Digital Business

Embracing Smarter Facilities Management

By leveraging and integrating intelligent solutions, facilities managers can transform buildings into self-aware, flexible and responsive structures that are adaptable to ever-changing environmental conditions and occupant preferences.

Executive Summary

In today's increasingly digital world, the nature and function of building facilities is constantly changing. Facilities managers (FMs) face increasing pressure to adapt to fast-evolving workplace and regulatory requirements. Buildings are expensive to operate and contribute significantly to energy and sustainability challenges. They consume the most energy, accounting for over one-third of final energy consumption globally and are an equally high source of carbon dioxide (CO_2) emissions.[1]

In the U.S. alone, the combined energy costs for nearly six million commercial buildings and industrial facilities is estimated at $400 billion.[2] The average building, moreover, wastes 30% of the energy it consumes due to built-in inefficiencies.[3] In addition, ongoing operating costs represent 50% of a building's total lifecycle expenses over an estimated 40-year life span,[4] and those costs are growing, often unpredictably. Add to these costs the mandate for facilities management to focus on key areas such as energy management and sustainability,

Cognizant

and a challenging business management picture emerges.

While a variety of building automation and management systems have been deployed over the last few years, most FMs do not take advantage of them. According to the American Council for an Energy-Efficient Economy (ACEEE), the deployment of intelligent efficiency in buildings is prevented by significant challenges such as replacement cycles, learning to process exponentially larger volumes of data, lack of consistency in data communication between platforms and misinterpretation.[5] FMs lack true visibility into the operations of their building portfolio. Managing multiple disparate systems with limited or no interoperability requires more manual intervention than should be needed in today's digital era, and demands reactive maintenance efforts that can and should be avoided at all costs.

Meanwhile, accelerating technology cycles are unearthing capabilities to build smarter and more responsive buildings that are increasingly self-aware and in-tune with the needs of its occupants.

Digital transformation and the Internet of Things (IoT) are delivering unprecedented opportunities for facilities management to optimize operating conditions by providing deeper insights and better services. By leveraging these intelligent solutions and integrating them with both building and enterprise systems across globally distributed portfolios of buildings, FMs can help organizations achieve ever-increasing levels of operational efficiency, cost savings, occupant comfort and productivity. They also enable facilities to meet environmental responsibilities such as Green Compliance, Waste Reduction and Zero Net Energy (ZNE) readiness.

This white paper illuminates the manifold challenges FMs face and highlights how our intelligent platform can enable organizations to operate smarter facilities. It also offers insights and recommendations for organizations to create facilities of the future — buildings that are flexible, responsive and adaptable to changing environmental conditions and occupant preferences.

Opportunities abound for smarter facilities management

The future holds exciting opportunities for FMs as a result of new technologies and the push by socially-responsible executives for sustainability. These business leaders see the deployment of building solutions as a way to enable smarter facilities management services that can transform safety, comfort and efficiency for their people and related organizational assets. According to Continental Automated Buildings Association (CABA), facilities with fully interoperable systems tend to perform better, have lower maintenance costs and have a smaller environmental imprint.[4] They also help meet environmental responsibilities such as lower energy consumption, reduced carbon footprint and even Zero Energy readiness.

Organizations that pursue these initiatives via smart facilities management will find tremendous opportunities for innovation and productivity across all categories of buildings. This is already playing out in a variety of ways:

❙ Residential buildings: The convenience of the digital smart home is being enhanced every day through developments in sensing, control and automation. Technologies from voice assistants to wearables can be used to factor in proximity as well as personal preferences, and to automate settings for lights, temperature and various other home appliances. Wearables can tap into a person's body temperature and automatically adjust thermostats in rooms throughout the house to settings configured by the user.

On the energy front, the U.S. Department of Energy is promoting the adoption of energy-efficient technologies and methods in new homes through the Zero Energy Ready Home Programs. The Building Technologies Office (BTO) strives to reduce by 2025 the energy used for space conditioning and water heating in single-family homes by 40% from 2010 levels.[6]

❙ Commercial buildings: Offices are well on their way to defining new ways of working. A facility is no longer just about providing a place to work; it is more about offering an experience that attracts and retains a talented workforce. "Hot desking" — a concept where workspaces are assigned to employees based on schedule: sitting desks, standing desks, work booths, meeting rooms, etc. — encourages new relationships, chance interactions and the efficient use of space. Desks are only used when required, which allows employees to break away from fixed locations. Mobile apps can register employee preferences for light and temperature, suggest desks, tweak the environment automatically, help find parking spaces or other colleagues, and report issues to the facility team in real time.

A facility is no longer just about providing a place to work; it is more about offering an experience that attracts and retains a talented workforce.

Quick Take

Energy Schedule Automation

We developed a schedule automation module as part of the 1Facility solution at the premises of a leading U.S. department store chain. This module automatically manages energy schedule variance requests from store managers for their HVAC and lighting systems across 2,000 stores.

The solution involved integration with multiple controllers — proprietary, legacy and various third-party, multi-generation — to monitor and validate input against business rules and initiate action for respective stores. It also can notify and react to approvals, and track and report change requests from managers. In addition, the solution utilizes availability of data to derive insights on seasonal requests, geography-based patterns, and other types of correlation and analytics.

The solution enabled a single point of control and automated coordination between the various lighting and HVAC systems across multiple locations. Store managers were able to easily operate services for extended hours and also derive optimal energy use.

