LTIMindtree

DEEP POINT OF VIEW

Smart Spaces

Executive Summary

When it comes to creating an ideal living and working environment, we are entering a new era. It is no longer sufficient for companies just to offer a space for us to come to sit at one set desk and work. The idea of **"Smart Space"** is gaining momentum as we look to create a more efficient, interactive, and sustainable living and working environment. By definition, a Smart Space is an adaptable and responsive environment that is equipped with technologies to sense, process, and act on data to optimize performance and occupant experience.

Smart Space is built upon key technologies like Intelligent Edge, Connectivity, PropTech, and Sustainable Urban Planning. These technologies will allow any smart space to harvest, store, and process bulk data, thus making an impact across multiple verticals. Technological advancements in IoT, computation, and artificial intelligence will allow organizations to create interconnected and interactive workplaces using Smart Space platforms. Further research in this domain will open business, agriculture, and patient care implementation opportunities.

Smart Space is in the early stages of adoption, but trial applications have exhibited spectacular results, especially in manufacturing, media & entertainment, and healthcare. Enterprises are experimenting with smart spaces for customer modeling, simulation, and performance management.

With significant progress, the market continues to exhibit tremendous potential, especially for system integrators. System Integrators will play an important role in integrating the Smart Space solutions into the existing system architecture. Based on initial research, Future Market Insights has reported that the Smart Space market will grow at **8.3% CAGR** over the upcoming decade.

Although the general outlook toward Smart Spaces as a solution has picked up momentum, it is still slow when it comes to implementation. Enterprises are struggling to establish synergy between Smart Space tech implementation and organizational framework.

In this Point of View, we shed some light on the current market and industrial scenarios and emphasize on key use cases and different areas of implementation for smart spaces. This document will also discuss the technological and legal challenges that smart space adoption will offer.

01 Introduction

Devices and gadgets around us are becoming smarter every day. From mobile phones to electrical appliances to automotives, everything is becoming smart, intelligent, and interactive. Today, we are becoming ambitious and are looking to make our buildings, campuses, and cities intelligent, interconnected, and interactive. This led to the creation of Smart Spaces.

Smart Space is not entirely new as a phrase and a term. In fact, in 2005, Cook and Das, in their book 'Smart Environments: Technology, Protocols and Application', already defined Smart Space/ environment as **"a small world where different kinds of smart devices are continuously working to make inhabitants' lives more comfortable."**

Smart Space leverages modern technologies, such as sensors, high-speed internet, and IoT platforms, to create a more dynamic and intelligent environment. Smart Space is also a viable way to deal with resources and environmental concerns.

To better analyze the need for this technology, it is necessary to understand the difference between Standard Space and Smart Space. The following table provides an easy reference to understand the differences:

Standard Space	Smart Space
Different networks require their own infrastructure	Convergent network, one, unified IP over Ethernet physical network layer
Exclusive space management	IP-based, integrated space management systems
There is no infrastructure to enable IoT	Future-proof infrastructure capable of supporting Internet of Things (IoT) applications and devices
There is no specialized interior mobile network or outside coverage	Cellular service within the building
Separate power and connection grids, which are frequently siloed by application and may not necessarily cover the full space	Power and connection systems that work together

Smart Space technologies hold a lot of promise. Despite the tremendous hype, the effectiveness of Smart Space is yet to be seen. Before implementing Smart Space solutions, it is important to know about the technologies that form the backbone of Smart Spaces solutions.

These key technologies can be broadly classified into four categories: Intelligent Edge, Connectivity, PropTech, and Sustainable Urban Planning.

Intelligent Edge

With advancements in IoT, we see an exponential rise in the number of edge devices. IoT devices today are more powerful and capable of harvesting, storing, and processing more data than ever. This is making an impact in industrial settings.

With the growing number of IoT devices, edge devices can significantly contribute to the quantity of data collected globally. Edge computing necessitates more effective bandwidth use, reduced latency, and resilience in the face of poor, unreliable, and lost connectivity. The intelligent edge combines sophisticated computing capabilities, artificial intelligence, data analytics, and improved networking to act on data considerably closer to its source and consumption point.

The Intelligent Edge is quickly spreading. Enterprises see the edge and the Internet of Things (IoT) as critical components of their operations. Organizations use IoT for three reasons: cost savings, new revenue generation, and regulatory compliance. As a result, at least initially, many business implementations focus on apps that provide operational efficiencies, such as quality control and asset and fleet management.

These findings demonstrate that AIenabled edge platforms are already being used by enterprises and provide some insight into its potential to transform enterprises, particularly in the physical environments, including smart buildings, connected manufacturing plants, retail stores, and smart hospitals.

Connectivity

The rising internet penetration throughout the globe is the primary driver driving the global smart spaces market. The next generation broadband connection is 5G. 5G will instantaneously link billions of devices with minimal latency, enabling never-before-seen applications, services, and commercial opportunities.

The exponential development in the ability to carry more data quicker will fuel unequaled growth

in Internet of Things (IoT) technology initiatives. Massive machine-to-machine communication would no longer be an issue, revolutionizing the operations of many industries such as manufacturing, agriculture, and mining.

