Green Quadrant: IoT Platforms For Smart Buildings 2022

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SMART BUILDINGS

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This report provides a detailed fact-based comparison of the 17 most prominent Internet of Things (IoT) platforms for smart buildings available on the market today. Based on the proprietary Verdantix Green Quadrant methodology, the analysis brings together information from extensive live product demonstrations with vendors, their responses to a 154-point questionnaire and insights from a survey of 285 real estate executives. The analysis finds that leading vendors have expanded their capabilities to deliver more comprehensive applications across areas such as asset monitoring and maintenance, energy management, space monitoring, and building security. The evaluation of capabilities and market momentum reveals that four firms — JCI, Schneider Electric, Siemens and Spacewell — currently lead the market, whilst other providers have strong capabilities in specific areas. Corporate real estate executives and technology buyers should use this report to understand the leading offerings in the market and the vendors that will best meet their needs.

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ORGANIZATIONS MENTIONED

ABB, ABM, Accenture, Accor, Accruent, Accu-Tech, Adidas, Airthings, Airthinx, Ameriprise, Angus Systems, ASML, Atlassian, Atos, Automated Logic, AWS, AXA, Axonize, Axxerion, AZMM Hospital, BigBasket, Bosch, Boston Scientific, Carrefour, Carrier, CBRE, CDP, Clockworks Analytics, Comfy, Co-operative Group, Cushman & Wakefield, Deloitte, DEXMA, Disruptive Technologies, Drees & Sommer, EcoEnergy Insights, EdgePresence, EDGE Technologies, Energisme, ENERGY STAR, Enlighted, European Commission, Fortive, Gaw Capital, GHG Protocol, Google, GRESB, Haltian, Hamilton Health Sciences, Harvard University, HID Global, Homebase, Honeywell, Humber River Hospital, IBM, Indolytics, Infogrid, ING, Integral, Intel, Irisys, ISS, JLL, John Hopkins University, Johnson Controls (JCI), Kaiser Permanente, Kontent, L & T Technology Services (LTTS), Larsen & Toubro, Leapcraft, Lenel, Maersk, Massachusetts Institute of Technology (MIT), Melbourne Airport, Mercury Systems, Microsoft, Monnit, NABERS, National Health Service (NHS), Nemetschek Group, Neptune Automatic, Northbay Healthcare, Northzone, Planon, PointGrab, PointGuard, Polytechnic University of Catalonia, Primark, Quercus Technologies, Radisson, Red Hat, Resource Data Management (RDM), Rigado, SALTO, Santander, SAP, Schneider Electric, Science Based Targets initiative (SBTi), Shaw University, Siemens, SmartClean Technologies, SonicWall, Spaceti, Spacewell, Spica Technologies, SPIE, SUEZ, Switch Automation, Tampere University, Thing Technologies, ThoughtWire, T-Mobile, Travelodge, Trend, Tridium, Unibail-Rodamco-Westfield, University of Arizona, University of Birmingham, University of Iowa, University of Westminster, University Properties of Finland, US Department of Energy, UTC, VergeSense, Verizon, William Osler Health System, Yanzi.

The State Of The Market For IoT Platforms For Smart Buildings

The IoT describes a network of connected devices and systems that collect and share data. This connectivity of devices and systems opens up opportunities for firms to understand, model, manage and even control the health of equipment, so that it operates in a more effective manner. A huge range of 'things' can participate in the IoT network – such as sensors, meters, equipment and building systems like HVAC or boiler plants – so long as they can communicate over a network, including with each other. The IoT has a wide range of applications, ranging from supporting and managing utilities, to monitoring factory lines, optimizing residential property operation and even operating autonomous vehicles.

In the built environment, IoT platforms for smart buildings have a key role to play in helping firms effectively collect, collate and analyse building data from sensors, energy meters, incumbent systems such as building management systems (BMSs) and HVAC units, and other internal and external data sources. Over the past few years, building IoT platforms have helped deliver greater levels of automation to building management, leveraging data insights to optimize building operations. Moreover, larger IoT datasets have begun to have strategic impacts on businesses, driving real estate strategies through space usage trends and prompting capital expenditure plans by predicting asset or device failures ahead of time.

Although facilities and real estate directors are typically the main buyers and managers of these solutions, building IoT platforms have now grown to impact every building stakeholder, from landlords to building occupiers, many of whom interact directly or indirectly with these solutions regularly. This report provides the individuals responsible for selecting, implementing and extracting value from IoT platforms for smart buildings with a detailed benchmark of the 17 most prominent solutions available on the market. The research for this report answers specific supplier selection questions, such as:

- Which IoT platforms for smart buildings will meet the requirements of my organization?
- Which IoT platforms for smart buildings are leading the market?
- How do solutions on the market integrate with my existing organizational systems and solutions?
- How can I benchmark the functionality and depth of experience of IoT providers and assess their ability to deliver value?
- How can IoT platforms for smart buildings support my wider business strategy?

To answer these questions, Verdantix analysed 17 IoT platforms for smart buildings using a 154-point questionnaire and conducted three-hour live software demonstrations. We also analysed results from our global corporate survey of 285 real estate and facilities management executives and interviewed a panel of buyers of building software solutions to understand their experiences, demands and feedback on solutions in the market. The resulting analysis is based on the proprietary Verdantix Green Quadrant methodology, designed to provide an evidence-based objective assessment of suppliers providing comparable products and services.

IoT Vendors Are Delivering More Comprehensive Platforms

The establishment of the internet and smart devices at the end of the 20th century led to the term 'Internet of Things' being coined in 1999. Since then, the volume of building IoT solutions available on the marketplace has grown, with IoT platforms proliferating in the past three years. The current smart buildings market:

- **Remains a fragmented ecosystem with a wide range of suppliers.**
  The building IoT marketplace comprises a plethora of vendors supplying different elements of the technology ecosystem, such as IoT sensors, connectors, devices, software and services. Firms implementing an IoT platform are likely to have to work with a varied set of vendors, encompassing sensor manufacturers such as Spaceti and VergeSense; gateway manufacturers such as Rigado; and solutions providers and systems integrators such as Accenture and Atos. With regard to IoT sensors, there is little uniformity around the network protocols that are used for data exchanges (see Verdantix Six Best Practices To Strengthen Your Building IoT Analytics Programme).

- **Boasts a growing number of comprehensive IoT platforms.**
  Although the IoT space still offers plenty of point solutions and platforms that tackle single use cases, there is a growing number of vendors offering more comprehensive IoT platforms in the market. These solutions deliver functionality across multiple use cases, such as asset and maintenance management, sustainability and security, consolidating these offerings into one platform. Vendors such as Johnson Controls (JCI), Schneider Electric and Siemens offer integrated suites of solutions that cover almost all elements of building management, whilst others provide solutions that target multiple key use cases.

- **Is consolidating as vendors aim to deliver more complete solutions.**
  To further enhance the completeness of IoT platform offerings, vendors are pursuing aggressive acquisition and integration strategies to fill gaps in their capabilities, as well as to consolidate different elements of building management and capitalize on innovation. For example, integrated workplace management system (IWMS) firm Planon acquired IoT platform vendor Axonize in June 2021, enabling enhanced insights into asset and building performance through connected assets and digital twins.

- **Brings together vendors from a diverse set of business heritages.**
  The vendors included in this report have entered the building IoT platform space from different heritages, such as asset and maintenance management, energy management, space and workspace management and BMSs. For example, EcoEnergy Insights (part of Carrier) has built out an IoT platform from an energy management background, while Schneider Electric has extended from a heritage in building controls. This report covers firms that deliver IoT applications aimed at the built environment and therefore does not consider vendors that only focus on other areas, such as IoT infrastructure or IoT devices and networking.

- **Delivers a range of use cases, with the capacity to support new usage scenarios.**
  Building IoT platform vendors have developed a set of well-established use cases. Some elements of functionality are traditional, such as energy or security management, whilst others, such as space analysis, have garnered interest more recently. IoT platforms are delivering value when it comes to new usage scenarios too, fulfilling customer needs as they emerge. For example, following COVID-19, IoT functionality around remote building management, space optimization, smart cleaning and occupant health and wellbeing has proved very useful for users. IoT platforms are now also going beyond day-to-day operations; collated building datasets can offer more strategic insights into businesses, which can impact and inform decisions around business strategy, such as real estate sizing or sustainability.

- **Is benefiting from cheaper and more reliable sensors and solutions.**
  One of the factors driving adoption of IoT solutions is the lowering costs of IoT sensors and solutions, breaking down one of the key barriers to entry. Sensors are also becoming more reliable and easier to deploy, helping to overcome some of the teething problems previously seen in the industry. For example, Infogrid was able to deploy thousands of sensors from Disruptive Technologies to hundreds of global Verizon sites in just six weeks (see Verdantix Infogrid Empowers The Rapid Deployment Of Building Intelligence At Scale).

Advanced Analytics And Improving Connectivity Will Drive Future Adoption Of Building IoT Solutions

The IoT platforms for smart buildings market comprises a range of vendors from different heritages, leading to increasing choices for buyers. These platforms are also fulfilling new use cases across different verticals, broadening the adoption of IoT solutions. In the future, the market for IoT platforms for smart buildings will be shaped by the:

- **Emergence of edge computing, driving IoT adoption by industries such as manufacturing.**
  Edge computing allows data to be managed and processed closer to the source, enabling quicker responses to incidents and reducing the volume of data sent to the cloud. The reduced latency and data-intensity allow industries that are typically underserved by IoT, such as manufacturing, to access IoT platforms for their buildings. These firms can now receive real-time insights without hindering time-sensitive processes or responses. Vendors are angling to combine edge computing with IoT to target these customers. For example, in May 2020 IBM announced Cloud Satellite, a service that runs IBM Cloud from any edge location, whilst in October 2020 Schneider Electric partnered with Accu-Tech and EdgePresence to deploy edge data centres in the US to support IoT applications.

- **Establishment of 5G connectivity, supporting more data-intensive use cases.**
  The deployment of 5G networks, including private networks, will enable firms to pursue more data-intensive IoT use cases, such as digital twins, as well as achieve greater global coverage and scale out solutions more effectively. One-third of real estate executives intend to use private 5G networks in the next few years to support their facilities and real estate activities (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). Solutions providers are pursuing 5G partnerships to enhance their offerings, appealing to industries that require the improved data bandwidth for data-intensive operations, such as manufacturing. In February 2021 Siemens announced a collaboration with IBM to combine the former's industrial IoT platform Mindsphere with the Red Hat OpenShift hybrid cloud platform.

- **Increasing momentum behind AI and machine learning.**
  With IoT no longer a nascent technology, demand for more advanced solutions is growing. Improving analytics that take advantage of AI and machine learning capabilities are enabling vendors to offer increasingly sophisticated solutions. For example, innovative video management solutions for building security can apply machine learning to rapidly identify and store still images of an incident from video streams, facilitating the work of security teams when identifying bad actors or threats. AI and machine learning also help deliver advanced use cases such as predictive modelling through digital twins and predictive maintenance, which can help real estate executives and facilities managers with maintenance efforts and capital spending planning.

- **Greater scrutiny around cybersecurity across smart buildings solutions.**
  While cybersecurity has been a constant item on the CIO's agenda, the topic is achieving increasing visibility in the realm of building technology. This reflects the fact that building systems are getting smarter, with embedded sensors and connectivity, introducing new risks of cyber-attacks. In addition, laws around cybersecurity are becoming more common, with regulations such as the US's IoT Cybersecurity Improvement Act of 2020 and the EU Cybersecurity Act now in place. With one report by cybersecurity solutions firm SonicWall stating that IoT cyber-attacks grew by 66% in 2020, buyers and vendors both have a responsibility to implement robust cybersecurity strategies. For example, solutions providers need to follow strict cybersecurity frameworks and employ strategies such as zero trust

networks and decoy edge devices (see Verdantix Six Best Practices To Strengthen Your Building IoT Analytics Programme). Buyers should ensure that new deployments align with existing security protocols and hire dedicated individuals to maintain cybersecurity.

- **New interest around sustainability, hybrid working and occupant health.**
  In the last 18 months, the COVID-19 pandemic has caused firms to drastically change their ways of working. With a shift to more hybrid working, businesses are focused on encouraging employees to return to the office – requiring technology tools to both engage with occupants and to ensure their health and wellbeing. The new working model has also shone a light on space utilization, with many businesses identifying an opportunity to rationalize their real estate portfolios. Sustainability, driven by new regulations and increased social interest around net zero carbon, has also solidified as a key business strategy for many firms. All these use cases are propelling interest around IoT solutions, which can fulfil these requirements both in the short and long term.

- **Continuing digitization journeys.**
  As was the case 24 months ago, building digitization remains a journey for most. As many firms lack the resources to purchase a full suite of solutions via IoT platforms, they instead opt for additive solutions, which can be scaled as required. Therefore, firms are continuing to seek long-term digital partners that can begin by extracting value from existing systems – in some cases, bringing legacy systems online – and deliver recurring value. Moving forward, these partners can then identify, support and execute new use cases to generate further value.

Firms Are Increasingly Leveraging IoT To Tackle Key Strategic Objectives

To gain a better understanding of customer perspectives around IoT platforms for buildings, Verdantix leveraged and analysed data from our 2021 global corporate survey of 285 corporate facilities and real estate executives (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). To support these insights, Verdantix conducted a series of interviews with a panel of buyers.