Many offices are pushing the boundaries for energy savings and green compliance. For example, The Edge, a commercial office building in Amsterdam, uses 70% less electricity than comparable commercial office buildings.[7] When there are no occupants, there is next-to-zero energy use.

I **Airports:** In the next 20 years, passenger traffic is set to double, reaching 7.2 billion; additionally, there will be 30% more freighters flying.[8] Airports need to be able to meet passenger expectations, reduce processing time on the ground and provide greater predictability. From optimal coordination of ground services to predictive modeling of airport operations and aircraft turnaround, airports can explore varied opportunities for efficiencies.

FMs must plan for heightened passenger experience at every terminal with reduced wait time and service queues. Real-time tracking of luggage with smartphone apps that identify the precise location of passenger bags is a near-time feature. Soon passengers will be able to choose when and where to pick-up or drop-off bags. Intelligent solutions can help airports and similar public centers enable businesses to target customers with messages based on their proximity. Video analytics can manage queue congestion and washrooms can be serviced based on real-time usage. Passengers knowing where they need to be and when, with smartphones issuing reminders, will free them up to make better use of their time, leading to a better airport experience.

Digital transformation enables smarter facilities

Digital, in the form of IoT, AI and mobile, is fundamentally changing how the building, its occupants and operators work. From wearables to conversational assistants, and from augmented reality to artificial intelligence, new developments are emerging daily to help FMs more effectively and efficiently manage their responsibilities, provide personalized services and enhance occupant comfort. The Wynn hotel chain recently announced that by the end of 2017, every room in its Las Vegas hotel will be equipped with an Amazon Echo — a "digital butler" that assists guests with opening curtains, setting room temperatures, turning on the TV and ordering room services.[9]

- **Internet of Things:** Sensor technology has enabled the systematic capture and harnessing of data to provide visibility into building portfolio operations like never before. It is now possible to measure, monitor, and manage the condition of practically everything in the environment in near-real time. Buildings can now record enormous amounts of data across an increasingly diverse array of functions. Data collection, storage and analysis have become critical features of building systems, and those facilities which can best analyze their data will gain competitive advantages.

    FMs can make use of various intelligent building systems to solve a multitude of challenges in operations and maintenance. Data collected from lighting, occupancy sensors, security, HVAC, electrical plug loads and utility meters, to name a few sources, can provide valuable usage patterns to inform and drive continuous improvements. Insights can help reduce greenhouse gas emissions and conserve electricity by operating systems on demand. Buildings can utilize video and image analytics to improve tenant safety and security, analyze patterns in human movement and correlate with data from occupancy sensors to improve space utilization.

- **Digital twins:** Powered by thousands of IoT-enabled sensors monitoring around the clock, it is now possible to build a digital representation of every asset in the building — from HVACs to elevators. This dynamic digital model will over time become a virtual twin. These digital twins harness data from sensors that are monitoring the performance of assets in the real world. Then they apply algorithms that offer continuous insight and support reasonable future projections, based on how the digital twin's dynamic model responds to the data from its physical twin's sensors. By implementing a digital twin — comprising data sensors and monitors, a digital brain and a communications protocol — the service team will know not only when to inspect or service a machine, but what parts to have on hand when doing so and how long the machine will be out of service.

- **Artificial intelligence:** The AI that now drives cars can also operate our buildings, perhaps even better than we can. Google revealed in 2016 that by using AI the company was able to reduce its data center cooling bills by 40%,

Data collection, storage and analysis have become critical features of building systems, and those facilities which can best analyze their data will gain competitive advantages.

By implementing a digital twin — comprising data sensors and monitors, a digital brain and a communications protocol — the service team will know not only when to inspect or service a machine, but what parts to have on hand when doing so and how long the machine will be out of service.

which clearly is a huge improvement in any large-scale energy-consuming environment.[10] Machine learning is capable of stretching the boundaries of building systems to learn and improve. Myriad sensors, coupled with the enormous data surrounding every aspect of the building's operations, provide the necessary impetus to drive performance. We expect that AI solutions will leverage the IoT infrastructure to unlock value for businesses. Imagine in the near future, those voice assistants powered by AI at the Wynn resort, learning the habits and preferences of guests to anticipate service requests.

▌ **Mobile:** Smartphones are the passport to facilities. The ubiquity of mobile devices has sparked the demand for creating the next generation of cloud-based applications or apps that are intuitive and easy to run — anywhere, any time. The rise of mobile technology (devices and apps) offers FMs flexibility and control of daily operations, better reporting and huge potential to improve service levels. They can easily manage assets, collaborate with co-workers or customers, and manage workforce allocation. Field service technicians can use augmented reality and remote assistance to consult live on site, seek expert advice on the job to secure a first-time fix, improve the work process flow and reduce costs.

Implementing intelligent building solutions

Today's global organizations need to effectively manage multiple facilities distributed across various locations and also support ever more mobile and flexible workforces in those settings. Most modern workplaces are powered by a multitude of building systems and applications. Managing these systems to ensure operational efficiency while retaining a seamless occupant experience is a priority for the various workplace maintenance stakeholders.

However, several processes and technological challenges in the facility management space prevent them from leveraging the wealth of information available for achieving these ends (see Figure 1, next page):

▌ Management of disparate building systems.

▌ Absence of comprehensive building analytics.