The most coveted advantage of 5G is the ability to process data in real-time and use it to boost productivity. Edge intelligent systems may exploit data generated by IoT, while 5G technology is critical in boosting enterprise potential for the continuing evolution of edge intelligence and IoT.

We believe that 5G networks will enable organizations to allocate computing resources strategically throughout the intelligent edge. Smart space devices will be able to transmit bulk data quickly and across multiple platforms simultaneously due to high-speed connectivity.

PropTech

Property technology, commonly known simply as PropTech, may be described as the employment of technology and software to aid today's real estate demands. For the office sector, everything from digitally supporting unique working experiences, delivering advanced data and analytics capabilities for real-time feedback, and even assisting property teams in acquiring, selling, and managing their assets. This also implies that it's not only for those who own and manage real estate but the individuals who lease and work inside the buildings.

For office employees, having an app for their building is becoming more of a need every day. It allows them to conduct various duties - anything from being a mobile key card to ordering meals to visitor registration and beyond.

The idea behind Protech is to merge everything into a single central building app on a tenant's smartphone instead of using numerous distinct applications. This generates, as we like to put it, a customer-facing "remote control" for your facility.

Sustainable urban planning

Traditional characteristics of urban regions include high population density and extensive development to support contemporary services such as transportation and commercial buildings. They are presently under increasing strain because of growing populations, limited resources, and the growing influence of climate change.

The smart space industry looks promising because

the smart building may produce a more pleasant built environment while minimizing a site's carbon footprint. Self-sustaining buildings are seen as the greatest answer for addressing ever-increasing technology and energy demand, as well as many governments' declared aim of being carbon-free.

Several developing countries are transitioning to Greenfield plans to relieve pressure on more established cities facing with difficulties such as rising population and infrastructural restrictions. Greenfield developments also deliver integrated smart infrastructure for new buildings, industries, airports, and power plants, which stimulates the expansion of the smart space industry.

The increase in government investment in smart city initiatives is expected to provide a variety of smart space market possibilities during the projected period. Furthermore, nations such as China, India, Europe, the United States, and others are extensively investing in smart city initiatives to address urban concerns, significantly contributing to the size of these areas' smart space industry.

Keeping in mind the above factors, we do realize that IT solutions are advancing from enterprise business applications to connected enterprises which will involve a host of integrations with a plethora of devices. Hence, it becomes imperative that organizations start looking at building accelerator that will help compose smart applications and enable an interweaving between various classes of data.

Hence, we firmly believe smart spaces will help lower businesses' costs, drive sustainability, and transform how we interact with our surroundings.

02 Types of Smart Spaces

Smart Spaces can broadly be classified into four types, as shown below:

Smart cities

Smart cities are urban areas outfitted with smart space technology for governance purpose. They contain networked infrastructure ranging from physical assets such as parking meters to lighting and trash cans with the objective of improving people's quality of life.

Smart cities must include:

- **State-of-the-art infrastructure**
  - Broadband networks around the city
- **Future-proof networks**
  - High-bandwidth capable of real-time data analysis
  - High interconnectivity and convergence
  - Broadband networks supporting IoT, cell towers, and CCTV cameras
- **Enhanced mobility**
  - Smart transportation
  - Traffic and vehicle parking management
  - Tolling and smart meters
- **Safety**
  - High-bandwidth capable of real-time data analysis
  - High interconnectivity and convergence
  - Broadband networks supporting IoT, cell towers, and CCTV cameras
- **Digital everything everywhere**

Smart Space is the future of building and infrastructure. Several countries have already implemented the Smart Cities initiative, and many more are in the process of doing so. Smart Cities initiative aims to make urban infrastructure more resilient, sustainable, and secure, which can be achieved by deploying smart space solutions. Examples of such implementations include BMW's Smart Factory in Germany, National Labs in Zurich, Google's offices in London, and many others.

Smart Buildings

Smart buildings combine operational automation and intelligent space management to create a digitally connected structure. Other benefits of smart buildings include better user experience, high productivity, and lower cybersecurity-related hazards. Some researchers have shown that smart buildings are becoming a deciding factor in attracting great talent, especially in the IT sector, as IT professionals prefer to work in a high-tech environment.

Smart buildings must include:

- Internet of Things (IoT)
- Converged infrastructure
- Universal connectivity grid
- Automated infrastructure management (AIM)
- Power over Ethernet (PoE)
- Standardized audio and video connectivity
- In-building wireless (IBW)
- Low-voltage lighting
- Energy savings
- Security
- Safety

Smart Homes

The smart home, also known as home automation, uses internet-connected devices to manage and monitor various household appliances and systems. It is a cutting-edge technology that makes the functioning of various household appliances more convenient and energy efficient. This technique uses wireless technology to control all the electrical equipment in the home.

It provides end-users with comfort, energy efficiency, security, and convenience by allowing them to operate all electrical appliances via a smart home app on their mobile phones or other networked devices.