Cost Reduction, Occupant Wellbeing And Building Decarbonization Are The Foremost Real Estate Strategy Drivers

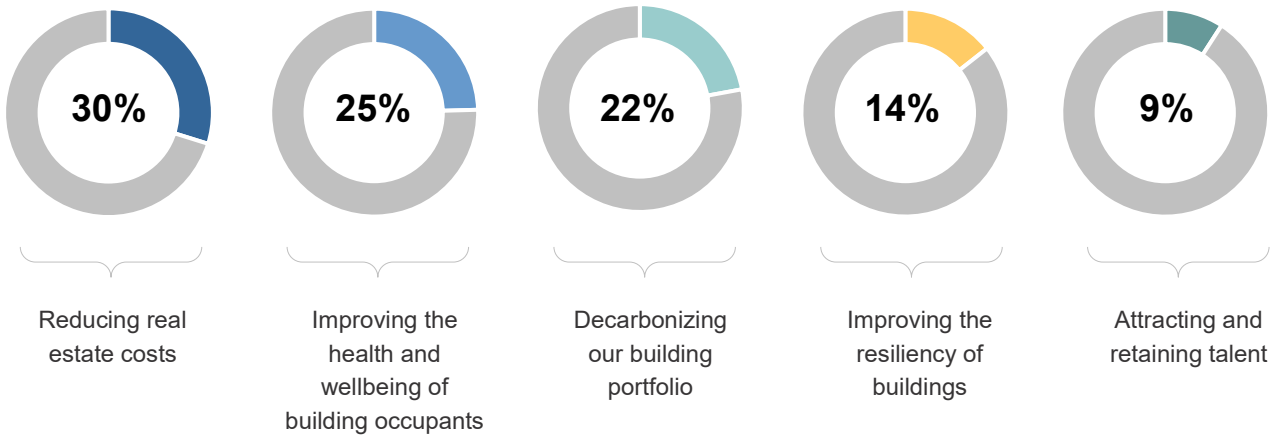
To better understand the overall strategic priorities of corporate real estate executives, Verdantix asked them to highlight their main real estate strategic objectives over the next three years. Facilities and real estate executives are looking to:

- **Reduce real estate costs in an era of post-pandemic cost management.**
  The number one priority amongst real estate executives over the next three years is to reduce real estate costs, with 30% ranking it as their top priority (see **Figure 1**). Primarily driven by the COVID-19 pandemic, firms remain concerned about the uncertainty surrounding their businesses and are therefore looking to optimize costs such as energy and maintenance. The shift towards a hybrid working model also presents an opportunity for firms to review their real estate portfolios and rationalize their space and spending to fit a more modern and efficient way of working. To achieve this, firms are prioritizing investment in IoT platforms to monitor space usage, as well as tools to facilitate workplace activities such as booking services.

FIGURE 1

Real Estate Executives' Top Strategic Priority Over The Next Three Years

"What is your firm's number one priority in real estate management over the next three years?"



Source: Verdantix Global Corporate Smart Building Survey 2021

N = 285

- **Improve building occupant health and wellbeing.**
  The health and wellbeing of building occupants is the second most significant priority for real estate executives overall. A quarter of respondents consider it to be their top priority over the next three years. Following the COVID-19 pandemic, businesses are trying to persuade employees back to the office. Despite more homeworking, most businesses still plan to retain some form of office working to support key business initiatives such as organizational culture and collaboration. To achieve this, firms are looking to improve occupant health and wellbeing, with the aim of instilling confidence in employees that the workplace is a safe and comfortable place to work. Thirty-nine per cent of executives intend to focus on air quality and building health even after COVID-19 vaccines have been widely adopted.

- **Decarbonize their portfolios to better meet sustainability goals and regulations.**
  Interest around sustainability, driven by increased regulations and social awareness, is reigniting executive focus following COVID-19. Twenty-two per cent of executives ranked the decarbonization of their building portfolios as their top strategic objective for their businesses over the next three years. Many firms are setting ambitious targets, such as shopping mall operator Unibail-Rodamco-Westfield, which intends to cut carbon emissions in half across the value chain over the next decade. Nearly half of executives plan to newly invest in tools to report building ESG data to stakeholders and investors in the next 12 months, demonstrating the prominent focus around sustainability.

Leading IoT Use Cases Reflect The Most Prominent Strategic Priorities

Cost reduction, hybrid working and decarbonization are the key trends shaping real estate strategies today. How do building IoT platforms factor into these strategic objectives? Our survey found that IoT solutions are being used to:

- **Monitor space utilization, in line with leading business priorities.**
  The leading use of IoT solutions within facilities management is space utilization monitoring, where 75% of firms are currently using the technology (see **Figure 2**). Forty-one per cent of firms are also using IoT solutions to some extent to support hotdesking or agile offices. Driven by the COVID-19 pandemic, businesses are turning to IoT tools to facilitate the transition to new working models. These investments will support employees, through functionality such as room or desk booking, as well as management looking to optimize space usage. Thirty-eight per cent of executives are evaluating or trialling IoT solutions to support hotdesking or agile offices.

- **Track asset compliance and energy consumption across different assets.**
  The third most popular use case for IoT is capturing temperature data to support compliance around systems such as refrigeration and ovens, as well as legionella monitoring. This process sees significant use of IoT by 19% of firms, with a further 28% employing some degree of IoT capabilities in this area. Compliance is a key management process across industries such as retail, manufacturing and healthcare. Forty-seven per cent of firms also use IoT to some or a significant extent to support energy management, with a further 46% currently evaluating or trialling IoT solutions. With the impetus around building decarbonization and sustainability growing rapidly, IoT solutions are a key stepping stone to supporting firms with their early efforts around energy data collection, tracking and management.

- **Support more proactive asset and maintenance management efforts.**
  Building management use cases around asset monitoring – such as leak and fault detection, asset condition monitoring and continuous asset commissioning – also see the use of IoT in more than 40% of cases. In these areas, advanced IoT solutions deliver predictive maintenance and real-time monitoring capabilities to minimize business disruption, enabling more measured and coordinated responses ahead of major faults. For example, the CORTIX platform from EcoEnergy Insights provides actionable maintenance recommendations to prevent equipment failures before they manifest themselves.

- **Deliver improved building security outcomes.**
  Forty-four per cent of real estate executives are using IoT in some capacity to monitor physical security risks, transforming a traditional building process to become nimbler and more effective. Around a third of executives are also evaluating or trialling IoT security solutions around this application. Firms have invested in a range of IoT-enabled security solutions, such as video analytics, cloud-based access control and cloud-based video surveillance. These three security tools are also the IoT technologies with the most ongoing interest – more than a third of executives are currently evaluating or trialling these technologies (see **Figure 3**).

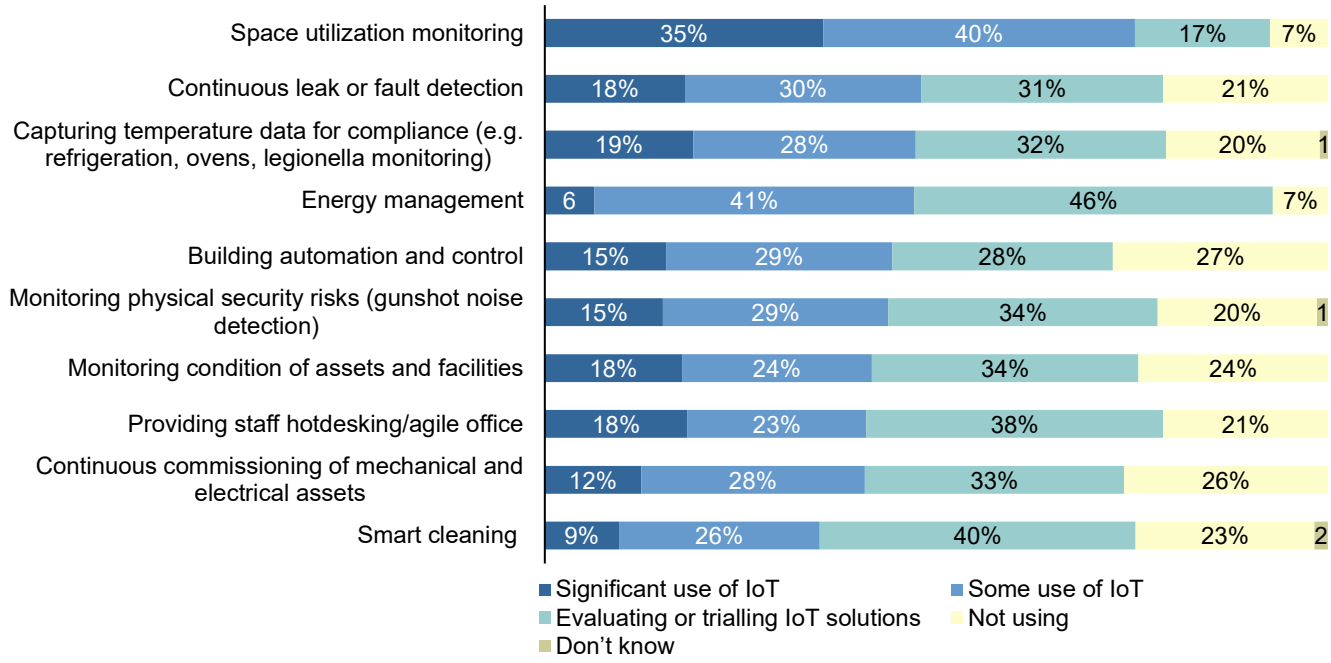
Building IoT Platform Investment Levels Will Soon Catch Up With Other Major Software Technologies

Firms are planning investments in IoT platforms that provide enhanced insights across areas such as space utilization, energy management and maintenance. How does the use of IoT platforms stack up against other technology categories such as computer-aided facility management (CAFM) or IWMS? Our survey shows that:

FIGURE 2

IoT Deployment Levels For Facilities Management Processes

"Do you currently use, or plan to use, IoT solutions for the following facilities management processes?"



Note: Data labels are rounded to zero decimal places; chart is ranked by first two responses; percentages less than 7% are written as numbers

Source: Verdantix Global Corporate Survey 2021: IoT Platform Investment Plans By Industry

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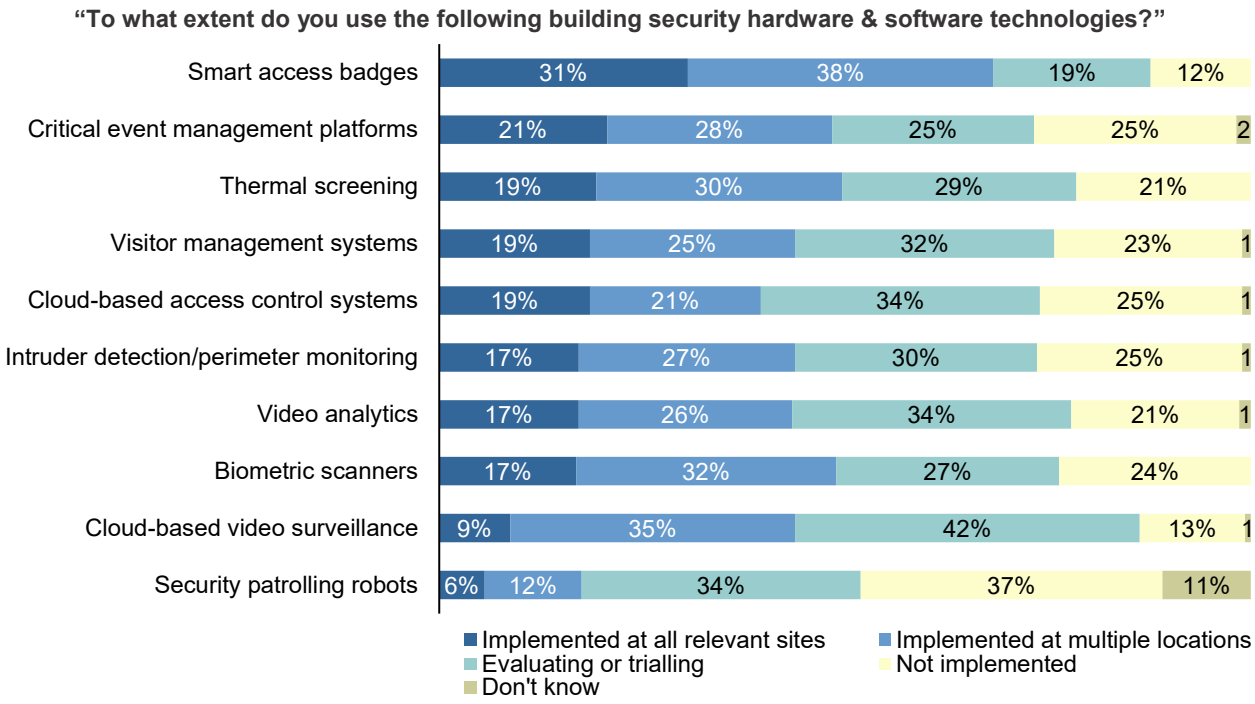
- **IoT platform implementation is catching up quickly with other key software technologies.**
  Thirty-seven per cent of firms have building IoT platforms implemented at all or some of their sites, with a further 29% currently evaluating, trialling or planning to invest in these (see **Figure 4**). Deployments of IoT monitoring platforms for buildings are rapidly catching up with other, more traditional, software technologies, such as IWMSs and BMSs. This is a sharp uptick on 2020, where IoT platforms severely lagged all other software categories, with more than two-thirds of firms exhibiting no intention to invest (see Verdantix Global Corporate Survey 2020: Smart Building Technology Budgets, Priorities & Preferences).

- **Investment in IoT platforms is set to continue.**
  Building IoT platforms are behind only IWMS solutions in terms of increased investment compared with pre-COVID spending levels (see **Figure 5**). Thirty-one per cent of executives will boost their investment in IoT platforms by up to 5% going into 2022, with a further 13% increasing investment by more than 5%. This elevated level of spending highlights how firms have been turning to IoT platforms in the last 18 months to support their most pressing objectives, such as occupant health and wellbeing – a trend that is set to continue into 2022.

- **Customers are continuing to pursue different deployment options.**
  As was the case in 2019, real estate and facilities executives are targeting different visions for organizing their technology landscape. More than a quarter of executives plan to use a few solutions that have broad functionality, such as for workplace management, or for energy, assets and maintenance, whilst 19% intend to use a single integrated solution for most of their real estate needs (see **Figure 6**). Meanwhile, some vendors are still pursuing a strategy of point solutions. This scattered approach demonstrates the diversity in technology strategies across the market. Flexible solutions that can operate within these different strategies – for example, through integrations – will be likely to perform better.