▌ Lack of an integrated view of all buildings and assets.

▌ Reactive and manual maintenance and servicing.

▌ Closed systems with no interoperability.

A few key challenges in the industry

High energy cost due to lack of optimized consumption.

High cost of manpower-driven operations & troubleshooting.

High maintenance cost payouts due to lack of visibility on equipment health.

Cost leakage from energy & water wastage.

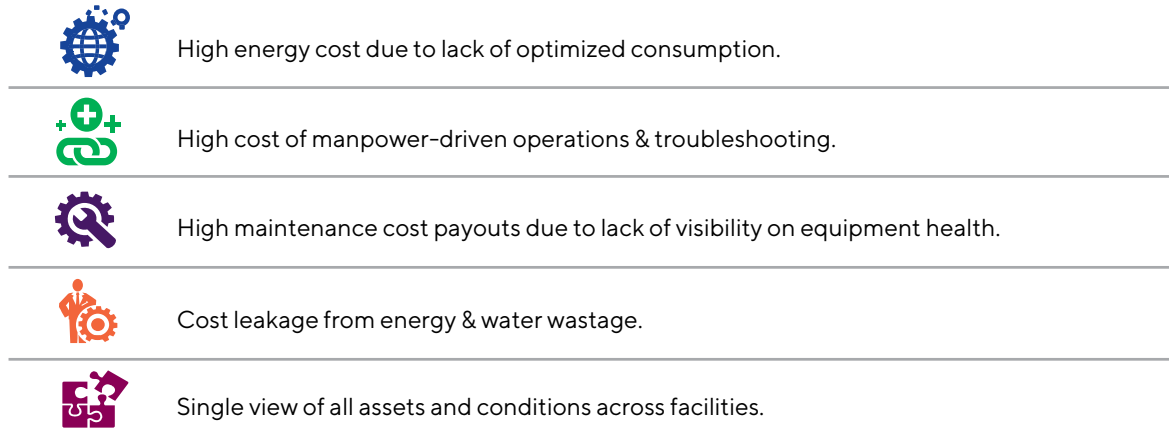Single view of all assets and conditions across facilities.

Figure 1

Facilities of the future must be able to connect multiple systems in an integrated, dynamic and functional way, in order to seamlessly fulfill operational goals while also keeping energy usage and environmental impact to a minimum. Many facilities are limited in what they see and know by proprietary systems that are functioning in silos. Ideally, executives and FMs should have a single source of truth to understand what is going on across their portfolios of buildings rather than being stranded on islands of hard-to-access data.

The economics of building management coupled with strategic sustainability goals add increased pressure on facility management personnel working with already constrained resources. World energy consumption is projected to increase by 48% over the next three decades.[11] Buildings consume nearly half (47.6%) of all energy in the U.S.; and 75% of all the electricity produced in the

U.S. is used just to operate buildings.[12] Globally, the percentages are even greater. Building energy use remains the single greatest contributor to carbon emissions in the U.S. — commercial buildings and industrial facilities combined are responsible for nearly half (45%) of greenhouse gas emissions.[13] It is estimated that a 10% improvement in energy efficiency would save $40 billion.[14] In order to address this growing concern, zero net energy (ZNE) buildings are now at the forefront of energy efficient design and operation, as they use only one-quarter of the energy of average buildings.[15] ZNE buildings have greatly reduced energy loads for some buildings so much that within the course of a year a building's annual energy needs could be met with onsite renewable energy. Continuous attention to building controls and performance monitoring and feedback are key components in most ZNE projects.

Quick Take

Food Safety for Perishables

Preserving perishable food was a major business objective for one of our large retail clients. It cost this client around $750 million a year due to spoilage and energy loss across more than 5,000 stores. The client used legacy controllers and alarm response systems for refrigeration and HVAC facilities maintenance, but these systems lacked the ability to interoperate with other systems, create automated work orders, predict failures and prioritize critical alarms.

We created a highly scalable, flexible and near-real-time intelligence solution to drive efficiencies and provide actionable insights on store operations, energy consumption, labor productivity and customer experience. For the initial phase of the transformation, the platform monitored hundreds of millions of sensor data points averaging over 100 million alerts per year across 125 stores.

The unified platform integrated a multitude of devices and controllers, standardized data aggregation to monitor parameters including temperature, humidity, occupancy,

lighting and HVAC, etc. and provided capabilities to automate service workflow based on events and thresholds. The system processed an average of 737 million transactions daily, retrieving data as frequently as every five minutes and by the hour.

The solution supports the processing of large volumes of message streams from refrigeration equipment controllers, carrying event and threshold values, and these are all processed in near-real-time. Business rules are defined and managed in the streams engine to detect and respond to imminent failures by creating automated work orders so that technicians are dispatched to service equipment before failures occur.

The high availability and responsiveness of the platform helps greatly reduce the latency in such work order processing, thereby preventing potential wastages in refrigerated food products.

Store FMs who are able to modify temperature set points and force defrosts remotely were equipped with rich visual dashboards and intuitive user interfaces to monitor and control the assets. The platform helped improve staff response times and maintenance efficiency, resulting in a 10% reduction in spoilage, while saving $18 million in operating costs.