Smart Factory

Smart space has connected factories with a digital supply chain network. In a smart factory environment, smaller units can make crucial decisions based on system-wide data available by this system. As the concept of a globalized supply chain gains prominence, smart space is utilized towards establishing agile and efficient operations. These smart factory operations have less downtime and are adaptable to new demands.

Smart factories can self-optimize their performance and self-adapt to new situations. It can autonomously perform production processes and learn about new systems in real-time. Due to the smart factory solution's powerful processing and analytical capabilities, organizations can now adapt according to dynamic demand scenarios.

The smart factory must be:

- Connected
- Optimized
- Transparent
- Agile
- Proactive

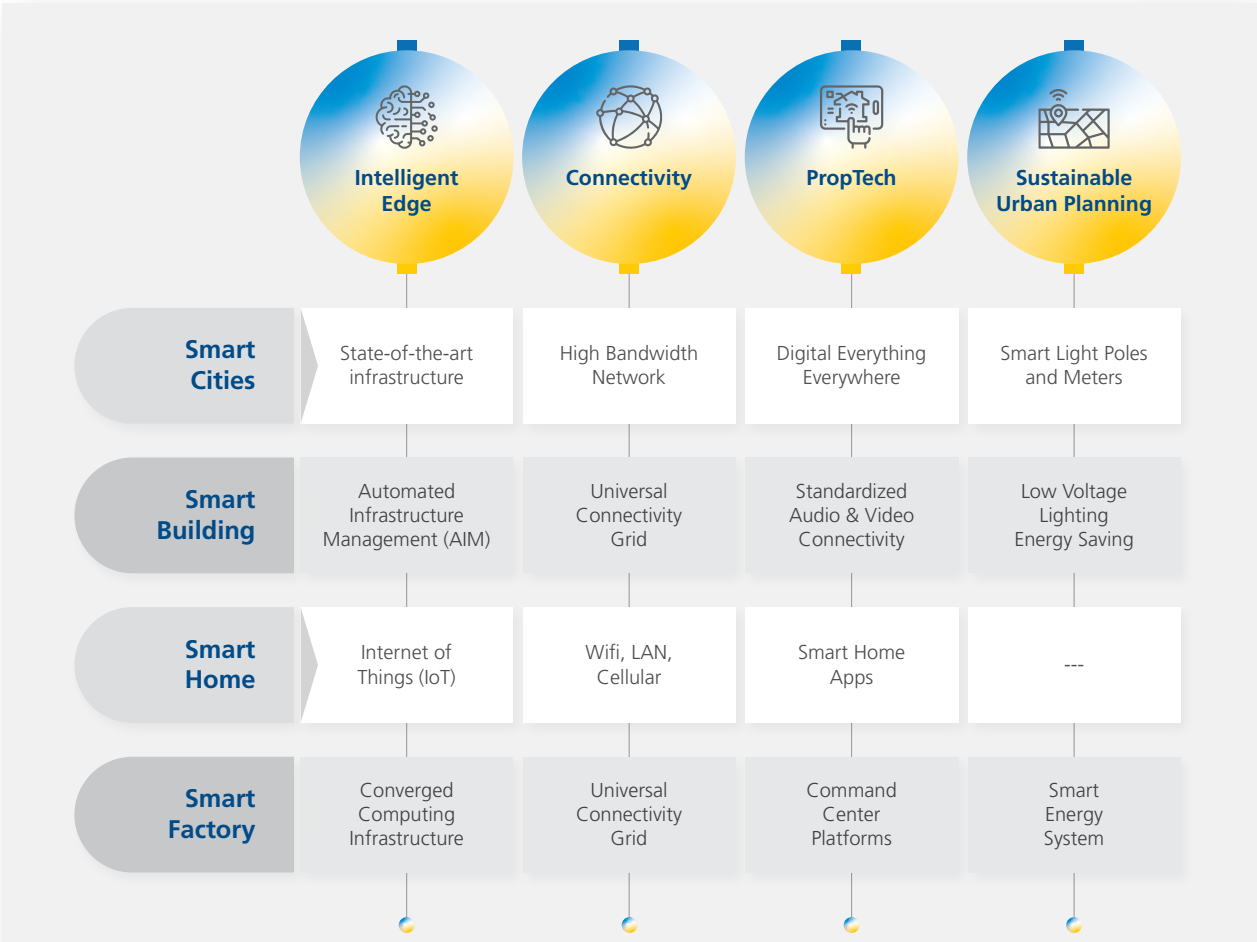


Fig.1: Smart Space Technology Landscape

03 Market Potential of Smart Spaces

Organizations across the globe want to transform their cities, buildings, factories, and business estates and create one intelligent and smart campus that offers better safety standards and promotes optimal utilization of resources. Smart space technologies have the capabilities to make this vision a reality.

Smart space technologies will assist in automating many functions that people currently conduct. The smart space solutions will also manage the operations themselves, employing sensors and artificial intelligence-driven autonomy to make choices on their own.

This domain has tremendous business potential, especially for system integrators and service providers. Smart space market will grow at a steady **8.3% CAGR** over the upcoming decade. The segment-wise market potential is explained in fig.2.