FIGURE 3

Smart Building Security Hardware And Software Deployments



Note: Data labels are rounded to zero decimal places; percentages less than 3% are written as numbers
Source: Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences

N = 285

Real Estate Managers Face Prominent Challenges Around Data Integration And Cybersecurity

With the adoption of building IoT platforms on an upward trajectory, Verdantix probed executives about the biggest challenges they encounter when implementing building technology projects. The key difficulties firms face are:

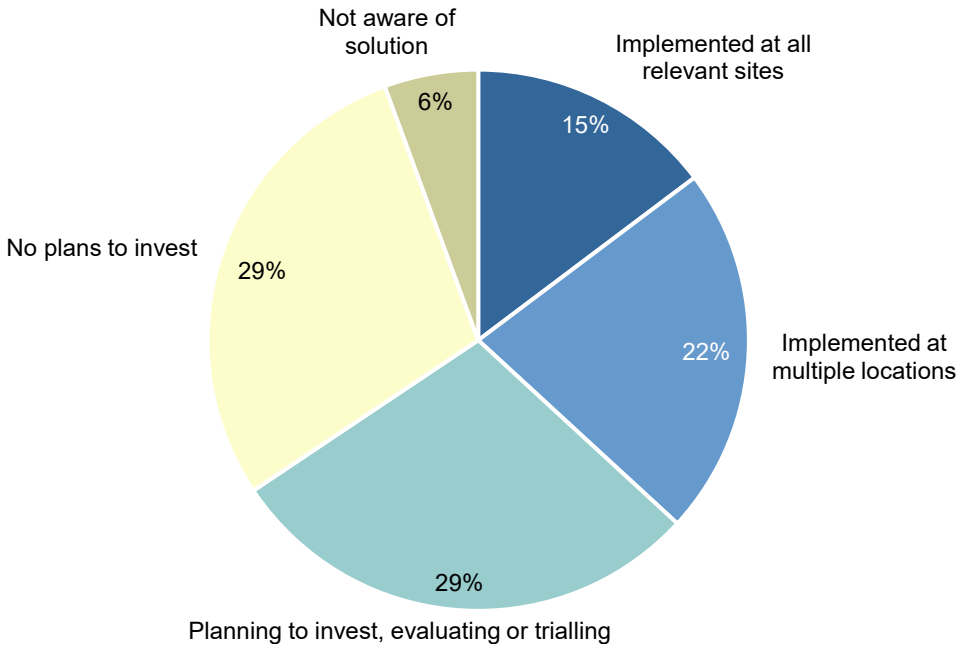
- **Integrating with incumbent data sources and systems.**
  Customers are increasingly demanding that new technology investments interact with and generate value from incumbent solutions. Rather than a 'rip and replace' approach, firms are keen to drive further value from existing implementations, such as BMSs, energy meters and security solutions, by bringing these systems together and extracting data. IoT platform vendors are focusing efforts on this aspect of implementation by developing building connectors and working with customers to connect to legacy systems – as well as other implementations that may exist – and break down data silos.

- **Making data and tools accessible and easy to use for all stakeholders.**
  In addition to leveraging legacy systems and data sources, customers are seeking to improve the experience for all stakeholders in real estate ecosystems. For example, firms would like to simplify building management processes for building and facilities managers, whilst also enhancing the occupant experience. One of the challenges that stems from this is how to maximize building occupant engagement. Firms are increasingly turning to mobile solutions to achieve this. Forty-seven per cent of real estate executives consider an increasing use of mobile applications as a high priority in the next 12 months. When evaluating real estate and facilities management software, 92% of executives ranked the

FIGURE 4

Software Investment By Type Of Software

"To what extent do you use IoT platforms for smart buildings?"



Note: Data labels are rounded to zero decimal places
Source: Verdantix Global Corporate Smart Building Survey 2021

N = 285

quality of mobile apps as important or very important, making this the most significant factor in their purchasing decision.

- **Ensuring a robust cybersecurity strategy.**
  Enhancing cybersecurity risk management is a high priority over the next 12 months for 47% of real estate executives, highlighting the growth in importance of cybersecurity in the last two years. Multiple respondents on our customer panel noted the importance of cybersecurity in their technology decisions, with one interviewee stating that it was the reason for disregarding 80% of relevant vendor solutions. With the proliferation of building technology solutions, firms are only now catching up on the cybersecurity front, and many are faced with the challenge of applying a standardized framework and approach to incumbent solutions. Going forward, we expect firms to increasingly factor cybersecurity into every technology decision, to ensure that new vulnerabilities are not introduced into the business.

Cutting Costs And Improving Efficiency And The Occupant Experience Lead The Business Case For IoT

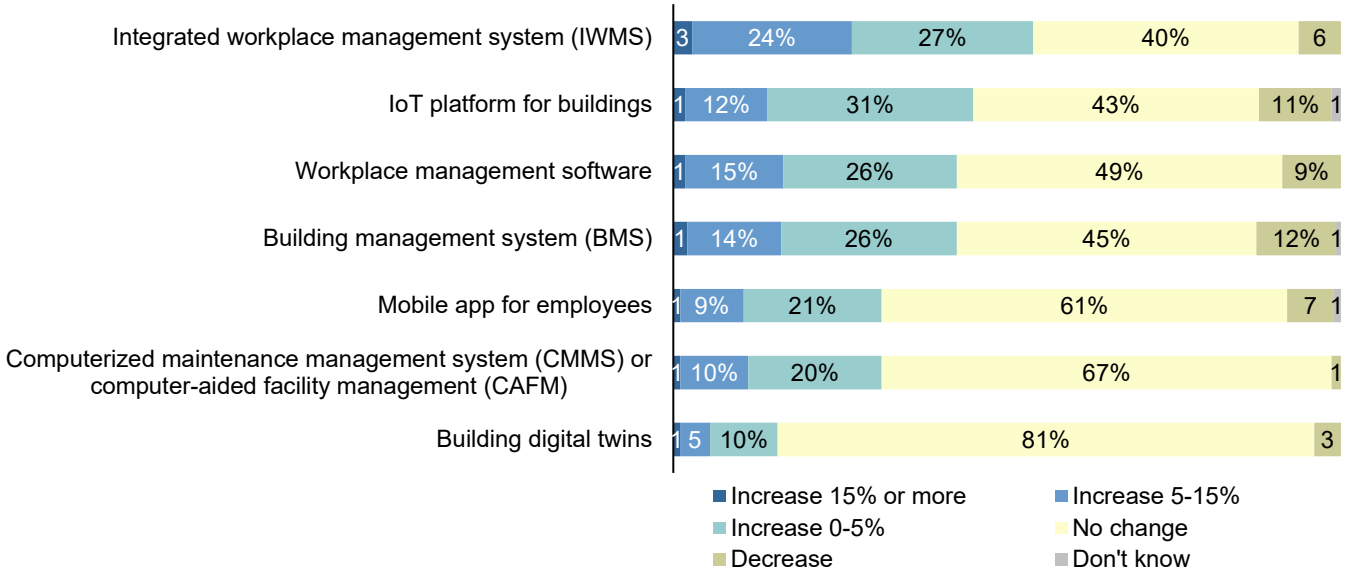
With investment in building technology a strategy that businesses are increasingly adopting, what are the outcomes buyers are focusing on when developing business cases? The data show that:

- **Cost reduction and business efficiency remain key drivers.**
  Reducing business costs and increasing operational efficiency – two long-running focal points in facilities management – remain key elements of the business case for investing in building technology. A primary focus for cost optimization is maintenance: 43% of real estate executives either plan to extend or replace

FIGURE 5

Smart Building Technologies Expenditure Changes For 2022

"From a 2019 baseline (pre-COVID-19), how do you expect your spending to change across the following categories of software?



Note: Data labels are rounded to zero decimal places; percentages less than 8% are written as numbers; chart is ranked by first three response options
Source: Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences

N = 285

their current deployment, or newly invest in software for asset and maintenance management, to help maximize asset uptime and reduce business disruption. For example, the University of Iowa used Schneider Electric's EcoStruxure Building Advisor solution at its campus of 49 buildings, leading to 17% of HVAC workorders being completed via predictive maintenance and resulting in $0.6 million in energy savings in one year.

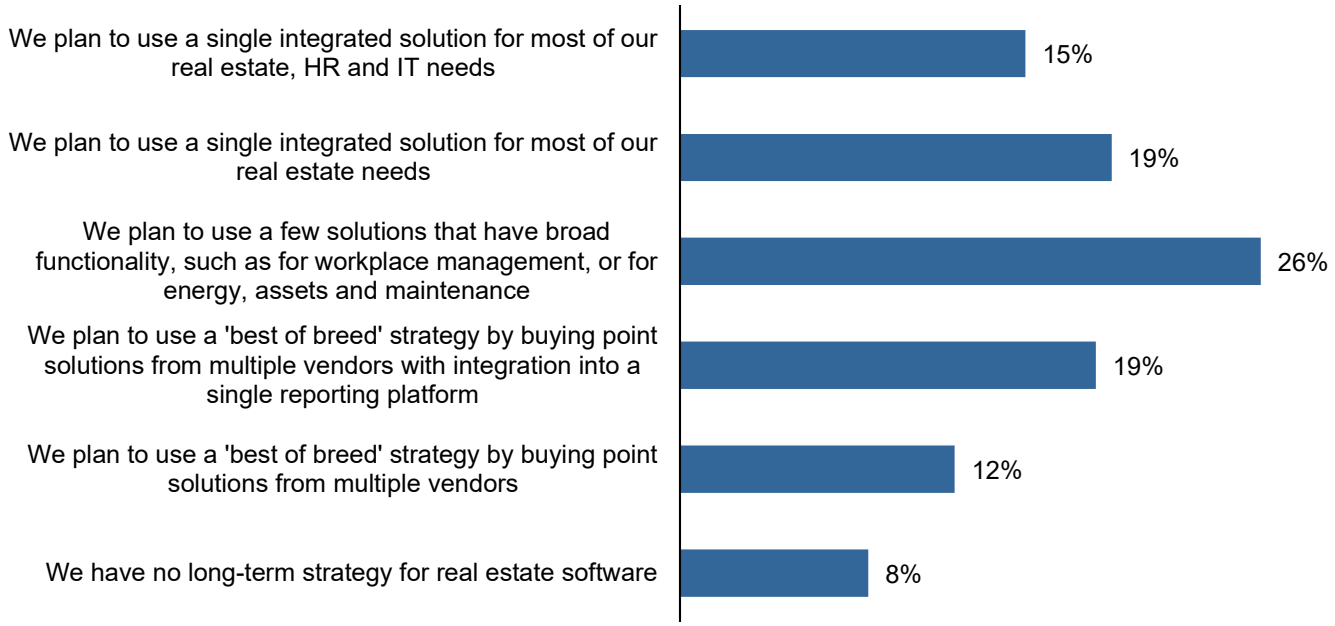
- **Occupant experience and wellbeing are vital elements of the business case.**
  Following COVID-19, many businesses have shifted towards a hybrid working model, with a greater focus on workplace wellbeing. As such, both occupant experience and wellbeing have become major factors in the business case for building technologies. Tools that maximize occupant wellbeing, through methods such as optimizing airflows, enforcing health questionnaires and smart cleaning, as well as making information available to customers on screens and through mobile apps, are becoming more commonplace, with the aim of increasing employee confidence. Firms are also seeking seamless mobile experiences that include features such as access control, booking and catering services, to enhance the user journey and minimize touchpoints.

- **Fast return on investment increases the appeal.**
  With few firms able to pursue wide-ranging technology enhancements due to budgetary constraints, executives are looking for the most tangible and impactful use cases to target first. Use cases that can be deployed quickly and deliver rapid return on investment (ROI) are thus the focus of executives, with the success of these initial deployments supporting the business case for future, more expansive technology investments. IoT solutions that replace or optimize labour, such as remote security management offerings, typically represent an easy ROI. The upfront costs of IoT investment are also steadily decreasing, as IoT sensors become cheaper and as more vendors adopt open systems that can integrate and connect with other solutions through application programming interfaces (APIs).

FIGURE 6

Strategies For Real Estate And Facilities Software Over The Next Five Years

"Which of the following statements best describes your strategy for real estate and facilities software over the next five years?"



Note: Data labels are rounded to zero decimal places
Source: Verdantix Global Corporate Smart Building Survey 2021

N = 285

Green Quadrant For Smart Building IoT Platforms 2022

Based on the insights gathered from our surveys, customer panel and in-depth interviews with suppliers, Verdantix has developed an outline of smart building IoT platforms (see **Figure 7**). Verdantix defines IoT for smart buildings as:

"A software platform made up of a communication layer for capturing sensor, asset, building management system, and external data; a database layer, for storing the data; and an application layer for analysis and reporting, monitoring, and analysing and controlling building services, such as occupant comfort, space utilization, energy, maintenance and security."