A smart, scalable approach to building & energy management

End-state

| Configurable Alarm System | Configurable Rules Engine | Real-time Notifications | Auto Work Order Creation | Extensible and Scalable Architecture | Integration with 3rd Party Systems | Integration with SAP/EAM Systems |

Our Solution

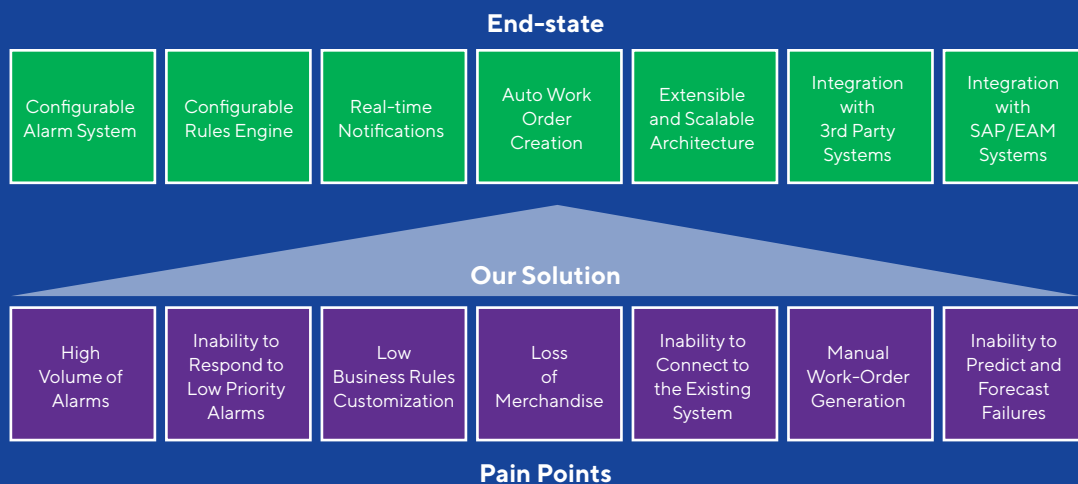| High Volume of Alarms | Inability to Respond to Low Priority Alarms | Low Business Rules Customization | Loss of Merchandise | Inability to Connect to the Existing System | Manual Work-Order Generation | Inability to Predict and Forecast Failures |

Pain Points

Figure 2

According to a survey conducted by Continental Automated Buildings Association (CABA) and the nonprofit New Buildings Institute (NBI), ZNE buildings rely on building and system-level energy controls, monitoring, energy management and operator/tenant feedback to help meet their low-energy-use goals. Among the findings, the report stated that "a vast majority (91%) of the ZNE buildings use control systems that integrate multiple end-uses" and "the highest-performing buildings have engaged operators and occupants standing on the shoulders of intelligent and integrated controls systems."[16]

What is needed is a cloud-based smart solution that can consolidate and optimize data across the entire portfolio of geographically dispersed buildings. This would inform various distributed stakeholder teams about patterns of facility usage, the interrelationships among assets and spaces, and how to better respond to alerts and requests (see Figure 3).

How smart-connected facilities generate insights across subsystems for decision-making

Smart HVAC
Smart enabling the heating, ventilating and air conditioning (HVAC); monitoring temperature, humidity, air quality, etc.

Smart Lighting
Automating lights according to human presence and external ambient conditions; track energy consumption.

Smart People Counter
Analyze customer flows and traffic trends; evaluate impact of advertising and promotions.

Smart Washroom
Responsive cleaning and replenishment is replaced with usage-based servicing, which reduces unnecessary service visits.

Smart Asset Tracking
Tracking the movement of assets/people/vehicles inside the building through tracking devices such as RFID.

Smart Energy Monitoring
Real-time tracking and optimization of building energy consumption.

Smart Security
Real-time surveillance of the building; monitor security elements' status and raise alerts.

Targeted Notification
Targeted notification inside the building (e.g., conference room availability; proximity, etc.) through beacons.
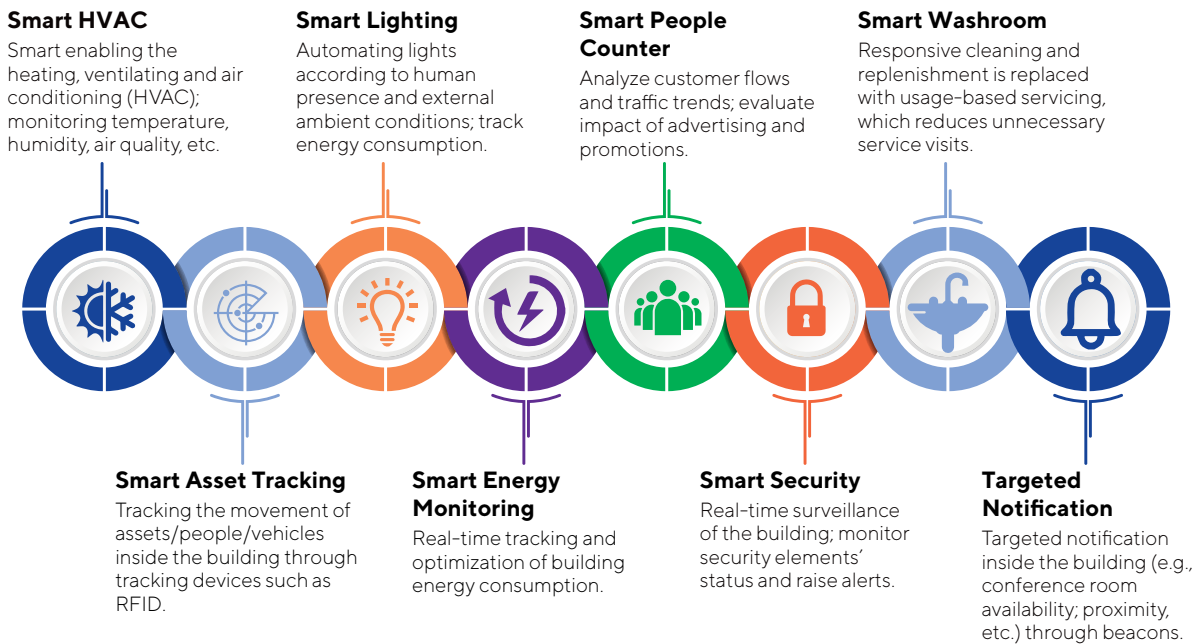
Figure 3

