Artificial intelligence (AI) and automation pose a long-run threat to demand for space. However, they will also support high-value human roles and drive productivity. Together, AI, the Internet of Things and alternative workplace solutions will transform the office. Workplaces of the future will use space more efficiently, have more collaborative space, and be healthier. We recommend that Indian enterprises embrace AI and invest in improving the skills of their staff. Meanwhile, developers should offer diversity and flexibility, and prepare for increasing automation of buildings. High rents and poor infrastructure are greater risks to continued growth in Indian property markets than AI.

Executive Summary
Colliers International India has recently organised seminars on the subject of the Impact of Artificial Intelligence on Real Estate in Chennai, Gurugram, Pune and Mumbai. Our speakers included numerous industry experts. Our own presentation drew on recent work by Colliers’ global Workplace Solutions teams and our Asian Project Management team, as well as earlier work by our research team in the Philippines.

Artificial intelligence (AI) and automation pose a long-run threat to demand for space, and have the potential to disrupt many industries including real estate. However, AI should also support high-value human roles and enhance productivity, thus creating value for businesses.

In combination with the Internet of Things (IoT) and the emerging alternative workplace solutions, AI promises to transform buildings and building management. The workplace of the future will use space more efficiently, have more collaborative space, and be greener and healthier. However, Indian enterprises can only reap the benefits of AI if they embrace it early and invest in increasing the skills of their staff.

The impact of AI will be felt increasingly over the next decade, with many routine roles likely to be replaced. Low visibility over future headcount needs will drive further demand for flexible working space in India. In addition, AI should boost industrial property as a new sector in the Indian market. We believe developers will need to adjust their strategies in response to the new trends (AI, IoT, activity-based or agile working) before the market forces them to do so. Overall, high rents and inadequate infrastructure still represent greater risks to continued growth in Indian property markets than AI.
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What is artificial intelligence?

According to a standard definition, artificial intelligence (AI) is “the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages”\(^1\). This definition is useful for two reasons. Firstly, it emphasises the range of activities which AI can perform. Secondly, it makes clear that AI encompasses computer programmes and software applications, and not simply the walking and talking robots of popular imagination (although such robots are now being designed and built).

However, AI can be used in a broader sense. According to one of the expert speakers at our seminars, AI is best understood as the platform underlying 10-12 emerging technologies, including mobile internet, the Internet of Things (IoT), advanced robotics and autonomous vehicles. These technologies employ either automated logic and reasoning, or large-scale processing of data.

All of them have the potential to disrupt established industries and traditional human working practices.

Al will complement human roles rather than replace them

Increasing automation certainly has the potential to replace human roles. It is natural for speculation about the scope for such replacement to be rife in India, where the technology sector accounts for about 60% of gross office absorption, due in large part to steady growth in the number of IT/BPM (information technology/business process management) staff.

We have examined some of the sectors and roles most vulnerable to replacement by automated processes. The sectors include manufacturing, retailing, real estate, technology, commercial banks and insurance. The roles most vulnerable to replacement are those involving routine, replicable tasks. We highlight telemarketers, secretaries, basic accounting functions, real estate agents and paralegals (see Figures 1 and 2).

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\(^1\) Source: Oxford Dictionary

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Figure 1: Chance of robots replacing human jobs

Probability robots will replace human jobs (in 20 years, 1 = Certain)

| Role                          | Probability
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Telemarketers</td>
<td>0.99</td>
</tr>
<tr>
<td>Accountant and auditors</td>
<td>0.94</td>
</tr>
<tr>
<td>Retail salespersons</td>
<td>0.88</td>
</tr>
<tr>
<td>Technical writers</td>
<td>0.96</td>
</tr>
<tr>
<td>Real-estate agents</td>
<td>0.88</td>
</tr>
<tr>
<td>Word processors and typists</td>
<td>0.91</td>
</tr>
<tr>
<td>Mechanics</td>
<td>0.85</td>
</tr>
<tr>
<td>Commercial pilots</td>
<td>0.55</td>
</tr>
<tr>
<td>Economists</td>
<td>0.45</td>
</tr>
<tr>
<td>Health technologists</td>
<td>0.43</td>
</tr>
<tr>
<td>Actors</td>
<td>0.43</td>
</tr>
<tr>
<td>Firefighters</td>
<td>0.37</td>
</tr>
<tr>
<td>Editors</td>
<td>0.60</td>
</tr>
<tr>
<td>Chemists</td>
<td>0.06</td>
</tr>
<tr>
<td>Clergy</td>
<td>0.09</td>
</tr>
<tr>
<td>Athletic trainers</td>
<td>0.09</td>
</tr>
<tr>
<td>Dentists</td>
<td>0.04</td>
</tr>
<tr>
<td>Recreational therapists</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Source: The Economist

