated the relationship between construction flow and economic growth for Saudi Arabia during the 1970–2011 period. The real estate sector has linkages with other economic sectors (Bon and Pietroforte 1990; ILO 2001; Ewing & Wang 2005; Jackman, 2010). According to Hillebrandt (2000), general economic situation and expectations about future changes are the two factors affect construction demand. Due to changes in economic conditions globally, the real estate sector has undergone through diverse change. According to Rene Van Berkel, (2019) from UNIDO, Indian SMEs need to first standardize their procedures and operations rather than merely following industry 4.0 innovations, (Economic Times, 2019).

### 3.1.1 Industry 4.0 and its Building Blocks

The advancement in technology in the form of industry 4.0 has the potential to transform the production. It results in better efficiencies and relationships among suppliers, producers, and customers. Different report have suggested different building blocks of industry 4.0. A report by BCG (2019) suggests nine technology trends that form the building blocks of Industry 4.0. They are big data analytics, autonomous robots, simulation, horizontal/vertical system integration, the industrial internet of things, cyber-security, the cloud, additive manufacturing and augmented reality. Report by Deloitte (2016) suggests three main technologies of industry 4.0 are artificial intelligence, augmented reality and virtual reality and online to offline intelligence.

**Table 1.** Building Blocks of Industry 4.0

Building Blocks	Benefits
Artificial Intelligence	Artificial intelligence is used by companies to engage with customers online. It can be used to collate information to make efficient decisions. Companies are deploying AI technologies around their products, solutions, and services to facilitate a natural-language Q&A dialogue with customers online and through mobile applications. AI-driven platforms can aggregate information across systems to make recommendations based on a broad swath of data regarding customers, applications etc.
Augmented and Virtual Reality	Augmented reality and virtual reality has indeed motivated consumers to visit showroom so that they can physically experience a product. Moreover, it has also helped customers to take product trials and focus on the preferred features in a product. Virtual reality gives a virtual feelings to the customers.
Big Data	Big data helps customers and property dealers to find building as per requirements of consumers. It also appraises the profitability of the property for the buyer. With big data and analytics, property developers or even customers can review patterns to judge property as a good investment. The frequency patterns of the buyers can be analyzed to create a model for better demand forecasting.
The Internet of Things	The internet of things is technological infrastructure with combination of physical systems like thermostats, plumbing, electrical devices etc. that are connected with internet. This activates the ‘smart functions’ of these devices. It has profound impact on the real estate sector as it has redefined the way properties are bought, sold or owned. The IoT helps in increasing energy efficiency and also in automating and resolving building maintenance issues. This results in convenience for property buyers and sellers, (Fisher, n.d.).
The Cloud	An online property exchange network company, Private Exchange Australia (PEXA), is providing innovative solutions. It facilitates legal and finance professionals in transferring the required paperwork to the land registries.

According to three technologies will play a pivotal role in the real estate sector. The three technologies are virtual reality, the cloud and blockchain. A report by Gfk (2018) indicates that one-third of consumers in US have two or more smart devices. They further state that 27% of US consumers have more than three smart home devices. Almost 50% of the people were found to have at least one smart home technology. Moreover, the results also hint that 58% of the people think that smart homes will result in change in their lives in the future. As per Deloitte (2018), there will be expansion in the market for real estate service providers towards the area of complex, high-tech services. Therefore there is an opportunity to link smart technology with the new ways to serve in the real estate sector.

The third industrial revolution is characterized with large industrial and manufacturing complexes that are interconnected. The industry 4.0 will result in a major change in real estate sector resulting in flexible and multifunctional buildings. The focus will be on the modular type of properties. These can be used as per the requirement of business ranging from warehouse to even R&D facility. The effect can be further studies in three real estate parameters: building fit-out and architecture; locational factors; building function (BEOS, 2014).

### *3.2 Specific Examples from Indian Real Estate Market*

In India, government has developed a smart city mission to transform traditional cities into smart cities. The efforts are initiated to provide better connected and automated systems. For example, there is plan to start uniform smart card that can be used across different systems like transportation, education, hospitals etc. The uniform card can be used by passengers on different modes of public transport. The same card can be used for attendance of students in class and also as a library card to

issue books or pay fine. The library building will be equipped with automated systems to implement this plan. In order to create awareness, government has started round of competitions among states. States like Dadar and Nagar Haveli, Tamil Nadu have secured first and second positions as smart cities. The smart cities will promote mix use of land, expand housing opportunities, create walkable space, develop online services for better governance and citizen-friendly city, use of mobiles for better implementation and developing e-groups for better communication, having online control systems and cyber tour of worksites, (Smart Cities Mission, Government of India, 2018).

### *3.3 Views of Key Players in Indian Real Estate Sector*

NBM Media's publications NBM&CW that publishes on building and construction industry has compiled views of the prominent players in the real estate sector. The advancement in the technological innovations has potential to reshape real estate sector in India. Three enterprises have shared their view on smart technologies and real estate sector (NBM, n.d.).