Our 1Facility platform for smarter facilities

Our 1Facility is a device- and platform-agnostic SaaS solution that can be easily integrated with a broad range of existing building management and control systems, assets and new sensors across facilities to provide intelligent management insights to all stakeholders.

The solution derives information from data residing within the buildings, analyzes it against KPIs and then streams it to a common platform for a cohesive view of the performance across the building's many systems. Aided by adapters for interconnection with existing building automation and management systems, the solution can accelerate data capture and process event streams in near-real time. (see Figure 4).

1Facility can help create smarter buildings by delivering specific capabilities to support energy efficiency management, operational safety and security, regulatory standards compliance, optimized utilization of assets and spaces, improved cost cycle control and reduction of waste.

Using a rich set of custom dashboards, managers can monitor real-time work orders, KPIs and consumption patterns across the property portfolio. They can also analyze best practices and processes to learn from top-performing buildings.

A formula for more effective facilities management

Once installed and integrated, Cognizant's 1Facility Platform provides the following benefits:

🔄	Simplify and streamline integration with BMS systems.
🔀	Move to proactive and remote field servicing.
📊	Monitor, manage & reduce facility risk.
🎚️	Get equipped with insightful building analytics.
🖼️	Gain a single view of all the aspects of the facility.
📈	Optimize maintenance costs.
◎	Get access to new and customized sensors through partners in our sensor marketplace.

Figure 4

Overall, FMs will gain insights on the demands of people, systems and assets to reduce overheads and deliver savings in terms of energy, maintenance and productivity (see Figure 5).

The system can help detect minute changes in fan speed, air temperatures, space occupancy or ambient skylight, to name a few variables, and trigger continuous adjustments to optimize equipment performance or conserve energy. Event processing and analytics predict when a piece of equipment is close to failure and alert facility technicians to fix the problem. Finely-tuned

equipment maintenance extends asset life and reduces facility staff, operations and replacement costs.

Specialized microservices can be layered on top of the platform to handle smart building use cases such as occupancy, indoor positioning, activity-based cleaning and maintenance, visitor handling, service queue congestion, etc. (Learn more about microservices by reading our white paper "Overcoming Ongoing Digital Transformation Challenges with a Microservices Architecture.")

Anatomy of an intelligent facilities management system

BMS SYSTEM INTEGRATION
Integrate relevant data from existing BMS Systems with 1Facility Gateway.

BUILT IN CONNECTORS FOR ENTERPRISE SYSTEMS
IWMS and service management systems.

SENSOR MARKETPLACE
Access to our varied and leading sensor partners.

MULTILINGUAL SUPPORT
Support operations around the world.

WEB AND MOBILE ENABLEMENT
View information in various form factors.

FIELD SERVICE ENABLEMENT
Integration with field service to optimize such servicing.

BUILT-IN CONNECTORS FOR EXTERNAL 3RD PARTY SYSTEMS
External 3rd party systems like weather APIs and risk profile systems.

INTELLIGENT END USER APPS
Quick and easy way to access services and data, and to take action.

INSIGHTFUL BUILDING ANALYTICS
Domain analytics services.

Figure 5

A unified solution with intelligent interfaces

Using 1Facility, various building stakeholders can benefit from a rich set of custom interfaces and intelligent end-user applications, all unified within one integrated solution based on a single source of truth. The solution enables interactions in which previously independent systems within each building and across the portfolio of buildings work collectively to meet operational goals and continuously create an environment that is most conducive to occupants' needs (see Figure 6).

The solution can support different users with varied roles who interact using multiple devices such as laptops, smartphones, tablets, touch screens and conversational voice assistants. For example, occupants have easy access to services via smart apps or voice assistants to control air condition, ambient lighting, etc. FMs can perform wider functions using rich browser-based features and tablets. And service technicians can use mobile/AR apps for remote assistance and efficient work execution.

A single integrated intelligent solution

Stakeholders can benefit from perspectives derived from the custom insights.