System Integrators will play an important role in integrating smart space solutions into the existing system architecture. They will be crucial in data aggregation, analysis, and maintenance of the smart space platform. System integrators can bring strong implementation experience, especially in integration and operations by developing an integrated, multi-agency coordination platform. They can also provide expertise in incident and emergency management in case of system failure. They can develop a standard operating framework.

With significant experience in data analytics, system integrators can provide maximum decision-making support and performance of the systems. They can significantly build the capacity of many stakeholders to operate and administer smart space solutions efficiently.

We believe that smart space services will be offered as a cloud-based service offering in the near future. We think that cloud will allow easy management of huge amounts of data generated by smart space solutions and fulfill analytical needs cost-effectively and promptly. In the future, system integrators will deliver smart space solutions as Software-as-a-Service (SaaS) via the cloud-based deployment architecture.

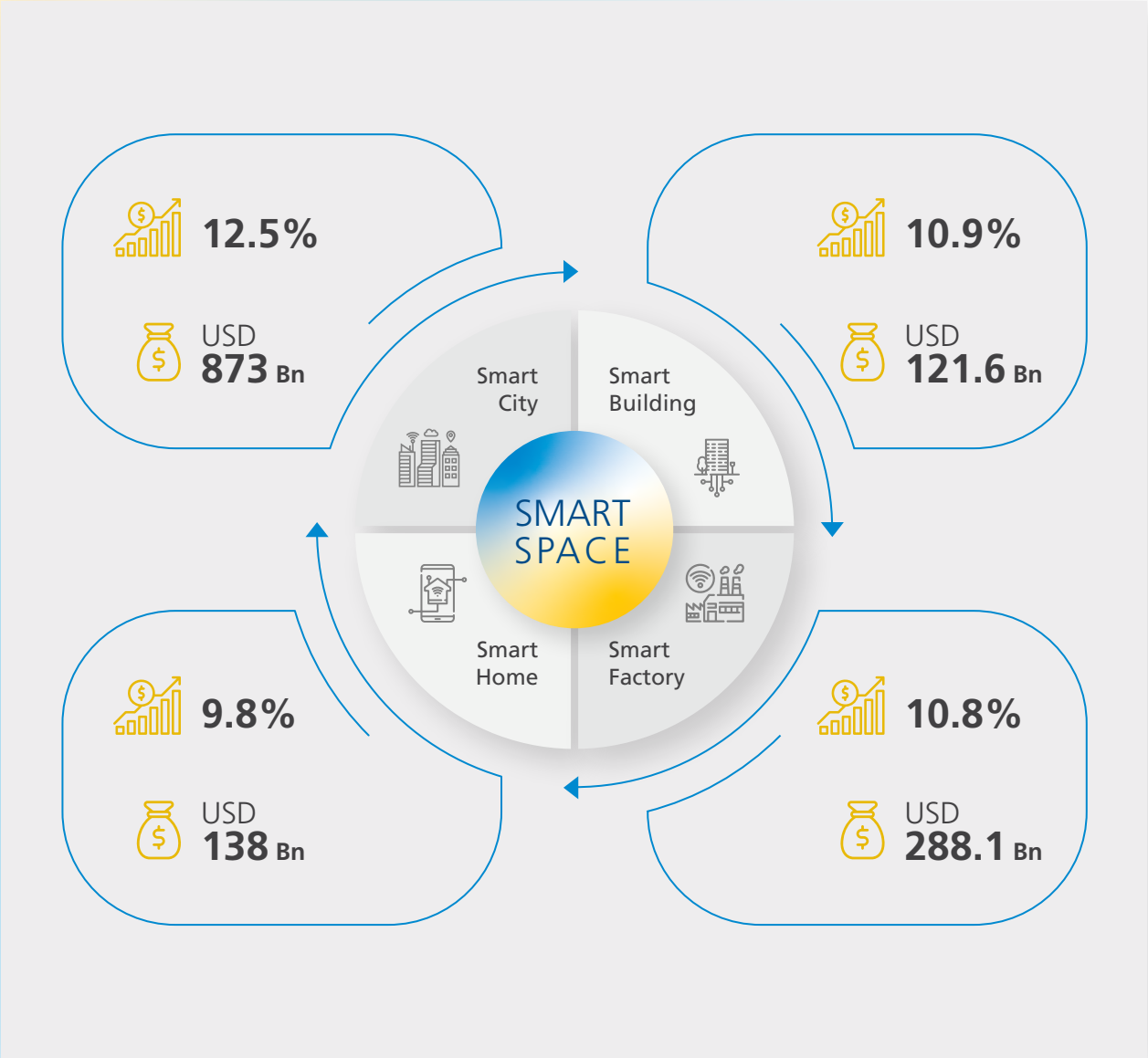


Fig.2: Market potential across segments

04 Implementation Opportunity Areas for Smart Spaces

This is only the tip of the iceberg when it comes to intelligent functioning. Consider how much electricity will be saved through the smart lighting control system. With the advancement in IoT in our portable devices, our fridge may soon be able to warn us if we're out of a certain food item or if milk is about to expire and ask whether it should order more or throw it away. Our Office chair will reveal how our posture was throughout the working shift. We'll be able to communicate with our appliances and gadgets from any location with a network connection. Building upon these, the following are a few applications of smart spaces:

Businesses

Smart spaces would help businesses streamline processes, data collection, and analysis so that workers are freed up to perform more creative tasks. How businesses interact with their employees and each other would also be impacted.

