Chapter 2
Green and Smart Building Trends

Green and Smart Buildings have evolved over the past two decades from being an environmental idealism to a business case with strong industry growth and a long-term business opportunity. Most of the building construction sector stakeholders such as architects, engineers, planners, owners and consultants are now increasingly focusing on green building projects in their portfolio. This is driven by factors such as client/market demand, lower operating costs, greater environmental consciousness, regulatory requirements/incentives and improved health and productivity benefits. Construction of green buildings rose to 325 million m^2 of new floor space in 2013, representing a \$260 billion market, according to a report by Lux Research (Lux Research 2014).

2.1 Business Case for Going Green

According to the latest report by Dodge Data and Analytics (formerly McGraw Hill Construction), the global green building activity continues to double every three years. The percentage of firms expecting to have more than 60 % of their projects certified green is anticipated to more than double from 18 % currently to 37 % by 2018. It is encouraging to note that the growth of green building activity is also happening in emerging economies such as countries in Asia and Africa. The top triggers for architects and engineers to focus on green buildings are client demand, environmental regulations, market demand and the notion of 'right thing to do'. However, there are several barriers or obstacles for green buildings such as higher perceived first costs, lack of public awareness, lack of political support and incentives, and the perception that green is for the high-end project sector only (Dodge Data and Analytics 2016).

The report also highlights several recognized business benefits of green buildings such as follows (in order of decreasing importance based on sector survey):

1. Lower operating costs (savings in energy and total life-cycle costs)
2. Quality assurance (provided by the documentation and certification)
3. Education of occupants about sustainability
4. Higher building value at point of sale
5. Future proofing of assets
6. Flexibility of design built into green buildings
7. Increased productivity for tenants
8. Higher rental rates
9. Higher occupancy rates.

A study conducted by Lux Research (Lux Research 2014) covered utility savings, rental rates, resale value and government incentives in green buildings and their impact on internal rate of returns. The following are their main findings:

- Energy efficiency codes offer unparalleled market opportunity for green buildings. While green building standards and certifications helped build market demand for green buildings, building energy efficiency codes can create a much larger market opportunity. In Germany, Lux estimates that in 2013, new floor space compliant with the EnEv 2009 code was 50 million m^2, or about 36 % of overall new construction.
- Green certification fuels growth and buildings with higher level of certification standards outperform their baseline peers. As an example, the report notes that higher rental income added $4.1 million in value to a model 80,000 ft^2 commercial building in Los Angeles.
- Internal rates of return are increased from subsidies. Incentives like Germany's subsidized interest rates for energy-efficient homes, or government cash rebates in India, can lead to an internal rate of return of 5–6 % over 15 years.

2.2 Smart Buildings Solutions on the Rise

Smart building solutions are attractive tools for energy management because they provide visibility into system-wide operational and energy efficiency and provide tools for analyzing, tracking, and communicating the impact of energy-efficiency improvements. According to a new IDC Energy Insights report (IDC 2015), smart building technology spending will grow from $6.3 billion in 2014 to $17.4 billion in 2019, registering a compound annual growth rate of 22.6 %. The most aggressive adoption will be in Asia/Pacific, North America, and Western Europe.

There is an increasing availability of building data than can be processed through big data analytics tools to understand possibilities of making building greener and smarter. There is also applications of analytics engines and cognitive computing to analyse and interpret the data to detect anomalies and identify opportunities to optimize building performance at all times. For the US, estimates predict that smarter buildings could save US$ 20–25 billion in annual energy costs. This opportunity is largely untapped today, as many building owners and operators are not yet aware of how data-driven optimizations can reduce energy consumption (Accenture 2011).

The adoption of smart building solutions in North America, Europe and Asia/Pacific is particularly positive due to a combination of policy and business dynamics, which help drive market awareness of the business value of these solutions and as a result the market demand. There are also growing regulations at the local, regional, and national levels driving awareness of the benefits of energy efficiency and energy benchmarking. In addition, a number of large corporations have made commitments to sustainability and energy management.

2.3   Green and Smart Buildings Standards and Regulations

Governments across most major economies of the world are starting to care about energy efficiency and sustainability in the building sector. This has resulted in several regulations, bylaws, codes and standards related to green buildings. Some governments have introduced clear incentives and sanctions related to green building performance. Although the level of activity and intervention from government bodies varies from region to region, it is clear that there is a clear positive shift towards and smart green buildings globally.

There are also various non-government bodies that are actively championing the growth and proliferation of green building standards and implementation. One such well known and highly active non-government entity is the Green Building Council. Green building councils are member-based, non-profit organisations that empower industry leaders to effect the transformation of the local building industry toward sustainability. With one hundred thousand buildings and almost 1 billion m^2 of green building space registered, the influence and impact of this global network is a significant force for social and environmental change. The World Green Building Council is a network of national green building councils in more than one hundred countries, making it the world's largest international organisation influencing the green building marketplace (please refer to their website: http://www.worldgbc.org for further details).