REAL ESTATE SERVICE PROVIDER	ERGONOMICS, EFFICIENCY, BRANDING	• Improved portfolio risk management. • Service innovation to tenants. • Space management. • Efficient and effective field services. • Overall energy usage management.	• Improve occupant experience. • Enhanced building performance. • Create loosely coupled systems. • Institute data governance.
TENANT/ OCCUPIER	OPERATIONS COST, INTEGRATED OPS, TRANSPARENT TRANSACTIONS	• Enhanced energy efficiency by tracking usage. • Increased interconnectivity and data capture enhances cyber-security and data privacy. • Creating value through new revenue sources.	• Get real time data about building. • Increased cost savings from operational efficiency. • Reduced insurance premium due to reduced risks. • Safety and security of assets.
INVESTOR/ OWNER	MONETARY, REGULATORY, LEGAL	• Enhanced building performance. • Management and reduction of property risk. • Reduced insurance premium. • Compliance management. • Availability of real time building data for decision-making. • Safety and security of the building and structures.	
FACILITIES MANAGER	SAFETY, SECURITY, SIMPLIFIED CONTROL	• Focus on employee, occupant health and productivity. • Develop clear responsibilities. • Safety compliance. • Environmental compliance. • Unified view of all buildings and data.	• Remote monitoring and control. • Increase staff convenience by designing more comfortable and customizable workspaces. • Simplified operations.

Figure 6

Getting there from here

To achieve a single, smart and integrated view of building operations, FMs need a partner that understands business priorities and takes a holistic approach. Our consulting framework for assessment and improvement helps FMs along the entire journey into smarter facilities management (see Figure 7).

Our 1Facility solution is fundamentally a transformation in facilities operation and maintenance.

The approach begins with assessing the business objectives, organizational readiness, existing processes and staff capabilities, in order to implement a customized solution based on the current level of facilities maturity. Each facility is unique in its mission and operational objectives and, therefore, the implementation roadmap will aim to balance short- and long-term needs accordingly.

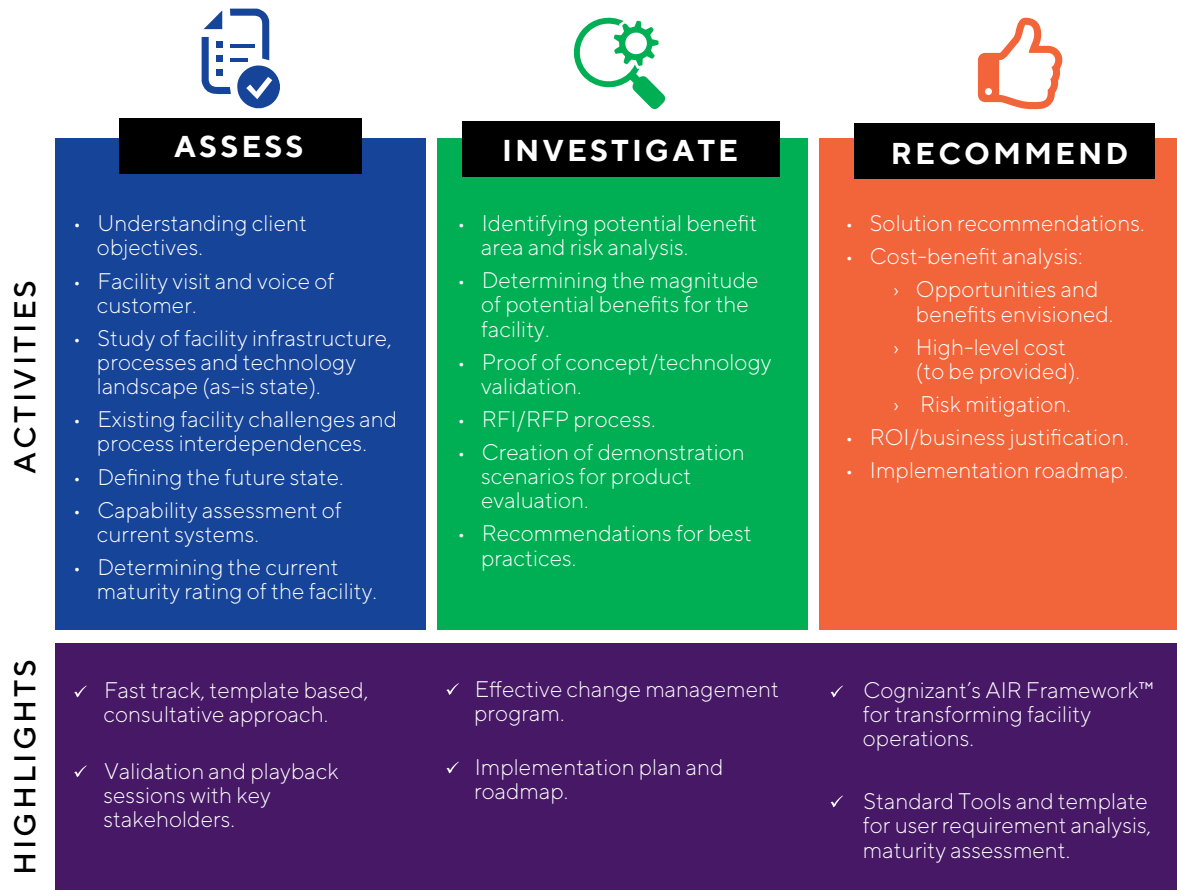## A framework to advance the building portfolio transformation journey

	ASSESS	**INVESTIGATE**	**RECOMMEND**

ACTIVITIES	• Understanding client objectives.
	• Facility visit and voice of customer.
	• Study of facility infrastructure, processes and technology landscape (as-is state).
	• Existing facility challenges and process interdependences.
	• Defining the future state.
	• Capability assessment of current systems.
	• Determining the current maturity rating of the facility.
		• Identifying potential benefit area and risk analysis.
		• Determining the magnitude of potential benefits for the facility.
		• Proof of concept/technology validation.
		• RFI/RFP process.
		• Creation of demonstration scenarios for product evaluation.
		• Recommendations for best practices.
			• Solution recommendations.
			• Cost-benefit analysis:
			  › Opportunities and benefits envisioned.
			  › High-level cost (to be provided).
			  › Risk mitigation.
			• ROI/business justification.
			• Implementation roadmap.