In a factory setting, physical production processes and operations are combined with technology such as IIoT, embedded sensors, improved connectivity, automation, and machine learning. This gives factory workers real-time data and an in-depth range of information, which aids in making crucial decisions quickly, making processes efficient, and saving time and money. They also extend to improving safety through alert sensors, and environmental benefits as efficient energy consumption reduces carbon footprint.

Recreation & Leisure

Smart spaces have paved the way for creating new ways of entertainment. This technology has been used to create experiences that will make the visitors feel in all their senses and not just experience with their eyes. Other applications in entertainment could also be the use of light and sounds according to a stimulus in the environment. Smart space technology can also be used to nurture existing green spaces/recreational parks.

Smart sensors can be used to create automated irrigation systems around parks. Also mesh Wi-Fi networks allow for reliable connectivity through existing green spaces. This enables the use of smart security systems and interactive digital experiences, such as virtually led nature walks.

Patient Care

Smart technology can be used in hospital rooms to view the state of the patients, resulting in less distraction to them, requiring fewer efforts of nurses that are no longer required to check on the patients. This would enable cognitive patient care, which would provide constant monitoring of the patients, and instant alerts in case of a change in the situation. A smarter room could provide voice activation, one-click doctor recall, automatic light, temperature, humidity, angle of the bed control, and so much more.

With COVID-19, there is a renewed focus on the healthcare and well-being of occupants of a building. Owners are looking at solutions to address concerns, such as increasing purified air flow, disinfecting work areas, optimizing lighting solutions, and increasing accessibility to outdoor spaces.

Smart technology helps address these concerns. IoT-enabled HVAC systems can be used to analyze air quality, formulate an action plan, track progress, and assess mitigation effectiveness. Companies have also developed cleaning robots that use ultraviolet radiation to disinfect surfaces with sensors to detect the environment.

Disaster Management

Smart space technology helps gather data necessary to predict possible problems and hazards in the future. These solutions can help create a diagnosis of the environment where authorities such as police, and fire can be alerted before an event occurs.

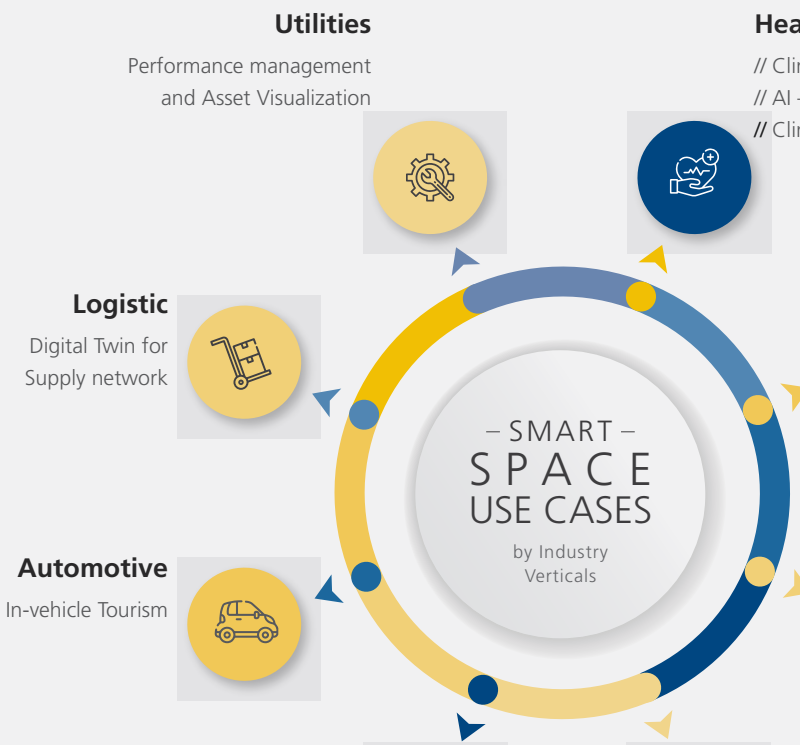
Smart space technology will be helpful in monitoring various natural environments at a much higher granularity and accuracy than the presently used techniques. This sort of technology is being used today to study phenomena such as flooding, coastal erosion, and glacial movement.

Agriculture

In agriculture, manufacturers of farming equipment are now outfitting their tractors, combining harvesters and farming implements with sensors and remote servers (gateways) to collect, store, and display real-time information. The machinery sends data to the cloud for analysis with other data sets (climate, operator, agronomic inputs) to calculate the optimal machine settings, which are sent back to the tractor to adjust things like tractor speed or depth of seed. This helps farmers in doing precision agriculture where earlier they couldn't measure how specific, micro-level changes affected yields.