However, many human functions are less vulnerable to automation. These include high value-added and decision-making roles, creative roles, and roles requiring high customer interaction. Moreover, even in sectors likely to be heavily affected by AI, the roles of robots and humans may well be complementary.

For example, in the real estate world, it seems very probable that drones will take over the task of surveying land and high-rise buildings. However, human planners will almost certainly decide the zoning suitability of the land surveyed by the drones. In the same way, 3D printers have already been used in experiments to construct emergency shelters or simple residential dwellings. However, humans will probably continue to design the dwellings, or at least adapt the basic designs to different markets and cultures. Figure 2 provides some additional examples.
In fact, we see AI as a productivity enhancement tool that should enable businesses to grow at a faster rate. According to a recent and widely quoted study by the McKinsey Global Institute, “A Future That Works” (January 2017), only 5% of occupations are candidates for full automation. However, almost every occupation has the potential to be up to about 30% automated. Furthermore, GDP growth over past 50 years reflects population growth and increasing productivity; however, with population growth slowing, the focus must now be on productivity gains. AI is a powerful tool for achieving this productivity growth. Many of the industry experts at our seminars agreed with this assessment; see, for example, the opinion of Hexaware Technologies at right.

We should also refer to our own report “Nots and Bots: Unboxing the Truth About Robotics’ Impact” by Colliers International (Philippines), published on 27 October 2016. This report cited studies by and surveys of Business Process Outsourcing (BPO) operators which suggested that they expected robots to improve processing efficiency by 30-35%, but that only a limited number expected widespread adoption of automated processes to result in loss of full-time employees. This conclusion is, of course, open to debate, with warnings increasing recently about the threat to BPO jobs in the Philippines from AI. We accept that there is the potential for disruption, notably among lower-value roles.

"I believe that AI will be a game changer in the Real Estate Industry by bringing in massive improvements in productivity by taking the humdrum activities out of the daily routine of an agent. It will do all the basic groundwork, collect, collate, tabulate as per preferences, taking into consideration culture, location, historical weather data, trending traffic, workforce mobility, etc. to arrive at solutions customised to individual preferences. It will change from delivering more information to delivering the right information to the customer."

Sujeet Oommen, Senior Vice President & Global Head, Corporate Affairs, Hexaware Technologies
Through increasing productivity, AI and automation should help to drive value creation for enterprises, both by accelerating revenue growth and by reducing costs. This was a point made most clearly by a speaker from the management consultancy Accenture at one of our seminars (see the opinion below). However, it was echoed by a speaker from a financial consultancy who emphasised how AI facilitates large-scale processing of data. Ownership of large volumes of data about customers in particular is a very important tool for businesses in driving value creation, but it is not yet shown on a company's balance sheet as an asset.

"Artificial Intelligence has the potential to create significant enterprise value by driving top line growth, increasing operational efficiencies and optimizing costs without compromising on ‘human’ values and sustainability. AI is real and now – democratization of skills, investment by organizations in managing data as a strategic asset and easy availability of high performance computing power is driving increased adoption across sectors.”