HIGHLIGHTS	✓ Fast track, template based, consultative approach. ✓ Validation and playback sessions with key stakeholders.	✓ Effective change management program. ✓ Implementation plan and roadmap.	✓ Cognizant's AIR Framework™ for transforming facility operations. ✓ Standard Tools and template for user requirement analysis, maturity assessment.

Figure 7

Quick Take

Intelligent Restrooms Drive Automated Replenishments

A multinational client of ours — a personal care corporation with manufacturing facilities in 41 countries and product sales in more than 150 countries — leveraged our solution to intelligently maintain restroom facilities and provide a complaint-free washroom experience for occupants.

We designed an ecosystem of sensors for smart washroom dispensers that gathered near-real-time data on consumption and stock situation, and that then used predictive analytics to drive the consumables replenishment without interruption to service. We developed the intelligent restroom (IRR), a responsive front-end web app built on top of the 1Facility platform that interfaces with intelligent sensor integrated restroom amenities such as dispensers, entrance doors, etc., in near-real-time and provides a quick and easy way for service personnel to access restroom data and take action.

The platform enabled operational and cost efficiencies to building managers across a huge establishment serviced by the client. This established our client as a pioneer in the world of automated, intelligent and future-ready devices in the restroom, while it simultaneously drove increased purchases of consumables.

As part of the pilot, the solution was able to provide:

l   90% reduction in dispenser complaints owing to advance alerts by the system.

l   33% reduction in consumables inventory due to accurate safety stock prediction.

l   20% reduction in consumables consumption by avoiding premature refilling of inventory.

l   10% reduction in operational costs and restroom service time.

Quick Take

Connected Smart Commercial Buildings Platform for a Global Insurer

We helped a global insurer embrace intelligent monitoring across its business portfolio of connected smart commercial buildings. The platform utilized sensors and a gateway from our device partner, a large European engineering company, to securely capture building telemetry, consolidate and interpret over 100 data points from each building's monitoring systems, and provide timely notification services to escalate critical facility issues.

Using our 1Facility, the client can monitor the status of the buildings periodically, assess risks and design insurance premium plans accordingly based on real-time condition and maintenance parameters. The solution enabled:

I   Advanced risk selection without site visits.

I   Early loss detection and prevention.

I   Usage-based pricing, rewarding well-managed buildings.

I   Sophisticated pricing techniques that leverage building data throughout the policy lifecycle.

I   Reduced claims in commercial building insurance.

Looking ahead

Today, innovative companies demand an increased focus on productivity, occupant satisfaction through service enhancement, workplace innovation and technology enablement. An approach like our 1Facility Platform can help building owners and facility executives to meet those demands and gain competitive advantages.

There is tremendous value in smarter facilities that actively engage occupants and understand the performance of its assets in near-real-time. The benefits extend much beyond maintenance, energy, emission and cost-effectiveness, resulting in enhanced occupant experiences, productivity and increased revenue.

Given the fast-changing dynamics of the facility world, executives and building owners should:

❚ Redefine FMs' goals toward more strategic focus areas of effectiveness, productivity and engagement in order to drive business value and attract talent.

❚ Explore the opportunities presented by several current technology paradigm shifts such as cloud, mobile, IoT and AI to gain true visibility into their facilities programs.

❚ Take advantage of the enormous amounts of data collected about the workplace and the workforce to derive actionable insights for smarter operations and personalized services.

About the authors

Rajesh Rajagopalan

Director of Projects, Cognizant Intelligent Products & Services Practice

Rajesh Rajagopalan is a Director of Projects within Cognizant's Intelligent Products & Services (IPS) Practice. In this role, he is responsible for the delivery of IoT services and competency and solution development. Rajesh has spent 16 years with Cognizant working in various capacities. He received a bachelor's degree in computer science and engineering from Coimbatore Institute of Technology, Tamil Nadu, India. Rajesh can be reached at Rajesh.Rajagopalan@cognizant.com | www.linkedin.com/in/rajeshrajagopalan.

Thariq Hameed

Manager, Cognizant Intelligent Products & Services Practice

Thariq Hameed is a Manager within Cognizant's Intelligent Products & Services (IPS) Practice, specializing in the Internet of Things, blockchain and facilities management. He has 11-plus years of overall experience in IT services and entrepreneurship. Thariq has handled business analysis, requirements management, consulting, product implementation and project management across domains and projects both in the U.S. and India. He can be reached at Thariq.Hameed@cognizant.com | www.linkedin.com/in/thariq-hameed.

Balaji Rajamani

Senior Manager, Cognizant Intelligent Products & Services Practice

Balaji Rajamani is a Senior Manager within Cognizant's Intelligent Products & Services (IPS) Practice, specializing in the Internet of Things and facilities management. He has 16 years of experience in IT services implementing delivery processes and meeting business goals. Balaji handles BMS integrations, core IoT platform solutions, IWMS & DFS implementations and custom web apps. He can be contacted at Balaji.Rajamani@cognizant.com | www.linkedin.com/in/balaji-rajamani.