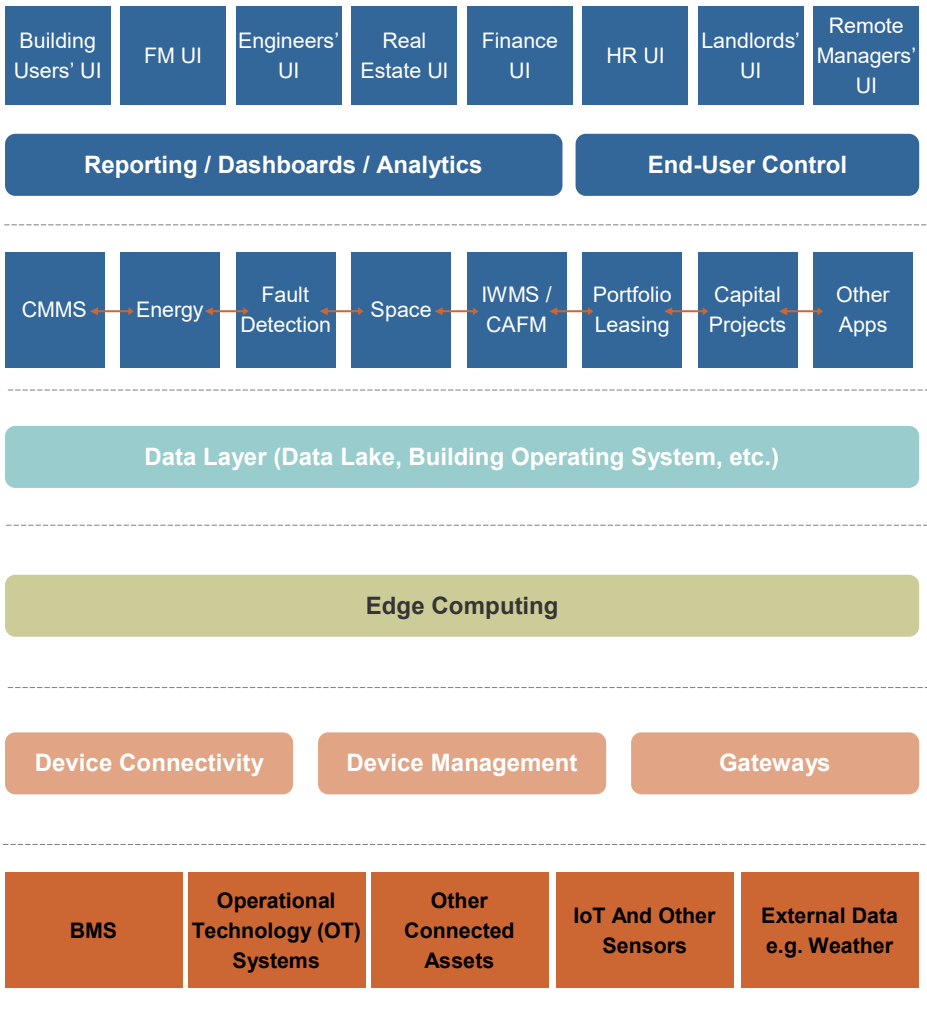
We note that there is a broad range of vendors that offer IoT infrastructure platforms, which typically consist of networking and communications hardware and/or software, including middleware, but which do not contain their own applications. These solutions fall outside the scope of this study and will be covered in future Verdantix research.

Green Quadrant Methodology

The Verdantix Green Quadrant methodology provides buyers of specific products or services with a structured assessment of comparable offerings across vendors at a specific point in time. The methodology supports purchase decisions by identifying potential suppliers, structuring relevant purchase criteria through discussions with customers and providing an evidence-based assessment of the products or services in the market. To ensure the objectivity of the study results, the research process is defined by:

FIGURE 7

Building IoT Platform Technology Stack



Role-based **user interfaces** (UI) across desktop apps, mobile apps and kiosks for different end-user groups.

The **reporting layer** delivers the analytics and insights. End-users can control devices to change operation.

The **cloud application layer** exchanges data with the data layer. Enterprise and third-party (point) solutions, via APIs, perform analysis and produce insights.

The **data layer** stores and centrally aggregates all data. It filters, processes and organizes the data for exchange.

Edge computing provides local rapid analytics via data servers. This layer can be bypassed for deeper analytics. Edge computing can also take place in the field and connectivity layers.

The **connectivity layer** connects systems and sensors to the IoT ecosystem and provides device monitoring and management.

The **field layer** includes sensors, as well as BMSs and other OT systems. Two-way communication with systems such as BMSs allows users to control systems remotely through UIs above.

Note: Different buildings will employ different technology stack configurations, depending on size, incumbent systems and operating processes. Other components exist beyond those shown.

Source: Verdantix analysis

- **Transparent inclusion criteria.**
  We analysed all providers that would qualify for inclusion in this research. For those providers that declined our invitation or failed to respond, we worked to include them based on publicly available information, which provides an impression of those firms' market positioning.

- **Analysis from a customer's perspective.**
  We spoke with a panel of customers who have bought or plan to buy a building IoT platform to understand the relevant buying criteria. These discussions informed how we weighted the evaluation criteria in the model that drives the Green Quadrant analysis graphic. Additionally, we utilized data from Verdantix corporate surveys of real estate and facilities management decision-makers.

- **Reliance on professional integrity.**
  As it is not feasible to check all data and claims that providers make, we emphasized the need for professional integrity. Correspondingly, competitors and existing customers can check each participant's assertions as they are placed in the public domain through this report.

- **Scores based on available evidence.**
  To assess the expertise, resources, business results and strategies of individual providers, we collected evidence from public sources and conducted interviews with multiple representatives of each solution, as well as industry experts. When providers claimed to be 'best in class', we challenged them to present related evidence.

- **Comparison based on relative capabilities.**
  We constructed measurement scales for each assessment criterion, ranging from 'worst in class' to 'best in class' for performance at a certain point in time. A provider's position in the market can change over time depending on how its offering and success evolves compared with its competitors. This means that even if a provider adds new capabilities, makes a strategic acquisition or receives new investment, its Quadrant positioning may not improve relative to other service providers, if these competitors also enhance their offerings. Verdantix repeats a Green Quadrant analysis for a product or service market annually, or every two years, to capture these transitions over time.

Inclusion Criteria For The IoT Platforms For Smart Buildings Benchmark

To ensure the Green Quadrant analysis only compares firms providing a similar breadth of functionality at a comparable level, we defined inclusion criteria. The 17 IoT platform suppliers included in this study were selected because their applications have:

- **Functionality for at least two smart building processes through an integrated platform.**
  Mirroring the buying trends for IoT platforms for smart buildings, this study only includes suppliers whose solutions deliver applications that can manage at least two smart buildings processes, out of eight defined processes. This eliminated solutions that provide a single functionality, such as asset or energy management.

- **At least 25 customers on their IoT platform.**
  As this is our second IoT Platforms for Smart Buildings Green Quadrant, with a proliferation of vendors and buyers over the past 24 months, we decided only to consider vendors with at least 25 customers on their IoT platforms – excluding customers that may be using other, non-IoT products offered by the vendor. This increased number, from 15 in the last study, is to ensure that the solutions compared are well-established in the market.

- **Ability to support enterprise-scale architecture.**
  This study only considers solutions designed to scale up to support large-scale operations in a multi-site deployment configuration upon request. This does not mean that all customers of the vendors covered in this Green Quadrant are this large, but it does indicate that the IoT platforms covered in the study can support customers of this size.

Based on these inclusion criteria, this report looks in depth at 17 IoT platforms for smart buildings vendors: Accruent, Carrier, Clockworks Analytics, Energisme, Honeywell, Infogrid, Johnson Controls (JCI), L & T Technology Services (LTTS), Planon, PointGuard, Schneider Electric, Siemens, Spacewell, Spica Technologies, Switch Automation, Thing Technologies and ThoughtWire (see **Figure 8**). Fifteen IoT platform suppliers included in this

study actively participated through interviews, product demonstrations and responses to a 154-point detailed questionnaire. Carrier provided a product demonstration. Siemens was scored based on publicly available information and information from the firm's submission to the 2019 Green Quadrant study. Bosch, EDGE Technologies, IBM and Microsoft qualified for this study, but declined to participate. These vendors may be included in future Green Quadrant IoT for Smart Buildings studies.

Evaluation Criteria For IoT Platforms For Smart Buildings Providers

Verdantix developed the evaluation criteria within the Green Quadrant through a combination of interviews with practice managers and customers, desk research and general industry knowledge. Additional insights were taken from the 2021 global corporate survey of real estate decision-makers, which contained specific questions on customer preferences for functionality and building management processes, as well as the purchase criteria these decision-makers use when selecting a provider with which to work. In full, this Green Quadrant analysis compared offerings from 17 IoT platform providers, using a questionnaire with 30 weighted sections. Of these, 23 measured the strength of each participant's solution capabilities. The remaining seven measured each participant's forward momentum in the market. Individual metrics were classified as:

- **Capabilities metrics.**
  This dimension, captured in the vertical axis of the Green Quadrant graphic, measures each software supplier on the breadth and depth of its software functionality, differentiators against other providers, and proven experience in each area. To assess performance on this dimension, Verdantix collected data on 132 criteria grouped into 23 areas across platform and applications. Platform capabilities cover data input; IT systems integration; database design; master data management; configurability; code base consistency; application development environment; implementation options; business intelligence; mobile applications; user interface; internationalization; and application and data centre cybersecurity. Application capabilities cover asset management, monitoring and control; energy management; space monitoring and analysis; occupant health and wellbeing; workplace services; facilities management services; building security; sustainability and ESG; reporting; and breadth of customer focus.

- **Market momentum metrics.**
  This dimension, captured in the horizontal axis of the Green Quadrant graphic, measures each software supplier on a range of strategic success factors, covering publicly announced customers, geographic coverage and internal financial performance. We collected 22 criteria grouped into seven areas: market vision and product strategy; customer time to value; partnerships; installed customer base; deal sizes; organizational resources; and financial resources.

Verdantix weighted each primary criterion and sub-criterion based on its importance within the individual capabilities and momentum dimensions. We developed the weightings based on customer survey data regarding what IoT platform functionality is most widely used, along with Verdantix analyst perspectives about the broader IoT platforms for smart buildings landscape. Verdantix defined success measures for each sub-criterion and scored each participant's performance on each sub-criterion from zero to three. For example, energy management is a criterion considered in the capabilities section and is composed of nine weighted sub-criteria that determine the overall score. All sub-criteria are scored between 0 and 3. Subsequently, each high-level criterion is allocated a percentage weighting which then determines how much that score contributes to the overall score. The combination of high-level criteria scores in the capabilities and momentum sections generates the Green Quadrant graphic. **Figure 9** and **Figure 10** provide details of the study criteria; **Figure 11** and **Figure 12** provide the scoring for all participants against the criteria. The figures also present the weighting of each primary criterion, shown inside the parentheses. **Figure 13** provides the Green Quadrant graphic summarizing the positioning of all service providers in this benchmark study.

FIGURE 8

Suppliers And Software Assessed

Vendor	IoT Platform/Apps
Accruent	EMS, vx Observe
Carrier	Abound, CORTIX platform, CORTIXEDGE, EnergyReports, IntelliSuite, MyWay, WebCTRL
Clockworks Analytics	Clockworks
Energisme	N'Gage
Honeywell	Enterprise Buildings Integrator, Honeywell Forge, Tridium
Infogrid	Infogrid
Johnson Controls (JCI)	Connected Equipment, OpenBlue Active Responder, OpenBlue Central Utility Plant, OpenBlue Companion, OpenBlue Enterprise Manager, OpenBlue Location Manager, OpenBlue Risk Insight
L & T Technology Services (LTTS)	i-BEMS
Planon	Axonize, Planon Universe, Planon Workplace Insights, Smart Building Edition
PointGuard	Assurance, Building Healthcheck, Enterprise, Goldilocks, Insights Report, Pro+, RCx, The Snapshot
Schneider Electric	EcoStruxure Asset Advisor, EcoStruxure Building Advisor, EcoStruxure Engage Enterprise App, EcoStruxure For Retail Integrated Management Platform, EcoStruxure Microgrid Advisor, EcoStruxure Resource Advisor, EcoStruxure Security Expert, Planon Workplace Insights, Planon Smart Building Edition
Siemens	Building Twin, Comfy, Desigo CC, Enlighted, MindSphere, Navigator, Siveillance
Spacewell	Axxerion, Cobundu, DEXMA
Spica Technologies	GemEx Engine Environment Monitoring, GemEx Engine Healthy Water, GemEx Engine Smart Cleaning, GemEx Engine Workspace, Luna
Switch Automation	Switch Digital Layer, Switch Dx^3, Switch Platform
Thing Technologies	Thing-it, Thing-it Mobile App
ThoughtWire	@WorkApp, Early Warning System, Nerve Center, Notification Center, Patient Transport and Logistics, PrecisionHub, ThoughtWire Digital Twin, ThoughtWireOS

Source: Vendor data

FIGURE 9-1

Capabilities Criteria For IoT Platforms For Smart Buildings

Capabilities	Questions
Data Input (6%)	What functionality is provided to integrate with and capture data from different sensors, electricity meters, building management systems, building equipment and security systems deployed in buildings? What is the range of indoor positioning systems into which your solution can integrate? What functionality is provided to capture data from a site's IT system and network, external sources, building occupants and other data feeds?
IT Systems Integration (3%)	What functionality is provided to integrate with computer-aided design (CAD) and building information modelling (BIM) or import the relevant data, other enterprise systems, third-party real estate, energy and facilities information management systems, and online third-party worker collaboration tools?
Database Design (3%)	What scalability/clustering can the vendor demonstrate with customer deployments? How does the IoT platform handle large volumes of data? What functionality is provided to support data audits, ensure and enhance data quality, and deal with data gaps? How does the solution provide extensible, flexible and interoperable data access to customers?
Master Data Management (3%)	What functionality is provided to define and/or upload the organizational structure and hierarchy? How are users able to configure and reconfigure the organizational hierarchy data? How does the system enable users to aggregate data in a data warehouse?
Configurability (3%)	How can elements such as forms and metric libraries in the system be changed or reconfigured? How can business rules, workflows, role definitions and other elements be changed, reconfigured or added to? What tools and processes are available to version, package and promote changes across systems?
Code Base Consistency (1%)	How many different product architectures do you offer? How many applications are included? How many programming languages is your product based on?
Application Development Environment (2%)	What development tools can clients use to customize the application? What development tools can clients use to develop new apps/modules? What is the development environment?
Implementation Options (2%)	What are the multi-tenant-hosted, single-instance-hosted and on-premises offerings? Does the offering provide edge computing capabilities?
Business Intelligence (3%)	Does the app have its own business intelligence (BI) tool or is it sold with a third-party BI tool? How can a customer export data to their own BI tool? What tools are available for benchmarking, dashboarding, forecasting, geospatial analysis and digital twin analysis?

Figures in brackets represent the weighting given to each criterion in the flexible multi-criteria model that generates the Green Quadrant graphical analysis.