Tushar Walwadikar, Principal, Accenture Management Consulting

Key implications of AI for real estate

Colliers International has carried out extensive research on the future of the workplace, through our global Workplace Solutions teams and our Asian Project Management team as well as our Research Department. Based on our research, it seems reasonable to make the following general predictions about the implications for real estate of increasing automation and adoption of AI:

> Urbanisation will accelerate as jobs are replaced in manufacturing and agriculture
> The Internet of Things will transform buildings and building management
> Offices and industrial units are likely to become smaller, or at least more efficient
> Investment capital will migrate toward sources of human talent, notably university cities
> Technology, media and creative industries will become key sources of demand for new space
> Boundaries will blur between different categories of property, and there will be a shift towards mixed-use buildings
> Demand for dynamically managed logistics warehouses will strengthen

In the space of this introductory report, we cannot do justice to all the important themes mentioned above. We have therefore grouped some of them together, and over the rest of this report will concentrate on how the combination of AI, the Internet of Things and alternative workplace solutions will transform the design and efficiency of offices. We will also explore how increasing AI and the need to acquire and retain human talent will shape location decisions in the technology sector. This is an especially important theme in India.
Emerging trends will reshape the world of work

Alternative workplace solutions: activity-based and agile working

Globally, increasingly dynamic and mobile employees and the growing importance of the Generation Y/millennial demographic segment within the workforce have started changing office space design. Most offices have already moved from a cubicle structure to an open floor plan within office buildings that are equipped with several amenities and recreational areas. A flexible and dynamic workspace has become key in guarding against real estate challenges and in attracting talent. With work no longer being done just at a desk, workspace needs are changing to accommodate various activities for both mobile and static staff.

Besides the need to attract and retain new categories of employee, workplace design needs to address the fact that 30-40% of space in the typical office is under-utilised. More efficient office design will help to reduce real estate costs, which for most businesses represent the largest item of overheads after staff costs.

Colliers International believes that the way forward lies in alternative workplace solutions. These are workplace strategies defined to optimise space usage and people’s performance. They move far beyond simple open-plan layouts. One approach is activity-based working (ABW), which has the aim of facilitating the various activities in which employees engage during the day, and of maximising the output from those activities. ABW has a strong emphasis on promotion of collaborative space where staff can mingle and work together, as well as leisure space and quiet zones where staff can concentrate by themselves when necessary.

In our opinion, adoption of the ABW approach can drive significant cost reductions. In addition, by promoting collaboration and staff engagement, it drives productivity. Finally, through providing a workplace which looks and feels enjoyable and practical, it facilitates attraction and retention of human talent. Figure 4 summarises the needs of the workplace which ABW seeks to address.

Figure 3: Trends in office planning: redefinition of the workplace

Source: Colliers International Workplace Solutions teams; Colliers International India

Figure 4: Factors impacting current office needs

Source: Colliers International Workplace Solutions teams; Colliers International India
Activity-based working may not be the ideal space solution for all enterprises. Another approach to workplace design and, indeed, business practice in general, is “agile” working. This concept has its roots in the information technology sector, where many companies employ an iterative approach to software delivery that builds a product incrementally instead of delivering a completed product in one go. Typical of the agile organisation is a structure involving “squads”, i.e. multidisciplinary teams of no more than eight or nine people which are intended to be nimble and hence capable of reacting fast to changing client demands.

In an agile environment, the central focus of workspace organisation becomes the needs of the team rather than the needs of the individual. As noted in the Insights report, “The Future of Workplace and Occupancy” by the Occupier Services team of Colliers Asia (September 2017), agile working requires less workspace variety and limits flexible workspace usage. This is because an agile team spends most of its time during a specific project in one block of workspaces dedicated to that project. In most cases, unoccupied positions in these dedicated blocks are not used by other teams.

This situation raises the challenge that space efficiency may be lower in agile than in activity-based work environments, where it is more likely that employees use all available desks in the office or in their dedicated areas. However, this disadvantage is mitigated by the fact that agile working increases workplace occupancy. This is because agile organisations must be able to bring people physically together in the workplace in order to boost collaboration between employees with different areas of expertise.

Effective workplace strategies will not be prescriptive. They will be tailored to the needs of different sectors and companies, and may contain elements of both activity-based and agile working. What seems clear is that the workplace has entered a process of evolution which will leave the office quite different from both the old-fashioned grid pattern and the somewhat chaotic open-plan pattern of the 1990s and 2000s.

Internet of Things transforming buildings and building management

At the same time as office design is moving towards alternative workplace solutions, the Internet of Things (IoT) is starting to transform buildings and building management. IoT refers to the increasing ubiquity of interconnected sensors and computer chips, which are constantly transmitting and receiving data.