#### *3.3.1 Transcon Developers*

Artificial intelligence, along with machine learning in real estate helps in managing cost, risk of mechanical systems. It further results in increased returns. Due to these reasons, AI has wider scope and ability to reduce operational cost, enhance customer service, in maintaining competence and in managing resource depletion within the industry. There are indicators of the positive response of real estate companies to address changing needs of their customers. There are different ways in artificial intelligence is modifying the real estate sector. Some of them are discussed below:

**Table 2.** Benefits of Artificial Intelligence

<b>Chatbots</b>	Many real estate companies in India have started deploying chat bots on their websites. These digital transformations have helped in bringing the overall cost down for customer services, and optimized the time intervals spent on answering customer queries.
<b>Investor Analytics</b>	Revenue and growth targets can be set by the property investors. They can then evaluate the risk involved in the property through intellectual robots. These robots can evaluate the investment parameters and suggest the necessary modifications to benefit the customers.
<b>Forecasting Loan Defaults</b>	This can help in forecasting loan defaults which results in increased profit. The risk valuation process becomes more organized. It focuses on the profitable investments.
<b>Deal Matching</b>	The investment criteria can be set by buyers and matched with the other deals.
<b>Construction Automation:</b>	There are tools used by companies to obtain quality material at best price from the best suppliers. The robots can act as a chief technological driver that increases profits and reduces cost.
<b>Property Management</b>	Another area where artificial intelligence can be used in property management. It can help in observing and planning the maintenance systems. Even the rental trends can be traced and updated on the basis of geographical zones.
<b>Intelligent Search Platforms</b>	Use of AI by the major search engines has provided major support to the users in getting more information about the property. There is refined search available now with detailed properties like information about neighborhood, available facilities etc.

Source : (NBM, n.d.)

*3.3.2 Synergy Property Development Services*

They have given importance to use of 'Drones' in building smart cities in a cost-effective, faster and safer manner. Drones will play a leading role in futuristic buildings. As per industry report UAVs (unmanned aerial vehicles) will have a fastest

growing market in India. It is expected to reach 885.7 million USD. The usage has seen growth of 239% globally. This is higher than any other commercial sector. In the real estate sector, use of drones can increase the value of a project throughout its lifecycle. They can help in completing huge projects on a timely basis and provide better finishing.

**Table 3.** Benefits of Drones

<b>Improved quality and thermal imaging</b>	High resolution cameras in drones can help in investigative tool building specific applications, for examples in case of inspection of roof insulation. They can also project energy inefficiencies graphically, help in identification of wet insulations in roof. They can display changes in the temperature within the building.
<b>Drones integration with BIM</b>	Drones are the main assets in case of for data-driven approach. They can play main support in BIM (Building Information Modeling) workflow. They provide scalable point cloud scanning and photography during the different stages of construction.
<b>Highly cost-effective in topographical surveys</b>	Drones can also carry inspection or surveys in a cost-effective manner. They can cut cost by half in case of topographic survey.
<b>Ensuring completion of projects</b>	The operational sites can be shut down for maintenance or inspection of pipes, flare stacks through use of drones. They can also help monitoring overall view of the work site. This will speed up the projects delivery and reduces unnecessary delays.
<b>Reducing risk and keeping people safe</b>	Their usage results in zero on-site incidents. The inspection work that a laborer does at a certain height, can be easily done by drone. Inspection can be safer, faster and more accurate. They can support the work of safety managers.
<b>Compact and intelligent results</b>	A smart camera can be installed on the drone. This camera can take digital photos. This provides a compact representation of the site. Even enhancement and maintenance plans can be carried out on the model generated through the camera.

Source : (NBM, n.d.)

**Table 4.** Automation in Real Estate Sector

<b>3D Printing (3D Printing (large-scale printing of homes))</b>	3D printing is going to reshape the way real estate will be developed. It can replace major amount of construction. This can be applied in residential, commercial or retail properties. It helps in reducing waste, cost and labour. It is possible to make buildings in the dense or inaccessible regions.
<b>Building Information Modelling (BIM)</b>	3D mock-ups of the planned structures can be produced through BIM software. But it has not been able to attract many users because of high human resource and technical cost. In India (Maharashtra), Nagpur Metro Rail Corporation has adopted 5D BIM technology. They have also created Issue-Based Information System (IBIS).
<b>Virtual / Augmented Reality Technology</b>	In real estate sector, Indian construction companies have started using Virtual/Augmented Reality technology. They are using it to enhance safety while training workers. Both workers and manager can visualize the construction hazards and prepare them for allows workers and work managers to visualize the more serious construction site hazards and prepare themselves for future.
<b>Drones</b>	Best used for managing and inspecting sites. They can map site and develop 2D and 3D images. They use a coordinate-based system to have accurate measurements.
<b>Brick-laying robots</b>	The repetitive and mechanical tasks can be done by robotics. This reduce the labor cost and increases the precision standards. 'Construction Robotics' has designed the semi-automated mason, 'SAM'. It can lay bricks faster and precisely. It is the first commercial bricklaying robot. It works And it increases their productivity by five times.