Source: Verdantix analysis

FIGURE 9-2

Capabilities Criteria For IoT Platforms For Smart Buildings

Capabilities	Questions
Mobile Applications (2%)	What functionality is offered via mobile app? How many active monthly users of the mobile app are there? What architecture and security framework does the app have? With which operating systems is the mobile app compatible?
User Interface (3%)	What is the usability/user-friendliness of the enterprise and mobile app interfaces?
Internationalization (2%)	How many user interface (UI) languages are provided out of the box? What is the extent of the multi-currency functionality? How does the software manage multiple time zones?
Application & Data Centre Cybersecurity (4%)	What vulnerability assessments are performed and when? What is the security framework for enterprise and mobile apps? How does your software support customers in their need to be GDPR-compliant? To which standards and certifications does your hosting environment adhere?
Asset Management, Monitoring & Control (11%)	What functionality is provided for asset monitoring and condition assessments, automated identification and diagnosis of equipment faults through FDD, continuous optimization of assets and asset lifecycle management? What functionality is provided for managing data on facility assets, controlling building assets in real time or changing automation parameters, and locating and tracking assets?
Energy Management (9%)	What functionality is provided for energy monitoring, analysis, reporting and targeting? What functionality is provided to leverage IoT data for utility bill management? What functionality is offered to help firms track the success and payback of various energy efficiency projects?
Space Monitoring & Analysis (7%)	What functionality is provided for leveraging IoT data to monitor how space is used? What functionality is provided to better understand, plan, organize and use space, and to support workspace right-sizing and redesigns? What functionality is provided around footfall and dwell time tracking, social distance tracking and heat-mapping for crowd monitoring?
Occupant Health & Wellbeing (5%)	What functionality is provided for leveraging IoT data to monitor environmental conditions such as temperature, CO_2, humidity and other factors? What functionality is provided for monitoring and tracking occupant health and wellbeing? Does the solution allow users to adjust conditions for greater comfort?
Workplace Services (7%)	What are the capabilities to provide self-service applications to building occupants for reserving space and workstations and lockers? What functionality is provided for occupants for real-time wayfinding and occupant feedback? What functionality is provided to deliver amenities to building occupants, including parking services? What functionality is provided to support data collection and reporting to different standards for wellbeing? What functionality is provided to integrate with indoor positioning systems to deliver location-based services?

Figures in brackets represent the weighting given to each criterion in the flexible multi-criteria model that generates the Green Quadrant graphical analysis.

Source: Verdantix analysis

FIGURE 9-3

Capabilities Criteria For IoT Platforms For Smart Buildings

Capabilities	Questions
FM Services (4%)	What functionality is provided to enhance FM services such as matching cleaning services to usage? What functionality is provided to leverage IoT data as part of monitoring, analysing and reporting on FM performance? What functionality is offered to ensure service level agreement (SLA) adherence?
Building Security (7%)	What functionality is provided around access control, visitor and contractor management, video surveillance and management, remote and central security management, alarm management and critical event management?
Sustainability/ESG (6%)	What functionality is provided to automatically or intermittently collect and manage ESG data, analyse sustainability performance and support carbon and other forms of reporting?
Reporting (3%)	What functionality does the solution offer that allows users to view, chart and analyse data? Does the solution support automatic reporting submissions? How does it facilitate the reporting process?
Breadth Of Customer Focus (4%)	To what extent have you developed specific functionality or out-of-the-box workflows to support the needs of corporates, service providers, investors and end-users?

Figures in brackets represent the weighting given to each criterion in the flexible multi-criteria model that generates the Green Quadrant graphical analysis.

Source: Verdantix analysis

FIGURE 10

Momentum Criteria For IoT Platforms For Smart Buildings

Capabilities	Questions
Vision & Strategy (15%)	What is the firm's vision for the evolution of customer requirements over the next 3 years? What is the firm's strategy to meet the needs of customers and develop its product over the next 2 years? What is the current product development roadmap?
Customer Time To Value (5%)	What is the average implementation time for a typical customer deal and the approach adopted for implementation?
Partnerships (5%)	With which software and hardware vendors does the firm have a formal relationship?
Installed Customer Base (20%)	What is the total number of firms using your building IoT software? Describe the typical size of customers by revenue or square footage.
Deal Sizes (25%)	How many building IoT software deals did the firm sign in the past 12 months or past reporting period? What was the breakdown of those deals by size? What was the average deal size in 2020, including software (licences, subscriptions) and implementation?
Organizational Resources (15%)	In how many countries does the vendor have offices and host the application? How many in-house employees are dedicated to the IoT platform business?
Financial Resources (15%)	What were the revenues from building IoT software in the past 12 months? By how much did the total building IoT revenues grow in 2020 compared with 2019 or in the last reporting period? How much capital was raised in 2019/20/21? What is your customer retention rate?

Figures in brackets represent the weighting given to each criterion in the flexible multi-criteria model that generates the Green Quadrant graphical analysis.

Source: Verdantix analysis

FIGURE 11-1

Vendor Capabilities Scores

	Accruent	Carrier	Clockworks Analytics	Energisme	Honeywell	Infogrid	JCI	LTTS	Planon
Data Input	1.8	1.8	1.1	1.7	1.8	1.4	1.9	1.2	1.9
IT Systems Integration	1.6	1.4	0.7	1.6	0.9	0.1	2.2	0.4	2.0
Database Design	1.5	1.7	2.0	2.0	1.7	1.5	1.5	0.5	2.0
Master Data Management	2.0	1.7	1.7	2.0	2.0	2.0	2.3	1.3	2.7
Configurability	1.9	1.3	1.5	2.0	1.1	1.5	1.9	0.7	2.2
Code Base Consistency	1.3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Application Development Environment	0.8	1.6	0.8	1.4	0.6	1.2	1.6	0.8	2.2
Implementation Options	1.3	1.5	1.0	1.5	2.0	1.0	1.8	1.3	1.8
Business Intelligence	1.3	1.6	1.3	2.3	1.2	1.3	1.9	0.9	2.0
Mobile Applications	1.9	1.4	0.0	1.8	1.6	0.3	2.2	1.9	2.7
User Interface	1.5	1.3	0.7	2.0	2.0	1.2	2.6	1.4	2.2
Internationalization	3.0	2.0	3.0	2.3	2.3	1.7	2.3	1.7	3.0
Application & Data Centre Cybersecurity	1.9	2.0	0.7	1.7	2.2	1.9	1.8	1.6	2.1
Asset Management, Monitoring & Control	2.0	2.1	1.7	2.0	1.8	1.1	2.5	1.0	2.2
Energy Management	1.8	2.1	1.3	2.1	2.0	0.6	2.0	0.9	0.9
Space Monitoring & Analysis	1.2	1.0	0.0	0.5	0.9	1.7	1.5	1.6	2.0
Occupant Health & Wellbeing	1.0	1.8	1.0	0.8	1.8	2.0	2.0	1.0	1.5
Workplace Services	1.1	1.3	0.0	0.0	1.3	1.1	2.1	1.1	1.9
FM Services	2.3	1.3	0.0	1.3	1.0	1.7	1.3	1.3	2.3
Building Security	0.1	2.0	0.0	0.0	2.3	0.3	2.3	0.9	0.6
Sustainability / ESG	0.0	1.0	1.2	1.8	0.6	0.6	1.2	0.8	1.0
Reporting	1.5	1.5	1.5	2.0	1.0	1.0	2.0	1.0	2.0
Breadth Of Customer Focus	1.6	1.4	1.2	1.4	1.6	1.6	2.0	1.6	2.0

Scoring Framework

3	Vendor provides evidence of market-leading functionality, supported by a broad set of references to customer examples
2	Vendor provides evidence of strong functionality, supported by a broad set of references to customer examples
1	Vendor provides evidence of moderate functionality, with limited references to customer examples
0	No response provided or available publicly, or supplier has a weak offering

Source: Verdantix analysis

FIGURE 11-2

Vendor Capabilities Scores

	PointGuard	Schneider Electric	Siemens	Spacewell	Spica Technologies	Switch Automation	Thing Technologies	ThoughtWire
Data Input	1.5	2.2	2.1	2.0	1.2	2.1	1.7	2.2
IT Systems Integration	0.6	1.7	1.9	2.3	1.6	0.9	1.9	1.4
Database Design	1.2	2.2	2.0	2.0	1.8	1.7	1.7	1.5
Master Data Management	1.7	2.3	2.3	1.7	2.3	2.0	2.0	1.7
Configurability	1.5	1.7	2.0	2.3	1.2	1.6	2.1	1.7
Code Base Consistency	2.0	2.0	2.0	1.7	2.0	2.0	1.7	2.0
Application Development Environment	1.6	2.0	1.6	2.0	1.0	1.6	1.4	2.0
Implementation Options	1.8	1.8	1.5	1.3	1.5	1.5	1.3	0.8
Business Intelligence	1.3	2.1	2.2	1.8	0.9	1.8	1.9	2.0
Mobile Applications	0.3	1.4	2.3	2.4	2.2	1.1	2.2	1.6
User Interface	1.3	2.3	2.0	2.4	2.5	1.6	1.8	1.8
Internationalization	1.7	2.7	3.0	2.7	1.7	2.0	2.0	1.7
Application & Data Centre Cybersecurity	1.6	2.1	2.0	2.3	2.2	2.0	2.1	2.1
Asset Management, Monitoring & Control	2.2	2.0	1.8	1.4	0.0	2.0	1.5	2.0
Energy Management	1.6	2.4	2.1	2.4	0.0	1.9	1.0	1.4
Space Monitoring & Analysis	0.5	1.4	1.9	2.2	1.6	1.5	1.9	1.6
Occupant Health & Wellbeing	2.0	1.5	1.8	1.8	1.8	1.3	1.0	2.0
Workplace Services	0.3	1.7	1.9	2.3	1.9	0.3	2.0	2.0
FM Services	1.7	1.3	1.3	2.3	1.7	1.7	1.7	1.3
Building Security	0.0	1.9	1.9	0.3	0.3	0.3	0.4	1.4
Sustainability / ESG	1.2	2.4	1.6	1.2	0.0	1.6	0.6	1.0
Reporting	2.0	2.0	2.0	2.0	1.5	1.0	1.5	1.5
Breadth Of Customer Focus	1.6	2.0	1.8	2.1	1.8	1.6	1.6	1.6

Scoring Framework

3	Vendor provides evidence of market-leading functionality, supported by a broad set of references to customer examples
2	Vendor provides evidence of strong functionality, supported by a broad set of references to customer examples
1	Vendor provides evidence of moderate functionality, with limited references to customer examples
0	No response provided or available publicly, or supplier has a weak offering

Source: Verdantix analysis

FIGURE 12

Vendor Momentum Scores

	Accruent	Carrier	Clockwork Analytics	Energisme	Honeywell	Infogrid	JCI	LTTS	Planon
Vision & Strategy	1.7	1.3	1.3	1.7	1.3	2.0	2.0	1.0	1.7
Customer Time To Value	2.0	2.0	1.0	2.0	1.0	3.0	2.0	1.0	1.0
Partnerships	1.0	1.5	0.5	0.0	1.5	2.0	3.0	2.5	2.0
Installed Customer Base	2.0	2.0	2.8	1.8	2.0	2.0	2.8	1.3	2.0
Deal Sizes	1.3	2.5	0.7	0.7	1.5	1.3	2.3	1.2	0.8
Organizational Resources	1.7	2.0	1.3	1.3	2.3	1.7	2.3	2.3	2.0
Financial Resources	1.9	1.8	1.7	1.5	1.5	2.2	2.2	1.7	1.7

	PointGuard	Schneider Electric	Siemens	Spacewell	Spica Technologies	Switch Automation	Thing Technologies	ThoughtWire
Vision & Strategy	1.7	2.0	2.3	2.3	2.0	1.7	1.7	1.3
Customer Time To Value	1.0	2.0	2.0	2.0	3.0	3.0	2.0	2.0
Partnerships	1.0	2.0	1.5	3.0	2.0	1.0	2.5	3.0
Installed Customer Base	1.3	2.8	2.8	2.8	1.3	1.0	2.0	1.3
Deal Sizes	0.7	2.2	2.8	1.3	1.3	1.3	0.8	1.2
Organizational Resources	1.0	2.3	2.0	1.7	1.0	2.0	1.3	1.7
Financial Resources	1.8	2.2	2.2	2.2	1.6	1.5	1.8	1.3

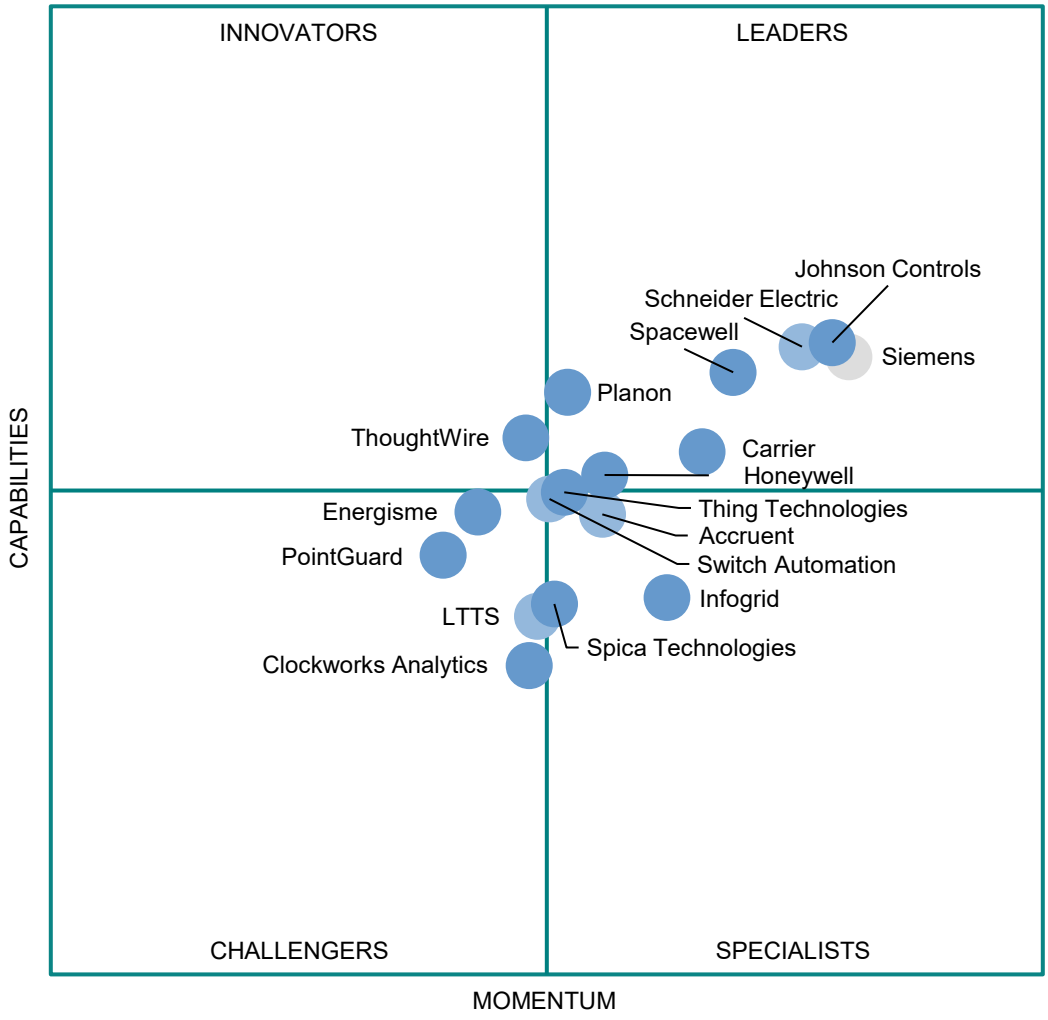
Scoring Framework

3	Vendor provides evidence of market-leading functionality, supported by a broad set of references to customer examples
2	Vendor provides evidence of strong functionality, supported by a broad set of references to customer examples
1	Vendor provides evidence of moderate functionality, with limited references to customer examples
0	No response provided or available publicly, or supplier has a weak offering

Source: Verdantix analysis

FIGURE 13

Green Quadrant IoT Platforms For Smart Buildings 2022



Capabilities	This dimension measures each software supplier on the breadth and depth of its software functionality across 23 capability areas, as outlined in Figure 9.