Balaji Sethuraman

Associate Director, Cognizant Intelligent Products & Services Practice

Balaji Sethuraman is an Associate Director within Cognizant's Intelligent Products & Services (IPS) Practice. He has 13-plus years of consulting experience across industries including media entertainment, retail and IOT domains working with global clients from top studios, retail & CPG leaders around digital transformation, IOT strategy consulting, commercialization and NPDs. Balaji can be reached at Balaji.Sethuraman2@cognizant.com | www.linkedin.com/in/balajisethuraman/.

Endnotes

1   International Energy Agency, "Transition to sustainable buildings – Strategies and Opportunities to 2050"; www.iea.org/Textbase/npsum/building2013SUM.pdf.

2   U.S. Department of Energy Better Buildings program, March 19, 2015; Energy Information Administration. "A Look at the U.S. Commercial Building Stock: Results from EIA's 2012 Commercial Buildings Energy Consumption Survey (CBECS)," March 19, 2015; and Energy Information Administration "2010 Manufacturing Energy Consumption Survey (MECS)"; www.energystar.gov/buildings/about-us/facts-and-stats.

3   U.S. Environmental Protection Agency, ENERGY STAR program. "Useful Facts and Figures"; www.energystar.gov/buildings/about-us/facts-and-stats.

4   CABA White Paper, "Bright Green Buildings: The Convergence of Green and Intelligent Buildings"; www.caba.org/CABA/DocumentLibrary/Public/Bright_Green_Buildings.aspx.

5   American Council for Energy–Efficient Economy (ACEEE), "Intelligent Efficiency: Opportunities, Barriers, and Solutions"; http://aceee.org/research-report/e13j.

6   U.S. Office of Energy Efficiency & Renewable Energy – BTO Residential Buildings Integration Program, www.energy.gov/eere/buildings/residential-buildings-integration.

7   BREEAM Profile: The Edge, Amsterdam, www.breeam.com/index.jsp?id=804.

8   IATA/TE Passenger Forecasting Service, www.iata.org/whatwedo/ops-infra/airport-infrastructure/Documents/AoF_brochure_02.pdf.

9   https://venturebeat.com/2016/12/14/wynn-las-vegas-to-put-an-amazon-alexa-in-every-hotel-room-by-summer-2017/.

10 Google's DeepMind AI Blog, July 2016, https://deepmind.com/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-40/.

11 U.S. Energy Information Administration (EIA) – International Energy Outlook 2016 (IEO2016), www.eia.gov/pressroom/releases/press432.php.

12 U.S. Energy Information Administration (EIA) (2012). Architecture 2030 Summary of Building sector energy uses, http://architecture2030.org/buildings_problem_why/.

13 Inventory of U.S. Greenhouse Gas and Sinks, 1990 – 2013, www.energystar.gov/buildings/about-us/facts-and-stats.

14 U.S. Department of Energy Better Buildings Program. Mar 19, 2015, www.energystar.gov/buildings/about-us/facts-and-stats.

15 New Buildings Institute – 2014 Getting to Zero Status Update, https://newbuildings.org/sites/default/files/2014_Getting_to_Zero_Update.pdf.

16 Zero Net Energy Building Controls: Characteristics, Energy Impacts and Lessons (CABA 2015).

Acknowledgments

About Cognizant Digital Business | Intelligent Products and Solutions

Cognizant Digital Business helps our clients redefine business models, innovate new products, deepen intelligence and enhance customer experiences to drive sustained growth. We do this by bringing together human insight, digital strategy, industry knowledge, product engineering and technologies like the Internet of Things (IoT) to transform industrial and commercial businesses in the digital era. Clients count on our IPS expertise to help them architect the bridge between the physical world of sensors, machines, industrial processes, places, people and the digital world of software, IoT platforms and data. We offer solutions to realize their dual mandate of driving efficiency by utilizing real-time insights of products/processes and fueling innovation in newer business models. Our global network of dynamic environments and labs allow us to workshop, fabricate and create new ideas and innovations with our clients. With our rich ecosystem of technology partners, IoT and cloud platforms, such as AWS, GE Digital, Microsoft and PTC, we help deliver industry solutions at scale. To learn more, please visit, www.cognizant.com/enterprise-iot-solutions or join the conversation on LinkedIn.

About Cognizant

Cognizant (Nasdaq-100: CTSH) is one of the world's leading professional services companies, transforming clients' business, operating and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build and run more innovative and efficient business-es. Headquartered in the U.S., Cognizant is ranked 195 on the Fortune 500 and is consistently listed among the most admired companies in the world. Learn how Cognizant helps clients lead with digital at www.cognizant.com or follow us @Cognizant.

Cognizant

World Headquarters

500 Frank W. Burr Blvd.
Teaneck, NJ 07666 USA
Phone: +1 201 801 0233
Fax: +1 201 801 0243
Toll Free: +1 888 937 3277

European Headquarters

1 Kingdom Street
Paddington Central
London W2 6BD England
Phone: +44 (0) 20 7297 7600
Fax: +44 (0) 20 7121 0102

India Operations Headquarters

#5/535 Old Mahabalipuram Road
Okkiyam Pettai, Thoraipakkam
Chennai, 600 096 India
Phone: +91 (0) 44 4209 6000
Fax: +91 (0) 44 4209 6060