Source : (NBM, n.d.)

### 3.3.3 ANAROCK Property Consultants

Real estate sector has seen many disruptions in many facets due to technological changes. Innovative technologies like automation in construction, innovative designs, sustainable solutions, application of prefabricated material and recently, online marketing initiatives, are generating better values for the products.

## 4. Discussion

Industry 4.0 has caused ripples across the business environment. The application of smart technology has changed the way real estate sector operates. It has resulted in more greener and sustainable buildings. Use of technology is resulted in cost saving, better alternatives and efficient management practices. Industry 4.0 is all about implementing a right kind of infrastructure. It has flexible cost, smart, reliable, fast wireless communications and robust control systems. The paper has explained the industry 4.0 innovations like big data, artificial

intelligence, building technologies, real estate operations automation, internet of things, augmented and virtual reality on real estate sector. Smart technologies provide better, convenient and more options to the both buyers and sellers. It can provide an innovative way of letting a prospective buyer to view property or buyers and sellers can search each other on internet and make profitable deal. Document verification can be done efficiently. Innovative building technologies provide housing that is environment friendly and sustainable. The environmental friendly building technologies that use greener building material can be used to develop affordable housing. Three real estate parameters like building fit-out and architecture, locational factors and building function. Industry 4.0 would result in flexible buildings where buildings can be utilized for multi functional purpose. The storage building can be used as production facility and vice versa. The multi-storey building can be utilized for office space in day time and for evening clubs by evening. In Gurgaon, (Delhi, NCR (India), several property owners are generating better value from their

property. Also, real estate developers have rented individual rooms for different purposes to different organizations from different sectors. Government has plans to transform some old cities into smart cities. The smart city will provide a better environment to live with less air, land and water pollution. It will make use of online services to provide better governance. There will be use of automated systems connecting different areas like transportation, education, health etc. The informal interview with the real estate developers and property dealers revealed that the effect of industry 4.0 on real estate sector will not just due to industry 4.0 rather it will depend on the cost of technology. And Indian SMEs will face challenges like, cost, skilled manpower etc. to implement industry 4.0 innovations. They further suggested that high cost of technology will deter individuals from buying high technology based properties. Different type of the property i.e. commercial, residential or agricultural properties with respective criteria's may be listed on the dashboard for better deals. Three corporate examples highlight the benefits of industry 4.0. They have given stressed on the benefits of artificial intelligence and machine learning, drones and other technological innovations in real estate sector. In future, real estate companies are going to reap benefits from technologies like 3D printing, building information modelling (BIM), artificial intelligence and machine learning. Virtual and augmented technology has changed the way safety trainings are given to workers. Drones are helping in site inspection and measuring accurate specifications. The best industry 4.0 innovation is the creation of 'Construction Robots' that can be used as semi-automated masons. They result in faster and precise construction work. But there will be always cost barrier for small and medium enterprises.

## **5. Conclusion**

The study has tried to understand the Industry 4.0 innovations for Indian SMEs in the real estate

sector. Industry 4.0 technologies like big data, internet of things, building technology, augmented and virtual reality have facilitated better services to the prospective buyers and sellers. It has provided a better platform to both buyers and sellers to complete and control transactions faster. The process of purchase has been eased. Now there is no need to physically check the property in the initially stages of buying property. Customers can take virtual tours of the property and make decisions accordingly. Greener building technologies are used to provide eco-friendly and affordable housing for everyone. Big data can help in analyzing customer life cycle in the real estate sector. Few specific examples from Indian real estate market are presented in paper to provide better understanding of the topic. In India, the government plans to focus on smart cities that will see increased use of industry 4.0. This will provide better connectivity and automated systems to the citizens. Cost of technology is considered as a main factor deciding effect of industry 4.0 on the real estate sector. This is suggested by real estate developers and property dealers who are approached for the study. The SMEs in the real estate enterprises see a bright future through use of industry 4.0 technologies in creating value additions for customers. Moreover, Indian SMEs need to first use standardized operations rather using 'jugaad operations' before embracing industry 4.0 innovations.

## **Limitations of the Study**

The study is limited by the selection of single sector. The impact of industry 4.0 can also be studied in the different sectors like education, automobile, healthcare etc. The study is relies on the secondary data. This can be extended to the other continents also. This will provide the global perspective of the study. Last, quantitative analysis can be done to ascertain the degree of effect of industry 4.0 innovations on the Indian SMEs in the real estate sector.

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