Momentum	This dimension measures each software supplier on seven strategic success factors, as outlined in Figure 10.

Note: A grey plot indicates a non-participating vendor, light blue shows an overlapping plot

Source: Verdantix analysis

Accruent Leverages IoT For Comprehensive Maintenance Work Order Management

Founded in 1995, US-headquartered Accruent provides software for managing the built environment for more than 10,000 customers globally, the majority of which are based in the US and Europe. Accruent was acquired by industrial technology firm Fortive in July 2018. Accruent offers a portfolio of best-of-breed software products, many attained through acquisitions, aimed at particular industries and use cases. Its Internet of Things (IoT)-based remote monitoring platform is vx Observe, which delivers capture and analytics capabilities of real-time data from assets and building systems and is primarily used by the retail sector and facilities service providers. This platform is deployed at more than 27,000 locations, connecting over 660,000 devices. It processes more than 198 million alarms and over 500 billion data points annually. Accruent also offer the EMS software solution, which provides space and resource management capabilities.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Accruent has strengths in:

- **Work order management for asset monitoring.**
  Stemming from its rich heritage in asset monitoring and management, vx Observe offers functionality to customers to track system performance and effectively respond to maintenance issues. With integrations with a range of real estate and facilities management tools, such as computerized maintenance management systems (CMMS) solutions – including Accruent's vx Maintain – Accruent offers a comprehensive alerting and work order management solution. Customers use vx Observe to manage alerts, but can also add rules that enable more predictive and timely responses to issues, where alerts are automatically triaged. The central alarm filtering and business rules engine, combined with the expertise of the Accruent professional services team, helps firms deliver more targeted work orders and avoid the expense of sending technicians to respond to false alerts.

- **Promoting adherence to SLAs.**
  Within the vx Observe platform, service-level agreements (SLAs) can be uploaded and centralized, with rules built to empower facilities managers and contractors to tackle the most important and urgent issues first. This allows facilities teams to deliver more effective services, whilst enabling customers to evaluate the service provision more accurately. Forty-eight per cent of real estate executives state that getting more value out of facilities contractors is a high priority for the next 12 months – an activity that vx Observe's effective SLA centralization and work order management capabilities significantly support (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). As work orders are completed, faults are normalized to ensure that fixes are appropriate to root causes and that setpoint validation and change notifications enable buildings to be operated in a state of continuous commissioning.

- **Role-based user interfaces (UIs) delivering targeted maintenance insights.**
  vx Observe provides role-based dashboards to support different stakeholders in the building management process. Portfolio managers are presented with a global view that provides oversight of all their locations, where they can easily drill down to examine alerts. Building managers, either on site or remote, can use a similar view and drill down to individual devices and systems for insights on asset performance. These users can also access a site layout, to better understand the location of an issue. On-the-ground personnel, such as facilities managers and technicians, are presented with a more targeted dashboard, which allows them to view issues and actions, create work orders where necessary and resolve issues accordingly. Combined with the platform's work order management capabilities, this

diverse approach enables each stakeholder group to perform their activities in the most successful fashion.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Accruent could improve by:

- **Revamping the UI of vx Observe to improve user experience.**
  Over the past two years, many smart building software vendors have been investing to make their UIs more intuitive and employee-centric, to engage all building users. This flurry of product investment is raising the bar for the level of performance customers expect. Our analysis found the vx Observe UI to lag the market, with opportunities for Accruent to improve the administrator's view, where alerts are configured and managed, for easier navigation. Dashboards also appear aged and would benefit from a revamp, as well as standardization across different job roles. This would complement the strong asset and work order management capabilities already offered.

- **Continuing to develop EMS into a more complete space management solution.**
  EMS is Accruent's space and resource management solution, offering core functionality such as space and room booking; it is currently deployed by more than 1,200 customers. EMS also supports the integration of health processes, such as COVID-19 questionnaires, into the booking process and is natively designed to operate on kiosks as well, enabling on-site booking capabilities. The solution could be improved through the inclusion of more real-time insights and dashboards to support building managers with monitoring space usage and overcrowding. Advances to the mobile application to enable occupant feedback, helping building managers improve spaces – and even the amenities that are provided – would also be beneficial.

- **Bolstering the reporting capabilities offered by EMS.**
  Beyond the day-to-day operation of workspaces, there is scope for Accruent to improve the reporting elements of EMS. The EMS solution currently offers more than 100 pre-configured reports, which can be automated, providing information on spaces such as utilization and no-shows. Although there is currently some support for more strategic elements of space management, such as understanding space usage, Verdantix believes that EMS could be improved to provide more high-level reporting on spaces, to help with space designing and real estate decisions, with reports delivering insights and trends on space usage, footfall and other key metrics. Focusing on the strategic side would help establish EMS as a more robust tool for space monitoring, rather than a simple tool for booking services.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Accruent should be included on shortlists by the following buyers:

- **Facilities management firms running ambitious digitization programmes.**
  Facilities service providers should consider leveraging Accruent's vx Observe solution to improve their work order management processes, deliver more targeted maintenance on building assets and aim for greater SLA adherence. Accruent's comprehensive work order management approach also extends to other key facility service use cases, such as cleaning. vx Observe permits facilities managers to better allocate their resources to urgent issues and ensures that work orders are correctly resolved before being closed. The solution also enables customers of facilities services to better judge the quality of service provided, which can help drive discussions around contract renewals.

- **Retailers looking to maximize compliance and minimize maintenance disruption.**
  Retail customers are the core customer category for Accruent's vx Observe solution. They typically leverage the solution to ensure that systems operate in optimal conditions and that faults are dealt with promptly. The solution also supports several key use cases around compliance, such as water monitoring for legionella and refrigeration monitoring. For example, UK retailer the Co-operative Group deployed vx Observe alongside vx Maintain to manage maintenance and monitor refrigeration assets. The solutions automated decision-making around maintenance and helped reduce the need for service providers by a third. Maintenance spend was also reduced by 5% and overall food wastage decreased, with increased compliance in terms of suitable storage conditions for refrigeration assets.

- **Organizations with diverse assets.**
  vx Observe supports 30 out-of-the-box integrations with third-party systems, such as CMMS solutions, building management systems (BMSs) and controller systems from vendors such as Automated Logic, Honeywell, Monnit, Resource Data Management (RDM), Siemens and Trend. Thanks to this agnostic approach, Accruent can deliver the maintenance management capabilities of vx Observe to organizations with diverse sets of assets, such as education and university facilities. Organizations with diverse assets should consider using vx Observe to help manage assets across their portfolios, centralizing systems into a single platform and supporting different stakeholders, from portfolio or facilities managers down to engineers and technicians. These organizations can also call upon EMS to provide reservation capabilities, which will be required in some of their spaces.

Carrier Extends Building Automation Heritage To Offer Maintenance And Comfort Optimization

Headquartered in Florida, Carrier Global is a global technology firm specializing in HVAC, controls, security and fire safety solutions, as well as commercial and transport refrigeration solutions. Having previously been part of UTC, Carrier was spun off into an independent organization in March 2020 and includes subsidiaries Automated Logic and EcoEnergy Insights. Automated Logic offers three key products that support building Internet of Things (IoT) monitoring and analysis: 1) WebCTRL, a web-based building automation system; 2) EnergyReports for energy insights; and 3) IntelliSuite for optimizing comfort, energy usage and maintenance. EcoEnergy Insights offers the CORTIX analytics platform, which aggregates and analyses building operational data to provide predictive actionable insights that underpin Automated Logic's IntelliSuite offerings (see Verdantix Automated Logic's IntelliSuite Solution Simplifies Asset Management With Advanced Analytics). Buyers can leverage these solutions as standalone packages or combine them for greater benefits.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Carrier has strengths in:

- **Energy monitoring at different granularities.**
  Carrier offers a strong proposition for energy management, scoring 2.1/3.0 for this capability. Through WebCTRL, users can monitor and manage building systems, tracking energy consumption at granular levels, including through submeters. The EnergyReports application helps portfolio managers track energy insights from IoT sources and utility bills, build energy reports, conduct trend analyses and monitor project paybacks. Information from EnergyReports can also be configured and broadcast to screens, where a competition feature allows building occupants to see how their sustainability performance compares with that of other tenants in the space, cultivating a culture of improved performance.

- **Predictive maintenance using machine learning.**
  The CORTIX platform offers users predictive actionable insights to inform maintenance schedules, which are leveraged by solutions across the Carrier portfolio, including the IntelliSuite solution. These insights flag impending faults before they happen, using machine learning to understand the performance trends that occur prior to equipment failure. By flagging these ahead of time, building and facilities managers can minimize business disruption and cost of maintenance. The insights are delivered through the CORTIX mobile app in plain language, informing users of the issue, its impact and the fix required, as well as its urgency status and how close to failure the system is. This enables non-technical users to make informed decisions on next steps. The recommended actions can be accepted, or users can provide feedback if they take an alternative action. This feedback is used by the solution's AI to improve recommendations in the future.

- **Building security monitoring for on-site and remote GSOC teams.**
  With a score of 2.0 out of 3.0, Carrier is one of the leading vendors for IoT-driven building security functionality in this benchmark of 17 firms. Carrier has a dedicated security division, Lenel, which provides solutions across access control, video monitoring software and integrated security platforms. For example, the OnGuard Integrated Platform is an integrated security solution that offers access control, ID and visitor management, biometrics and surveillance. Firms with global security operations centres (GSOCs) can use Lenel's offerings for central security management functionality, to manage sites remotely. Lenel also offers the BlueDiamond platform – an access control solution that supports a variety of entry methods and tools such as mobile credentials, badges and voice commands.

- **Comfort management and temperature optimization.**
  Through WebCTRL, facilities managers and technicians can manage the operation of HVAC units, ensuring that conditions remain optimal. In addition to manual changes, through an integration with building security systems, WebCTRL can monitor access control events on a seven-day basis and optimize HVAC operation in spaces based on occupancy patterns. This enables the automated optimization of setpoints to improve occupant comfort and minimize energy wastage. Carrier also empowers building occupants to manage their own comfort, with the MyWay app allowing users to directly control temperature and lighting or make requests.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Carrier could improve on:

- **Quality of the user interface (UI) across solutions.**
  Whilst EnergyReports and Abound are two Carrier solutions with modern interfaces, WebCTRL offers an aged UI in need of a revamp. WebCTRL currently offers a rich level of information, ranging from portfolio down to asset level, but would benefit from a modernization of the user experience and UI and an increased use of dashboards to make it easier to understand and navigate. In addition, Carrier should look at options to bring greater consistency to the UIs of its product portfolio to enhance the user experience, including its MyWay mobile app.

- **Space monitoring capabilities.**
  Carrier currently offers limited capabilities related to space monitoring and analysis. Although real-time and historical data around occupancy can be collected, reported and visualized, there is little functionality to support building managers looking to track footfall and social distancing. Moreover, there is no functionality to support more strategic elements of space management, such as real estate right-sizing or workspace redesigns. To tackle this deficiency, Carrier needs to increase its collection of space management data and build dedicated dashboards and tools.

- **Workplace services offered through its mobile app.**
  Although Carrier provides quite advanced functionality in building occupant climate control through its MyWay app, the solution offers little else in terms of workplace services. Users can book rooms based on availability, but cannot filter spaces based on traits such as desired equipment. The app also does not offer functionality for amenities such as food ordering or booking services, and building managers cannot deliver communications or notifications through the app. Given the advantages of being able to manage workspace climates, Carrier should look to improve the workplace services functionality offered through the MyWay app.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Carrier should be included on shortlists by the following buyers:

- **Firms looking to modernize their BMSs with enhanced insights and analysis.**
  Asset-rich firms looking to optimize the operation of their building systems and minimize maintenance disruption should consider Carrier. The web-based, BACnet-enabled WebCTRL offering can be combined with IntelliSuite to provide granular monitoring and management of building systems. Building and facilities managers can stay on top of maintenance issues thanks to predictive actionable insights and recommendations from the CORTIX mobile app, and historic information about equipment faults can be leveraged by engineers to support capital expenditure planning. Organizations in education and retail can

use these solutions to improve their building management. For example, a home improvement retailer with over 1,650 stores leveraged the CORTIX platform and saw, on average, the remote resolution of 92% of HVAC and lighting system work orders in 2020.