We believe that it is important to know that for companies to get started in the smart space market, they should evaluate their goals whether they want to improve their employee productivity and health or if it's the sustainability angle they are targeting. Companies could then contact system integrators that may have done IT installations for them in the past and integrate IoT solutions with their existing system.

05 Industry Use cases



Utilities

Performance management
and Asset Visualization

Healthcare

// Clinical Engineering
// AI – Diagnostic Support System
// Clinical process automation

Logistic

Digital Twin for
Supply network

Manufacturing

// Design Customization
// Operation Management
// Predictive Maintenance

Automotive

In-vehicle Tourism

Retail

// Customer Modeling
// Supply Chain
Management

Media & Entertainment

// Recommendation Generator
// Real Time Predictive Modeling

BFS

Risk management

Healthcare

Clinical engineering, real-time medical device location monitoring, and catastrophe preparedness

- Enable real-time control of medical equipment and medical sites through a combination of IoT, robotics, ambient sensors, wearable devices, and the web architecture platform.
- Real-time information interchange across employees, medical equipment, and medical sites by merging real-time staff information with medical equipment and medical locations.

Diagnosis support system based on AI

- Smart space technologies such as digital twin can improve diagnostics trajectory efficiency by tailoring patients' diagnostic paths based on probability and by offering comprehensive capacity control across the whole diagnostic supply chain.

Clinical process automation using clinical care procedures and AI technologies

- Smart space technologies can create and verify a workflow-driven system that will aid in the automation of clinical research execution procedures by enabling clinical care workflows, data collecting methods, and data sources.

In-patient and remote monitoring and rehabilitation

- A smart space platform will function as a smart information hub, facilitating the flow of structured data between patients' locations and hospitals.
- A multi-sensor platform with versatile data transmission capabilities will collect data from patients' houses and assist healthcare workers in remotely monitoring patients' lifestyles from hospitals.

Manufacturing

Design customization and engineering

- Manufacturers are embracing smart space technology such as Digital Twin Create Customization to ease the product customization process, which allows them to design and re-design goods online before generating the actual product that completely conforms with consumer needs.
- Companies may use digital twins to mimic and evaluate each stage of development to discover problems and potential failures before generating the final product.
- Twin Engineering assists development teams in understanding how a prospective modification in the manufacturing process may affect production outcomes and in adjusting their manufacturing processes to achieve intended improvements. Therefore, firms may improve operational procedures while lowering total engineering costs.

Operation management

- Digital Twin Operations Management improves operational efficiency, anticipates maintenance, and performs dynamic simulation. The real asset is equipped with IoT sensors, which continually provide real-time dynamic data flow about the asset and its status. The digital duplicate is then created using static data and continually updated dynamic information.
- Employees may digitally monitor and oversee the performance of assets as well as industrial activities.

Predictive maintenance

- Manufacturers use smart space solutions such as digital twins to forecast probable machine downtimes, allowing firms to reduce non-value-added maintenance chores and enhance overall machine efficiency by acting before a fault occurs.

Retail

Customer modeling and simulation

- Retailers may improve the customer experience by creating digital twins of consumer profiles as they enter the smart space environment of the store. They can give clients optimal fashion clothes goods based on their generated digital models.

Effective product supplies management

- Smart space technology will allow retailers to analyze the footfall pattern of consumers. Retailers may use smart tech like digital twins to spot bottlenecks, supply shortages, and demand curves, restock items, reposition products, and generate targeted advertisements to reduce waste and increase sales.

Avoid interruptions in the supply chain

- Retailers may integrate their smart space models with real-time data from other smart space applications like as traffic and weather. As a result, they can respond to any occurrence that may disrupt their supply chain.

BFSI

Management of branches and channels

- Smart space technology might be used to optimize and simulate the impact of changes in channel mix on consumers and employees.
- A bank will be able to develop the ideal channel mix for new interaction before implementing it in the actual world using branch and channel models and data about processes, skills, and experience.

Risk management

- The capacity to predict risk might be used for lending, particularly the performance of loans made to firms and consumers in the previous 18 months.
- Developing a system for projecting payback will allow a bank to manage reserves more effectively and enhance its balance sheet.
- Similarly, by simulating a bank's network and security capabilities, new threats may be assessed swiftly and efficiently.

Media & Entertainment

Better recommendation engines

- Smart space technologies in combination with artificial intelligence can lead to the development of better recommendation engines. Data collected by smart space technologies can be analyzed to develop AI-based interactive and smart content.
- Companies can also use a combination of structured and unstructured data from smart space as well as machine learning approaches to match individuals with content, boosting the relevancy of content suggestions and the efficiency of content delivery.

Real-time predictive modeling for demand prediction and segmentation

- Data generated by smart space technologies and platforms regarding current consumer trends and behaviors can be leveraged to perform real-time prediction. This will help companies to respond to consumers in real-time and influence long-term investments based on behavioral trends.
- Furthermore, businesses can forecast which clients are more likely to read a specific sort of material and what device they will use to do so.