2.4 Financing Green and Smart Buildings

Another useful trend for the green building industry in the financing realm is the model of a Energy Services Company (ESCO) that provide innovative financing schemes along with the full suite of energy conservation measures. The initial or capital costs of implementing the energy conservation measures are financed through the energy savings achieved by the measures over a pre-determined period of operation of the building. Another slight variation of this is a 'performance based contract' where the ESCO only gets paid fully if the pre-determined energy savings are achieved through the implementation of energy savings measures. These mechanisms are useful for retrofitting or refurbishing existing buildings into green and smart buildings.

2.5 Zero Energy Buildings

The next frontier in Green and Smart Buildings is the move towards Zero energy buildings. Energy efficiency solutions have already become mainstream in many regions around the world. Some building developers are now pushing the limits and trying to differentiate themselves by going towards net zero energy buildings. A net zero-energy building (ZEB) is a residential or commercial building with greatly reduced energy needs through efficiency gains such that the balance of energy needs can be supplied with energy generated locally from renewable technologies. In this respect, the use of solar photovoltaic (Solar PV) technology on buildings for local renewable energy generation is gaining prominence. With the cost of solar PV components dropping exponentially over the last decade and availability of third party financing schemes, the adoption rate of solar PV in buildings has been increasing rapidly. Other technologies for on-site renewable energy generation include solar hot water collectors, small-scale wind power turbines and geothermal energy.

2.6 Buildings Enabled by IoT

The advent of Internet of Things (IoT) is also affecting the way green and smart buildings are getting connected with various stakeholders throughout the world. IoT for buildings can be imagined as a network for buildings that are embedded with electronics, software, sensors, and network connectivity that enables them to collect and exchange data. In 2016 and beyond, building owners and key decision makers will invest in an array of smart building solutions that embody the technology foundation of Internet of Things (IoT) and cloud computing, according to a new white paper from Navigant Research.

Rapid deployments of cost-effective data acquisition devices and the integration of IT and traditional building automation and controls are changing the industry of facilities management. This network-addressable IT backbone is generating continuous data streams associated with building operations. An evolving menu of software analytics and energy management services is leveraging this data to provide actionable insights for efficiency and optimization. The result is the development of intelligent buildings that are dynamic systems capable of managing energy consumption for efficiency and a whole suite of non-energy business improvements.

The whitepaper lists the following 10 trends that reflect the evolving facilities industry and the push for more intelligent buildings (Navigant Research 2016):

1. Building energy management systems (BEMS) will deliver benefits beyond energy efficiency. Building Energy Management System Revenue Is Expected to Reach $10.8 billion in 2024.
2. The energy cloud will redefine buildings as energy assets.
3. Climate change policy will mandate efficiency in buildings.
4. Intelligent buildings will optimize the occupant experience.
5. Innovative financing opportunities will disrupt the market.
6. Cyber security will be a key differentiator between intelligent building solutions.
7. Hardware and software analytics will improve health in buildings.
8. Intelligent building water management will emerge as a priority for innovators.
9. Smart cities will drive the development of intelligent buildings.
10. Electric utilities and energy providers will ramp investment in BEMSs.

2.7   People Centric Focus in Buildings

Buildings are also increasingly becoming people centric rather than engineering, construction or technology centric. The employee expectations are rising constantly for better technology in the workplace. This is leading to building owners, developers and facility managers to focus on providing more collaborative spaces, flexible and adaptable spaces, and increase their focus on occupant well-being and comfort. There is an increasing focus on building smarter workplaces that engage occupants, understand how they use buildings in new ways and get them involved in implementing sustainable practices.

2.8   Green Buildings at the Paris Climate Conference 2015

The world experienced a historical agreement on climate change mitigation action in the Paris Climate Conference in December 2015. It was for the first time in over 20 years of United Nations (UN) negotiations, that the Conference of Parties

(COP) was able to achieve a legally binding and universal agreement on climate, with the aim of keeping global warming below 2 °C.

The buildings sector's crucial role in mitigating climate change was also being recognised. For the first time in the history of climate negotiations, a Buildings Day was held on 3rd December 2015 at the Paris Climate conference. On this occasion, the Global Alliance for Buildings and Construction was launched to effectively to combat Climate Change. The alliance is supported by the United Nations Environment Programme and has been joined by 20 States, representing more than 1 billion people. It also has participation of 8 major corporations and over 50 national and international organisations.

The Global Alliance for Buildings and Construction (Global ABC) will work to facilitate mobilisation of international resources for efficient local operational solutions, align existing initiatives, commitments and programmes to achieve greater scale, and catalyse a greater pace and impact of climate action in the buildings and construction sector. The following are the objectives highlighted for this global alliance (UNEP 2016):

- Bring together all the relevant global players on a large scale around a common ambition and sustain this momentum to ensure that they work together over time;
- Increase the share of green building in international funding to implement new initiatives and increase the visibility of exemplary initiatives;
- Gather around a program of operational activities strategic networks and partners covering the full range of stakeholders in the building production chain;
- Promote initiatives and solutions by all the members signatory to the Alliance to make them reproducible and ensure their appropriation;
- Create a network for public authorities in charge of construction, to align regulations and financing towards low-carbon strategies.

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