As also noted in our Insights report, “The Future of Workplace and Occupancy”\(^2\), one of the best examples of the way in which the Internet of Things is already transforming the workplace is the Edge building in Amsterdam, primarily occupied by the consulting and audit firm Deloitte. This building has not only been dubbed the “world’s most sustainable office building” but also the “smartest”.

When employees drive into the building, a camera recognises their licence plates, lets them in and directs them to an open parking spot. Employees use a smartphone application to locate open workstations based on their schedules and preferences. The app enables employees to adjust lighting and temperature — and even order groceries to be picked up at the end of the day.

By aggregating usage data, the building’s management can execute responsive decisions from refilling a coffee machine to temporarily closing an unused section of the building to save costs. Since opening the new space, Deloitte has noted a marked increase in employment applications specifically tied to a desire to work in the Edge building.

Two features of the design of the Edge building are especially noteworthy. Firstly, the LED panels designed by the Dutch technology company Philips specifically for the building, are powered by the same cables that carry data for the Internet. They are also packed with sensors that constantly monitor motion, light, temperature and humidity. In total, the Edge contains about 28,000 sensors. In effect, the Edge building has become intelligent – an example of the power of automation and AI in practice.

Secondly, about 2,500 Deloitte workers share only about 1,000 desks in the building. This is the concept of “hot desking” taken to its logical extreme: nobody in the building has a permanently assigned working station, and the app which finds staff a sitting desk, standing desk, work booth or place in a “concentration room” on their arrival for the day is another example of the power of AI in action.

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Spotlight on the technology sector

One of the sectors set to be heavily impacted by artificial intelligence is the technology sector. Colliers Asia carried out detailed interviews over the summer of 2017 with multinational, Chinese and Indian technology sector occupiers; a report commenting on our findings is in preparation. Here we only really need emphasise the fact that the companies we interviewed regarded acquisition of talent as their single greatest challenge.

To our surprise, the technology companies in our survey considered Beijing/North China to be the single greatest source of talent within Asia. Three places came in joint second place: Shanghai/East China, India (general) and India (Bangalore). There is room for dispute about whether Beijing really is so important. However, with several highly reputed universities and a well-known technology hub in the Zhongguancun area, there is no doubt that Beijing it is a centre of technical and academic excellence in a very large market where mobile internet and e-commerce are growing rapidly. Similar comments could be made about Bangalore (Bengaluru).

Looking forward, we believe that Investment capital will migrate toward sources of human talent, including both traditional university cities like Cambridge in the UK but also financial centres with a good technological reputation like Singapore. In a world where artificial intelligence is increasingly important, such centres will be the key sources of human talent required to design, programme and operate robots and automated systems.

Another finding from our interviews was that over 80% of the technology occupiers have a strategy to promote the health and well-being of their staff. This finding is important because it indicates that the technology companies are not interested in simply slashing costs – an objective which automation could help them to achieve. Rather, they are prepared to invest in systems and processes which benefit the health of the staff, because they perceive that doing so will help drive growth and value creation in the future.

The methods by which the technology occupiers promote the well-being of their staff vary. Two multinational companies that we interviewed focus on ergonomics within the office and healthy food options. A Chinese company focuses on gym rooms, dancing classes and provision of three meals per day for staff at its large campus facility in South China. The three Indian companies in our survey told us that they focus on annual health check-ups and counselling, medical camps and sponsored events.

Convergence of AI, IoT and alternative workplace solutions set to cut costs, boost returns and enhance well-being of staff

The convergence of alternative workplace solutions, the Internet of Things and artificial intelligence has the potential to change the shape of the workplace profoundly. On the one hand, it will almost certainly permit greater efficiency in use of space. Based on research in Singapore, Colliers’ Asia Workplace Solutions team recently estimated that the use of agile collaborative design by technology companies would permit usable square feet per employee to drop from 161 to 146 (i.e. from 15.0 to 13.6 sq metres) within three years.

In India, as an average across business sectors, usable area per employee has already fallen to 90-95 sq ft (8.4-8.8 sq metres) in many cities, and as low as 65-70 sq ft (6.0-6.5 sq metres) for offices in certain sectors, e.g. insurance. Adoption of alternative workplace designs, supplemented by dynamic reconfiguring of use of space during the day through AI solutions, will probably allow these numbers to fall even further. Greater efficiency in workplace use will reduce costs and increase return on assets for enterprises in many different sectors.