Automotive

Smart space-based application for in-vehicle e-tourism

- Smart space platform application can be integrated with an in-vehicle system that searches, retrieves, and analyses important information about nearby points of interest for the driver and presents it in a user-friendly style utilizing the in-vehicle multimedia system.
- The smart space technology platform can enable the execution of resource-intensive activities on powerful computers as well as the implementation of communications utilizing smart space technology.

Logistics

- Smart space services can help businesses create digital twins of their physical supply networks. The solution consolidates data from different sources and provides clients with a comprehensive and clear picture of their logistics.
- The technique might open the door for significantly quicker data analysis: operations that previously took up to two hours can now be completed in a matter of minutes.

Utilities

Asset visualization and performance management

- If a corporation wishes to demonstrate a new sophisticated utility product at an exposition, it does not need to transfer it to a remote site; instead, it may utilize an exact digital smart space model that does not require transportation or installation.
- Smart Asset Performance Management improves visibility across plant assets for utility companies. Executives can readily evaluate asset health, process efficiency, and equipment dependability, thanks to the continuous transfer of industrial data on power generation and renewable assets.
- Additionally, predictive diagnostics enables a digital twin to detect possible problems and equipment breakdowns, decreasing unnecessary downtime.

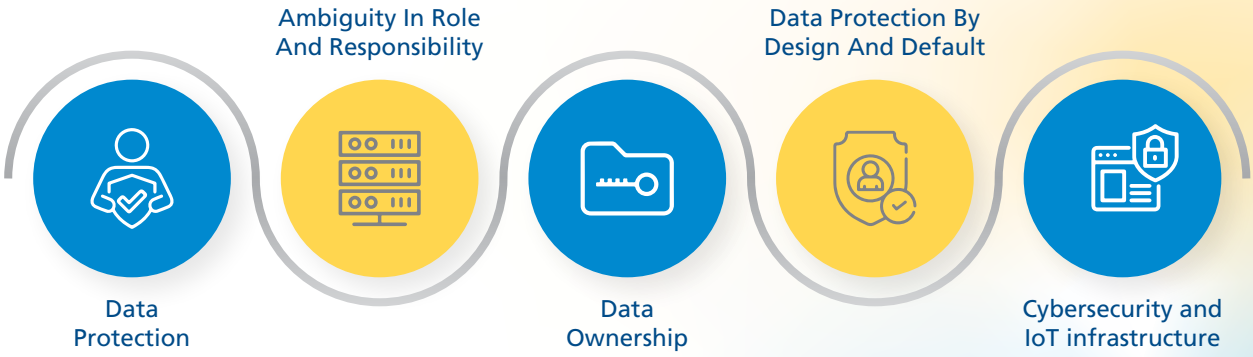
06 Challenges in Smart Space Adoption

The Smart Space may share data to create larger database and accompanying analytical solutions. This pervasiveness of ICT enables unparalleled data profiles on the lives of users and its surrounding. The data based on user's life activities and choices is available for sophisticated and demanding analyses which any organization can exploit. The Smart Space data surveillance may pose dangers to human autonomy, individuality, and privacy.

Many vulnerabilities exist in smart space solutions because they may be exploited by external services to conduct attacks (such as denial of service) on the consumer's network. Smart space solutions collect and transmit information that can be intercepted and can be used to steal personal information. Fact is that concerns regarding consumer data safety, privacy, and data security outweigh the probable benefits of smart space solutions.

Smart space projects may come in a variety of forms and sizes. Depending on critical operational decisions such as the business models of the parties involved in the establishment of smart space, preferred post-construction ownership structures, and service delivery set-ups during facility operation, a slew of legal issues arise that necessitate dynamic, business-oriented, and inventive solutions.

Some key points in data protection, cybersecurity, and property law are mentioned below.



Data protection

All GDPR regulations apply to smart space systems in terms of personal data processing. For example, the controller must guarantee that data protection principles are appropriately applied, all processing activities must always have a solid legal basis, a Data Protection Impact Assessment (DPIA) is done and maintained up to date, and transparency standards are met. However, some issues may necessitate special attention.

The legal problems associated with data protection apply solely when smart space data generation falls under the purview of data protection legislation. According to the GDPR, not all created data is deemed personal data. Sensors might, for example, monitor the building's temperature, carbon dioxide levels, light intensity, and sound levels. In many cases, this information would not be deemed personal data.

Ambiguity in role and responsibility

IoT-based service providers may be considered processors for the advantage of the smart space owner, who may be regarded as controllers of the information acquired by the services. However, data protection tasks and responsibilities will be linked to the reasons for which the created data will be utilized.

Obtaining a clear perspective on purpose determination may prove to be a hurdle in and of itself. Smart building user data will aid in the delivery of these services in a more efficient, tailored, and cost-effective manner, but the transition to a smart space environment will result in the digitization of old equipment and user operations. All of them will suddenly begin processing (personal) data, implying that many more activities will require processing covered by the GDPR.