- **Businesses with strong energy agendas.**
  Firms with a heavy focus on energy management should strongly consider Carrier's offering to support their efforts. Through WebCTRL, users can track energy usage at a granular level, including through individual submeters. The EnergyReports solution centralizes energy data and empowers building managers to perform analyses, monitor usage and track energy management projects. Building managers can also push these data down to occupants through screens, where tenants can compare their performance through the competition tool. This can help partition the effort for sustainability between building managers and tenants, particularly in buildings such as educational campuses and residences, and in multi-tenant corporate real estate.

- **Global enterprises requiring building security.**
  Large organizations with dispersed portfolios should consider Carrier to support their building security requirements. Through Lenel, Carrier offers building-level security capabilities such as access control, ID management and video surveillance. On a more global level, Lenel's integrated platform capabilities provide global security teams at GSOCs with the tools to manage security across portfolios, such as video surveillance, tracking alerts and directing security teams according to needs in a remote fashion.

Clockworks Analytics's Market-Leading Fault Detection And Diagnostics Drive Predictive Maintenance Capabilities

Clockworks Analytics was founded in 2008 within the Building Science Department of the Massachusetts Institute of Technology (MIT). Clockworks was previously known as KGS buildings, before a rebrand in December 2020. The firm is focused on improving building performance with its Clockworks Internet of Things (IoT) platform for fault detection and diagnostics (FDD), which aims to make the optimization of building operations a more proactive process. Clockworks currently supports more than 350 customers and over 2,500 buildings, with typical direct customers each boasting real estate of around 5 million square feet. Since the beginning of 2019, Clockworks has raised $8 million in funding.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Clockworks Analytics has strengths in:

- **Fault detection and diagnostics.**
  The standout feature of the Clockworks offering is the FDD delivered by the platform, which offers both AI and rule-based methods of fault detection. The vendor achieves a best-in-class score of 3.0/3.0 for this sub-criterion. The platform connects into existing building management systems (BMSs) and metering systems, analyses large volumes of data points, and provides diagnostics insights that help direct the efforts of building and facilities managers. The platform also has an established diagnostics library, where diagnostics for a large range of HVAC, lighting, metering and other building assets have been built and stored, enabling all customers to benefit from these by applying them to their systems. Indicative of the strength of the offering, the Clockworks Analytics platform powers Schneider Electric's EcoStruxure Building Advisor solution.

- **Energy consumption monitoring.**
  The Clockworks platform offers a Performance Indicators module, which provides analytics on energy consumption, including the ability to compare site-specific utility meter consumption against data that have been normalized for weather and square footage. Firms can also drill down into these analytics and examine individual buildings or systems that are underperforming. In addition, the platform offers an Impact Report dashboard, where users can see a breakdown of costs and avoidable expenses associated with assets and buildings – information that supports long-term strategic work such as capital expenditure planning. Firms can use these insights to prioritize upcoming capital investment based on areas of greatest financial benefit.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Clockworks Analytics could improve on:

- **User interface (UI) of the Clockworks platform.**
  One possible area for improvement is the enhancement of the UI of the Clockworks platform, to simplify navigation and understanding of diagnostic alerts and to give a modernized feel. There is also a lack of alignment between modules, with the UI for the Impact Report dashboard looking significantly different. Clockworks should focus on delivering consistency across these tools through a modern UI that makes the platform more intuitive to use.

- **Occupant wellbeing offering.**
  The Clockworks platform first began supporting indoor air quality data from sensors in 2020. The functionality for healthy buildings, however, is still fairly nascent on the platform, with the focus

remaining around the maintenance of systems that impact indoor air quality, rather than on optimizing their performance. Clockworks should look to build out this capability beyond air quality to track other key environmental factors, comfort management and water quality management. Our research finds that corporate healthy buildings programmes will outlive the pandemic (see Verdantix Positioning For Growth In The Healthy Buildings Technology Market).

- **ESG reporting and analysis capabilities.**
  As an extension to its energy consumption tracking capabilities, Clockworks should focus on developing its ESG functionality. Firstly, the platform will need to support the collection of more ESG-related data, such as utility billing, and expand its carbon reporting capabilities. Currently, the solution only provides CO_2 emissions projections and the exportation of carbon reporting associated with predictive maintenance and continuous commissioning activities. Clockworks has the opportunity to develop this solution to better respond to the growing market demand around sustainability and ESG, where more than half of executives regard decarbonization of their building portfolios as a top two objective in the next three years (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences).

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Clockworks Analytics should be included on shortlists by the following buyers:

- **Organizations within education, healthcare and pharmaceuticals.**
  Firms within the education, healthcare and pharmaceutical industries, which typically have diverse building portfolios, should consider Clockworks Analytics for the delivery of FDD capabilities, to promote predictive maintenance and maximize asset uptime. By doing so, these organizations can minimize disruption to their activities and manage issues effectively from a central platform, leveraging Clockworks's vast diagnostics library to ensure measured and effective responses to maintenance issues in a timely manner. Clockworks has already established a strong footprint in these markets, with clients such as Harvard University, John Hopkins University, Kaiser Permanente and the University of Arizona.

- **Facilities management firms looking to promote predictive maintenance.**
  Facilities service providers should leverage the Clockworks platform alongside their own computerized maintenance management systems (CMMS) solutions, so that tasks flagged within Clockworks map into work orders within the CMMS tool. The FDD functionality of the platform enables service providers to elevate the level of maintenance service they provide by identifying and managing issues in a predictive manner before disruption is introduced into a customer's business. The Impact Report dashboard can also be used as a tool to support customer capital expenditure planning, by identifying pieces of equipment that are most in need of upgrade or investment.

Energisme's Strengths In Data Connectivity Enable Richer Building Insights

Founded in 2004 and later acquired by energy sector specialists in 2015, Energisme operates out of its headquarters location in Boulogne-Billancourt, France. Energisme's primary Internet of Things (IoT) offering is its N'Gage platform, a Software as a Service (SaaS) data platform primarily designed to monitor, manage and drive energy and sustainability performance (see Verdantix Energisme's Powerful Analytics Engine Pushes New Boundaries In Energy Optimization). Energisme experienced growth of 35% in 2020, with total revenues of €2 million. To complement this, the vendor raised €6.1 million in funding in January 2021, adding to a total of €32.5 million in capital raised since the start of 2019. Energisme's current client base is exclusively European, with customers hailing from a wide range of industries, such as education, financial services, healthcare, hotels, manufacturing, facilities management and utilities.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Energisme has strengths in:

- **Data connectivity to a range of heterogenous sources.**
  Energisme's N'Gage platform can connect to and stream data from diverse systems, such as building management systems (BMSs), energy meters, IoT sensors and utility bills, as well as open data sources such as weather data. The vendor has developed a large library of out-of-the-box connectors, enabling firms to quickly break down data silos within their buildings. For previously unseen systems, Energisme also develops bespoke building connectors to extract and format the data correctly, ready for analysis. Once a system connector has been developed, it is added to the connector library. Firms with asset-rich buildings and large portfolios can leverage this data agnosticism to connect to a broad range of systems in their estate.

- **Comprehensive energy monitoring and management across portfolios and systems.**
  With a heritage in energy, Energisme offers a strong energy solution, scoring 2.1 out of 3.0 for energy management. N'Gage provides a portfolio-level view of energy tracking; users can drill down from this global perspective to individual buildings or even systems to track energy at a more granular level. Thanks to an intuitive user interface (UI), users can easily set up dashboards pertinent to their role, calling upon a wide library of templates and tracking the most relevant KPIs. Users are also able to configure new widgets in a low-code fashion to track new or specific KPIs. With the facilitation of two-way communication, N'Gage gives building managers the ability to remotely manage equipment, such as toggling systems on or off and changing setpoints, allowing them to take advantage of the insights provided by the platform.

- **Predictive modelling to drive maintenance efficiency.**
  Energisme offers a modelling tool where users can select a device and input dataset, and the platform automatically identifies the 'influencing factor' – the dataset that most significantly impacts performance – and builds a performance trend model. This model can be plotted against actions, such as the implementation of a new boiler, to highlight the return on investment (ROI) and impact of that action on performance. Users can also develop and modify their own models, manually selecting the 'influencing factors'. Additionally, firms can use the tool to model future performance and predict potential system failures. This predictive maintenance enables facilities managers to respond to issues ahead of time, for greater asset uptime and adherence to service-level agreements (SLAs). For serious issues, facilities managers can pinpoint areas in need of investment and predict the impact on performance of this investment, aiding business case development. Thus, Energisme scores a full 3.0 for the asset lifecycle management sub-criterion.

- **Sustainability management capabilities.**
  As an extension to its energy capabilities, the N'Gage platform facilitates sustainability efforts. N'Gage tracks GHG emissions based on calculations using the GHG Protocol. In scenarios with poor energy data coverage, the platform calls upon other sources – such as weather stations, utility bills and organizations such as the European Commission – to plug data gaps, so that algorithms can accurately estimate metrics such as energy consumption and emissions. With respect to standards, the N'Gage platform simplifies the reporting process through pre-existing reporting templates. The platform is also natively connected to the GRESB submission portal through application programming interfaces (APIs), allowing users to directly submit reports. N'Gage offers the same functionality for the Décret Tertiaire framework, which is targeted at the French building market.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Energisme could improve by:

- **Branching out to collect social and governance data, boosting its ESG capabilities.**
  Despite having an above-average score in this study for sustainability and ESG capabilities, there is still scope for Energisme to improve its offering in this space and stand out as a frontrunner for IoT-driven energy and sustainability efforts. The N'Gage platform currently has API connections to two reporting submission portals, but there is scope to expand this further, to other voluntary and non-voluntary frameworks. Leveraging its strong foundation for data collection, Energisme should also focus on the capture of social and governance data, which is currently underserved, to enable users to monitor their ESG efforts in a more complete fashion, going beyond the traditional angle of sustainability.

- **Expanding the geographic breadth of its resources.**
  Energisme's current customer base is exclusively in Europe, with customers primarily headquartered in France. Although the vendor has developed strong customer relationships with leading firms in industries such as consumer services, facilities management and utilities – for example, with Accor, SPIE and SUEZ – it should look to expansion into new markets to bolster its recent growth and success. To target these markets, the firm should consider opening new offices and establishing new hosting locations for its solution. Given its core data capture capabilities, coupled with its focus around energy and sustainability, Energisme should try to take advantage of the current demand for such offerings, devising its business strategy accordingly.

- **Extending its occupant wellbeing capabilities.**
  The N'Gage platform currently offers basic functionality around occupant health and wellbeing, tracking simple condition metrics such as temperature. Leveraging its data connectivity capabilities, Energisme should focus on building out new use cases around wellbeing, and even space management, where there is growing demand amongst buyers. This functionality would help building and facilities managers combine insights on energy usage with occupancy and comfort, and allow them to exploit the two-way communication offered by the platform to remotely control systems, such as HVAC units, in a fashion that balances occupant comfort and building systems operation.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Energisme should be included on shortlists by the following buyers:

- **Firms looking to break down data silos through an end-to-end platform.**
  Businesses with a large portfolio of disparate systems, such as BMSs, IoT devices and energy meters, should consider Energisme's end-to-end data platform offering to help break down data silos and centralize information for analytics and insights. As part of their digitization strategies, many firms will encounter complications with legacy systems that make it difficult to extract data. Energisme's data connectivity capabilities, including the option to develop bespoke connectors, can help firms access all parts of their portfolios. Energisme's value proposition is enhanced by its data partnerships, leveraging access to other data sources such as weather stations and utility bills, for more complete data coverage.

- **Businesses devising strong energy and sustainability agendas.**
  Our interviews with 285 firms reveal that 41% consider the reduction of energy expenditure in the next year as a high priority (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). The N'Gage solution is highly compatible with organizations looking for a robust energy monitoring and management tool. N'Gage's advanced back-end analytics, combined with an intuitive front end, enable firms to easily monitor and manage the energy performance of their buildings and devices. The low-code customization of dashboards, rules and KPIs empowers users to track the most pertinent metrics and remotely control systems for optimized performance. The hierarchy of the platform also supports several key stakeholders. For example, portfolio managers can view energy performance from a high-level perspective, identifying poorly performing buildings in their estate, whilst building managers and engineers can focus in on more granular insights, pinpointing individual systems or devices that are performing sub-optimally.

- **Facilities managers targeting enhanced service delivery and SLA adherence.**
  Facilities service providers seeking a proven IoT platform that can underpin a more data-driven approach to services should review N'Gage. Using predictive modelling, facilities managers will be able to monitor performance and identify and rectify maintenance issues before they disrupt the business. Meanwhile, the mobile functionality provided supports field technicians with their repair efforts. The predictive modelling insights into systems can also be used to inform capital expenditure planning. In 2020 Energisme launched a module for facilities service firms that centralizes contracts to support performance tracking against financial and technical KPIs. This tool helps ensure adherence to SLAs by allowing teams to redirect efforts if they are falling short in certain areas. A high level of compliance with SLAs demonstrates a good level of service and empowers facilities managers during contract renewals.

Honeywell Forge Differentiates Through Its Integration Of IoT And Financial Data

Headquartered in Charlotte, USA, Honeywell is a global technology firm with businesses across four major segments: aerospace, building technologies, performance materials and technologies, and safety and productivity solutions. With regard to the built infrastructure, Honeywell offers building technologies such as building controls, fire and life safety systems, integrated security solutions and healthy buildings solutions, as well as Internet of Things (IoT) and other sensor technology. The Honeywell Forge SaaS Solution for Buildings, launched in 2019, is the vendor's IoT software offering, encompassing features and applications such as Honeywell Forge Real Estate Operations, Honeywell Forge Predictive Maintenance and Honeywell Forge Energy Optimization. In 2020 Honeywell announced a relationship with SAP, permitting Honeywell Forge to combine building operation intelligence with financial data. Given its history, Honeywell boasts a global presence, with more than 4,000 global employees dedicated to the IoT business.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Honeywell has strengths in:

- **Occupant wellbeing management.**
  Honeywell Forge provides multiple dashboards that summarize building health insights so that different stakeholders can monitor environmental conditions and comfort. Executives such as COOs can leverage Honeywell Forge for a high-level summary of building health, whilst portfolio managers can use granular dashboards to examine occupant comfort and wellbeing performance, and drill down to systems to explore faults and service cases. The dashboards provide Comfort Performance and Healthy Building scores – KPIs that tie together data such as temperature, humidity, CO_2 and a pollutant index. These KPIs enable benchmarking between assets, zones, spaces and buildings, helping to prioritize maintenance activities. Digital signage is also supported, allowing building health and comfort metrics to be broadcast on screens within the space. In addition, Honeywell's video analytics provide mask compliance and body temperature detection capabilities.