However, it is encouraging that this cost optimisation process does not require slashing staff. On the contrary, the workplace of the future will be able to hold more staff within a smaller space, and will be designed to ensure the health and well-being of those staff. Engaged, motivated and healthy employees are more productive.

We can summarise the implications of increasing automation and the shift to alternative workplace solutions for offices as follows:

> Activity-based workplaces use space more efficiently. This suggests average office size will shrink, or at least average area per person will shrink

> Much more space will be devoted to shared and collaborative uses

> Wellness’ strategies and the IoT will make the office far greener and healthier

> Staff will be better trained, have specialist skills, and be largely more mobile both within and outside work
AI: what it means for the Indian property sector

Near term: use of flexible working space set to intensify

Flexible working (a very similar concept to "coworking") is gaining popularity in India. Primary tenants of flexible working space are businesses which either have limited visibility over future expansion plans or believe that a collaborative environment is conducive to the success of their operation. The trend towards flexible working started in India about three years ago, and today there are more than 160 large and small flexible/shared space operators with over 1,000 operational centres across various Tier I and Tier II cities.

According to a recent study by Colliers India Research, flexible/shared working space is likely to account for at least 8-9 million sq ft (0.74-0.84 million sq metres) of leased office space across India by 2020. If so, then flexible working space will have emerged as a real estate category in its own right.

At first sight, artificial intelligence and automation have very little to do with flexible working. However, we have pointed out that one of the consequences of increasing automation is likely to be reduced visibility over future headcount needs. This is perhaps especially true in a sector like information technology which is subject to rapid market evolution.

This is precisely the kind of environment in which flexible working should demonstrate its true efficacy. We believe, therefore, that increasing automation will provide additional impetus to growth in demand for flexible working space from large occupiers. Existing flexible working operators and landlords should be ready to devise solutions to meet this demand.

Near term: AI technologies likely to appear in the real estate market

We list below several AI-based technologies that we expect to appear in the Indian real estate market over the next few years; we have referred to some of them earlier in this report. These technologies may be disruptive to existing working practices for property developers, occupiers and consultants, but not necessarily so. Early adoption and investment in training to ensure that staff use the technologies effectively are the best defences against disruption.

- **Building management Systems (BMS)** to control and monitor all mechanical and electrical systems and processes in commercial, residential, industrial and airport buildings
- **New data requirements for any property through Location Analytics** enabling minimisation of time required for decision making
- **Virtual Reality (VR)** for design and display of buildings so that prospective buyers or tenants can inspect future purchase or rental locations remotely
- **Drones** for surveying land and high-rise buildings and accurate examination of properties in remote locations
- **3D printers** for construction of emergency shelters or simple residential dwellings, and prefabrication of building units

**Figure 5: AI technologies most likely to be adopted in the near future**
Medium term: developers should develop new strategies for an AI-led world

Developers need to prepare for occupiers' needs to evolve rapidly as the AI revolution gathers pace. We expect the needs of large occupiers to revolve around intelligent buildings and office spaces equipped with advanced technology. In addition, we believe that occupiers will increasingly demand activity-based office designs that appeal to a more mobile workforce consisting largely of Generation Y/millennial and emerging Generation Z/post-millennial employees.

In our opinion, developers should be proactive and start to adopt such designs now. Naturally doing so requires additional investment. However, it is better for developers to lead the way than to be forced to adopt new strategies in response to changing circumstances and competition in the future. Moreover, buildings with modern designs are more likely to command premium rents in the cost-conscious Indian property market.

Furthermore, we recommend that developers should build a varied portfolio of buildings catering to occupiers not only in primary business districts but also in secondary or peripheral areas with lower rents. This is because the preferred locations of companies in the technology sector - so important in India - vary widely.