Correctly assigning data protection duties will be critical, as it will bring accountability and liability for data protection compliance. Even if the project developers do not fall under the definition of a controller or processor under data protection laws, they may still be required to abide by various data protection obligations in the construction of smart buildings in order to ensure the building's commercial viability insofar as those obligations are (indirectly) contractually imposed by the (future) owner of the smart building. Such contractual agreements may be required for future building occupants to be allowed to utilize the property per data protection rules.

Data ownership

Personal data generated by smart spaces (e.g. on energy consumption) can have a huge value for the organization or third parties. An important question is whether the owner can use, resell, share, or transfer this data to third parties. Contractual arrangements between the parties involved regarding the data ownership will be crucial in this regard.

Data protection by design and default

To assist compliance, and because revisions to include IoT technologies may be costly, data protection by design and by default should be part of the building design and construction process from the outset.

This requirement can be challenging in a smart building context. IoT-based systems, for example, may act, respond, and adapt based on data collected by sensors and devices. As a result, it may be impossible to predict what information, especially sensitive information, will be acquired. When such devices are always linked, this data may be exchanged and sent automatically.

Another problem for data protection by design and default in this environment may be the difficulty in understanding when, where, and for what objectives, IoT data is gathered. Furthermore, IoT-generated data is frequently used for numerous purposes, and new ones may arise over time.

Cybersecurity and IoT infrastructure

Because of the interconnection of smart devices, the consequences of security (including data) breaches may be very severe, especially as enterprises become more reliant on their increasing IT infrastructure. Incidents can have disastrous repercussions, and numerous real-life instances illustrate that they can immobilize an organization for an extended period. Under data protection legislation, the organization acting as a controller of the smart building's processing operations is responsible for ensuring that effective security measures are in place that commensurate with the dangers posed by huge volumes of created data.

Adoption Challenges

Each capital project requires an agile strategy to manage suppliers, negotiate contracts, verify quality, and monitor cost and schedule risks. However, large-scale smart space initiatives require some extra attention in a few areas.

1

The first is technological integration. A smart space system should function optimally when its sensors, analytics, cloud storage, and underlying IT architecture are all in sync. This is a significant difficulty when dealing with numerous suppliers and designs across many properties, as well as attempting to combine performance data onto a single front-end UX that aggregates underlying systems and sources.

2

The second unique problem is establishing employee unanimity. The more your buildings can accomplish, the more your various end users will expect from them. This can lead to difficult internal disputes – and perhaps costly scope adjustments mid-project.

3

The third thing to keep an eye out for is technological obsolescence. The architectural environment is littered with yesterday's ideas that are no longer as enticing today — and obsolescence expenses may quickly add up when they occur across a portfolio of assets.

4

The Fourth issue is price associated with building and maintaining the infrastructure. Smart space solutions and services are new to the market and many companies are entering this market with innovative products and services. Due to this, early adopters are paying a huge sum of money to have this technology on-boarded. Moreover, governments are also taking more efforts to make the spaces smarter with the upcoming technologies.

5

Another key challenge is the growing demand for 24/7 connectivity and power supply. With more and more high-bandwidth applications emerging—such as autonomous vehicles or smart factories—network connectivity can sometimes not be up to the task.

6

As technology continues evolving, we are seeing more focus on ubiquitous, interoperable networks. The type of technology used matters less; getting the right connectivity for the application is more important. And that can be brought together to benefit from economies of scale.

7

Security issues in term of public data is an emerging problem that needs to be addressed. Cyber security's primary function is to ensure devices, and the services people access, are protected from being breached by unauthorized parties who could steal and wrongly use, or even damage, the device and/or the personal data stored in them.

Smart Spaces need a smart data strategy. There is a need to integrate data standards across numerous projects and guarantee that all data (including data handled by third parties) is accurate, secure, and in full regulatory compliance.

07 Conclusion

The smart space solution is a comprehensive solution that connects what happens within the four walls to what happens throughout the whole digital supply network. Far from being an "end state," the smart space is a dynamic solution that leverages numerous characteristics such as agility, connection, and transparency. At a high level, the dynamic nature of the smart space speaks to an everlasting appeal for creative thinking: visualizing the possibilities of the practically infinite combinations that a smart space solution makes possible. Investing in smart space capabilities may help organizations differentiate themselves and perform more effectively and efficiently in an increasingly complex and fast-dynamic ecosystem.

We believe the smart space journey needs more than a collection of interconnected equipment. Organizations would require a method to store, organize, interpret, and act on the data acquired. Furthermore, firms would want the necessary personnel to lead the journey as well as the proper processes in place. Each smart space journey would need transformation support in the areas of solution design, technology, and change management.

The organization's strategy and environment will define which specific challenges to solve and how to unlock value through smart space solutions. Customizing the strategy to each condition can ensure that the smart space solutions satisfy the organization's demands.

We have developed technology platforms to meet the growing demand for seamless operation in smart cities, cutting-edge security solutions, and improved operational efficiency in smart factories in response to the global demand for smarter, more secure, and intelligent solutions to improve quality of life. **Advanced Smart City Operating Platform, Digital Command Center @Edge, Device Data and Security Management (DDSM)** solutions are some of the end-to-end solutions that LTIMindtree can provide to the clients.

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