According to the interviews with Asian technology sector occupiers that we mentioned earlier, at present, the most common location for office facilities for technology companies appears to be the CBD fringe, although some of the companies are not primarily software or services groups but manufacturing enterprises with production facilities in business parks or campus facilities outside cities. Opinion was widely split about the best location for office location over the next five to ten years. The CBD fringe remained in the lead, but numerous preferences were also expressed for the CBD, business parks and campus facilities.

We should add that Indian developers and investors need to pay greater attention to industrial property as a category. At present this segment represents only a minor part of the organised Indian property market. However, we have mentioned that AI should allow both offices and industrial units to become more efficient, while in combination increasing automation and growth in e-commerce should mean higher demand for dynamically managed logistics warehouses. We think, therefore, that the industrial property market has the potential to expand significantly in India from now on especially after the implementation of the Goods & Services Tax (GST).

Summary of implications for India

We can summarise the implications of the spread of artificial intelligence for the Indian property world as follows:

> The impact of AI will be felt increasingly over the next decade. Routine roles such as simple call centre operators will be replaced first by AI

> Low visibility over future headcount needs will drive demand for flexible working space

> AI will boost industrial property as a new category in the Indian property market

> Companies will need to invest substantially in increasing the skills of their workforce

> A fresh business approach and proactive planning will play a key role in success for property developers in particular
Rents and poor infrastructure are greater threats

Artificial intelligence and automation have the potential to disrupt the real estate market significantly, both on a global scale and in India. However, we should conclude this introductory report into the impact of AI by pointing out that, at least in the short term, rising rents and poor infrastructure probably pose greater threats to the Indian property market.

Rents rising in India's IT-focused cities

Office rents in India's National Capital Region around Delhi and in Mumbai, traditionally the centres of economic and political power in the country, are more or less stable. However, as the charts below indicate, rents have been rising in the IT-focused cities of Bengaluru (Bangalore), Pune, Hyderabad. We expect this trend to persist over at least the next three years.

Landlords will need to be careful that they do not force out tenants in the IT-focused cities by raising rents excessively. We believe that Grade A developments and buildings with high accessibility will continue to command premium rents. We suggest that developers should continue to focus on such buildings, and preferably incorporate new features from the realms of AI and alternative workplace solutions that we have highlighted in this report.

Poor infrastructure holds economy back

Inadequate infrastructure is a familiar problem in India. While India's aggregate annual infrastructure investment amounts to 35% of GDP, the government estimates that it requires USD1.5 trillion in infrastructure investment over the next decade. Even this huge amount will probably only help bridge the infrastructure deficit rather than create room for future growth. 3

In particular, it is worth highlighting that workers in India typically face a daily commuting time to the office of one to two hours each way in most large cities. In the long term, AI will allow driverless cars and excellent real-time communication with the office, so that time need not be

Figure 6: Rental trends in leading Indian cities (INR per square foot per month)

Source: Colliers International India

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wasted. However, at least for the next few years, that long commuting time represents a major loss of productive time for the Indian economy.

We can point to the implications of lengthy commuting times at a very local level. For example, Colliers India Research has identified seven bottlenecks or "pain points" along the Outer Ring Road (ORR) which is one of the preferred locations for IT companies in Bengaluru (Bangalore). We estimate the aggregate economic loss per annum from hold-ups or accidents at these bottlenecks at INR31.2 crore (INR312 million, or about USD5 million). This is not a huge amount, but enough to be significant when combined with the loses on other such stretches across the country and additional economic losses from relatively slow internet connectivity and high electricity costs due to frequent power cuts.

Afterword: AI infrastructure and related problems

With regard to AI specifically, we should add that billions of dollars globally have been invested in the sector by venture capitalists (VCs) over the past few years. The US and China have led the way with very high funding in terms of total deals and dollars. In sharp contrast, Indian AI start-ups have collectively raised less than USD100 million over the period 2014-2017, according to data from the start-up analytics firm Tracxn⁴. This lack of investment may prove to be a major obstacle to the development of AI in India.

On the subject of infrastructure, we should also note that legacy IT systems may turn out to be a major drag on automation and adoption of artificial intelligence, both in India and elsewhere. Many older IT systems are not very intelligent, and getting them to work with systems which are intelligent is a process that could easily take several years.

396 offices in 68 countries

$2.6 billion in annual revenue

2 billion square feet under management

15,000 professionals and staff

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