- **Building security.**
  Honeywell is the joint leader in this study for building security, achieving a score of 2.3/3.0. Honeywell's Pro-Watch Integrated Security Suite centrally manages security, integrating with video management and access control solutions. The system works with both propriety and third-party systems such as HID Global, Mercury Systems and SALTO. The vendor has a strong product line of access control solutions, which support entry methods such as fingerprint readers and facial recognition. In addition, Honeywell Forge allows occupants to gain mobile credentials through the Honeywell Sine app. Visitor management, video surveillance and critical event management (CEM) capabilities, as well as supporting occupancy tracking and building automation in managing environmental conditions, are also part of Honeywell's suite of offerings.

- **Energy management modelling and reporting.**
  Honeywell provides energy management functionality through its Honeywell Energy Manager (HEM) solution. HEM provides data aggregation and modelling to allow tracking of energy usage and delivery of reports, as well as energy load forecasting. HEM also performs regression modelling to normalize consumption data against factors such as weather or space utilization. Normalized energy data are critical for understanding the impact of efficiency projects on building energy usage. HEM offers over 75 pre-configured reports covering variables such as energy profiling, load comparison, cost allocation, performance monitoring and sustainability. It also provides an Energy Demand Management module, which can automatically manage loads and generators to avoid reaching demand limits.

- **Data consolidation between operational and financial data.**
  In June 2020 Honeywell announced a relationship with SAP, bringing together Honeywell Forge and SAP's Cloud Platform to combine operational analytics and insights with real estate financial data. The collaboration offers a management dashboard on Honeywell Forge that centralizes and normalizes data to display portfolio performance across operational costs, space utilization, occupant experience and sustainability. With this dashboard, CFOs and real estate executives are exposed to insights into a portfolio's financial performance, with metrics such as expenditure per square foot. Facilities managers can drill down to the site level to pinpoint energy cost savings and operational efficiencies. By merging financial and IoT data, users are provided with more strategic insights to inform their decision-making.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Honeywell could improve by:

- **Providing more platform configurability for users.**
  Honeywell Forge does not offer customization tools for users, meaning that customers must rely on a customer success manager to facilitate customizations. This includes the customization of dashboards and reports, which severely limits the self-service capabilities of the software. Users are also unable to make changes to rules or create and assign new roles without the support of Honeywell services. With an increasing number of IoT software vendors offering self-service and low-code functionality, Honeywell should consider building out this functionality.

- **Developing its space monitoring and analysis functionality.**
  Honeywell Forge currently offers limited functionality around space monitoring and analysis. Although occupancy data are leveraged for the Healthy Building score, as well as predictive maintenance algorithms, there is minimal functionality to effectively track and manage occupancy. Honeywell also does not offer insights or reports around space utilization, which can feed into strategic elements of space management such as designing workspaces. Honeywell should target space monitoring and analysis as an area for improvement on its product roadmap, to better serve building and portfolio managers with their space management needs.

- **Incorporating smart cleaning capabilities.**
  Although Honeywell Forge does offer asset management capabilities, such as asset availability tracking, fault detection and diagnostics (FDD) and fault tracking, there is no functionality to support demand-based cleaning – a growing focus of smart facilities management programmes. Honeywell should look to develop its space monitoring capabilities and then leverage that data to drive smart cleaning, helping firms adopt a usage-based cleaning strategy. Cleaning data can also factor into the Healthy Building and Comfort Performance scores, for a more accurate representation of these metrics.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Honeywell should be included on shortlists by the following buyers:

- **Global firms seeking a platform that centralizes IoT and financial data.**
  Honeywell Forge is an enterprise solution, designed to support large organizations with a global presence. Large organizations should consider Honeywell for IoT capabilities related to occupant comfort and wellbeing, asset monitoring and energy management. Honeywell's global presence can support significant rollouts to ensure global coverage. The solution also includes pre-configured dashboards that support high-ranking stakeholders, such as COOs and portfolio managers, as well as an integration with

SAP that brings together IoT and financial data, supporting CFOs and real estate executives with their strategic efforts.

- **Firms focusing on occupant comfort and wellbeing in return-to-workplace programmes.**
  As many organizations implement strategies to encourage employees back to the office, firms need to instil a high level of confidence in occupants with regard to safety and wellbeing. Honeywell's offering allows building managers to track comfort and wellbeing, respond to faulty equipment or poorly performing spaces – including by changing the operation of HVAC systems – and broadcast comfort and building health information to occupants through screens. This visibility for all stakeholders helps generate confidence in the safety of workspaces for returning employees.

- **Multi-site firms looking for a robust platform for remote security management.**
  Businesses that require an expansive and robust security solution should consider Honeywell. Organizations with highly sensitive buildings, such as data centres or laboratories, or large enterprise firms that need to support global security operations centres (GSOCs), can leverage Honeywell to provide security solutions, including hardware or integration with incumbent security hardware. In particular, Honeywell's Command and Control Suite and Pro-Watch Intelligent Command solutions can help security teams manage global portfolios centrally and remotely, directing them to incidents in a more targeted and measured manner than via traditional security.

Infogrid's Innovative Sensor Deployment Strategy Empowers Rapid Building Digitization

Headquartered in London, with offices in New York and Tallinn (Estonia), Infogrid was founded in 2018. With a growing headcount, Infogrid now boasts 130 employees. In November 2020 the firm secured $15.5 million in Series A funding, backed by a combination of UK and US investors, led by Northzone. This funding will enable product investment. For example, Infogrid is launching functionality for energy monitoring and analysis in 2022. Infogrid offers an end-to-end data management solution, helping customers source and select cheap and easy-to-deploy sensors suited to their needs. To facilitate this, the firm has a strong roster of hardware partnerships with sensor manufacturers such as Airthings, Disruptive Technologies, Haltian and VergeSense, and supports the distribution process. The Infogrid platform pulls data from these sensors and performs analytics to deliver valuable insights, with the solution in place across several industry verticals, such as education, financial services, telecommunications and retail.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Infogrid has strengths in:

- **Rapid sensor deployment to enable data capture.**
  Thanks to partnerships with key sensor manufacturers, Infogrid supplies customers with low-cost sensor hardware. The firm utilizes a metadata folder system and its '10-click principle' to enable firms to easily track and manage the distribution and installation of sensors at scale (see Verdantix Infogrid Empowers The Rapid Deployment Of Building Intelligence At Scale). This enabled Verizon to deploy thousands of Disruptive Technologies sensors into hundreds of their sites globally in six weeks. Sensors can also be installed without previous technical knowledge. Witness the UK's National Health Service (NHS), which used its own nurses to rapidly install sensors across 120 sites to automatically monitor the cold storage of medicine. This approach allows firms to quickly start streaming data from their systems for analysis.

- **Healthy building and occupant wellbeing management.**
  Infogrid achieves an above-average score of 2.0 out of 3.0 for its occupant health and wellbeing functionality. It offers users a Healthy Building dashboard, which includes a Healthy Building score that ties together up to nine key metrics that contribute to building health. Building managers can combine these KPIs with other metrics, such as occupancy, to manage their spaces more effectively, to promote building comfort. Infogrid also enables building managers to push this information down to building occupants through kiosks, screens and tablets. Insights into occupancy and indoor air quality – or even simple messages, such as reminding occupants to socially distance – can be configured to these displays, helping increase occupant confidence in the health of their workspaces.

- **Compliance monitoring.**
  Infogrid supports firms who require compliance monitoring capabilities. Some of the most common use cases fulfilled by the Infogrid platform are air quality tracking, cold storage monitoring, leak detection and pipe monitoring – including tracking legionella – with all of these use cases having pre-built analytics and dashboards. Customers can use the platform to ensure that buildings or spaces conform to the necessary standards. For example, Integral, a JLL company, installed sensors to track water temperature and movement in its office building, monitoring pipes through the Infogrid platform. The solution delivered an 81% reduction in time spent by staff monitoring these bathrooms, with a return on investment (ROI) of under six months. A provider of student accommodation used Infogrid to remotely track open fire safety doors, supporting the efforts of security teams.

- **Smart cleaning for building and facilities managers.**
  Taking advantage of insights into occupancy metrics, such as desk occupancy, Infogrid empowers facilities managers to better understand usage, which in turn can drive more targeted cleaning services. Users can set up automatic alerts that notify cleaners through the Infogrid platform when thresholds have been breached, such as a toilet cubicle door being opened 20 times, allowing cleaning staff to target their services. The solution also supports occupant feedback through devices such as touch sensors, which can also trigger the cleaning process.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Infogrid could improve by:

- **Extending facilities management use cases to support smart maintenance.**
  The Infogrid platform currently offers limited functionality around asset maintenance. Current methods of asset performance monitoring rely on sensors being attached to systems and identifying non-compliant activity such as poor air quality, temperature fluctuations or excessive shaking. Although these can be indications of faults, it is a limited and reactive application, which identifies issues once they have begun impacting a system or building. To deliver a more complete Internet of Things (IoT) offering to support facilities management, Infogrid should expand its maintenance capabilities. For example, developing functionality for the platform to analyse sensor data and understand trends of historic faults would allow the solution to apply these insights to systems for predictive maintenance. This would complement the smart cleaning capabilities currently supported.

- **Reaching more stakeholders via a dedicated mobile application.**
  Infogrid currently does not offer a native mobile app, which is increasingly a requirement amongst facilities management software buyers. Developing a mobile app would enable Infogrid to reach a wider range of stakeholders, such as technicians and building occupants. In particular, the Healthy Building dashboard and occupancy tracking functionality would benefit building occupants in office buildings, allowing them to track factors such as air quality and occupancy. For example, an employee could use the native app to monitor occupancy and decide whether to work in the office that day, or even time their trips to the bathroom to avoid overcrowding, using the same data insights that are already available. The mobile app could also act as another feedback tool for processes such as cleaning, in a similar way to touch sensors.

- **Enhancing the platform's reporting capabilities.**
  Although Infogrid delivers some reporting functionality, there is scope for the vendor to improve its capabilities in this space, particularly to support firms with more strategic elements of their management. Despite providing insights into metrics such as occupancy, the ability for firms to produce reports around these is limited and it is therefore difficult to covert these analytics into impactful strategic decisions, such as how spaces should be organized.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Infogrid should be included on shortlists by the following buyers:

- **Firms looking to rapidly digitize their buildings at scale by leveraging sensors.**
  Multi-site organizations from different verticals, such as ABM, JLL, the NHS and Verizon, have already leveraged the Infogrid approach and platform to successfully distribute low-cost sensors and bring building analytics to their portfolios. Firms that are looking to quickly digitize previously siloed or

underserved buildings, especially those in global or disparate portfolios, should consider Infogrid to both facilitate the distribution and installation of sensors to kickstart data streaming, and to deliver analytics and insights for the desired use cases through the Infogrid platform.

- **Businesses with a strong remit around healthy buildings and wellbeing.**
  Although many countries are slowly returning to normal following COVID-19, the improvement of building occupant health and wellbeing ranks as the second most important real estate strategic objective in the next three years (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). Infogrid's offering enables building managers to track building health through the Healthy Building dashboard and easily configure alerts to ensure that conditions remain optimal. The flexibility of the platform allows these rules to be applied at different scales, ranging from portfolio level down to individual spaces, which empowers users to manage conditions and comfort at a highly granular level.

- **Facilities service providers looking to modernize through smart cleaning.**
  Over the last few years, the facilities management industry has undergone a wave of digitization, with service providers turning to technology solutions to enhance their provision. Facilities service providers should view Infogrid as a valuable tool to augment their work order processes around cleaning. Rather than following traditional cleaning processes that run on a scheduled basis, facilities managers should use Infogrid to complement their computer-aided facility management (CAFM) or computerized maintenance management system (CMMS) solutions. Occupancy insights, as well as occupant feedback, can be combined with rules to trigger alerts when a certain condition has been met, such as a specific number of desk uses. This results in targeted cleaning, where services are only applied based on usage. Witness a facility manager of a large mall, who leveraged usage-based washroom cleaning and achieved an ROI within six months.

- **Businesses targeting higher levels of compliance.**
  Infogrid is a suitable solution for organizations looking for a smarter way to monitor and implement facilities compliance requirements. For example, the firm is already working with several large food retailers and healthcare organizations, supporting cold storage compliance, which can also reduce wastage of food and medicine. Other customers are calling on Infogrid to deliver water pipe monitoring and to support compliance around factors such as legionella. The simple installation approach allows customers to leverage Infogrid to initiate data collection for these use cases, and then to easily track compliance against them.

Johnson Controls Empowers Building Managers To Balance Energy Efficiency, Comfort And Wellness Objectives

Headquartered in Cork, Ireland, Johnson Controls (JCI) has been a major player in the building technology market since its founding in 1885, expanding across building automation and controls systems over the last few decades. In 2020 JCI launched the OpenBlue smart building product line, a suite of connected solutions and services aimed at optimizing building performance whilst reducing operating costs and improving occupant experience. JCI targets OpenBlue at firms with multi-site portfolios, such as retail chains and owners of commercial office space. It also focuses on firms pursuing modernization strategies that operate large individual sites, such as airports, healthcare institutions, schools, stadiums and universities. Typical customers for JCI's Internet of Things (IoT) offerings occupy facilities of approximately 150,000 square feet.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that JCI has strengths in:

- **Asset monitoring and management.**
  JCI achieves a market-leading score of 2.5/3.0 for asset management, monitoring and control, offering comprehensive functionality for enhancing asset management. For example, using the Asset Manager tool on the OpenBlue Enterprise Manager (OBEM) platform, building and facilities managers can track the performance and conditions of building systems. The platform also provides fault detection and diagnostics (FDD) capabilities for a large range of HVAC systems. OBEM leverages machine learning to make predictions around energy demands and anomalies, which can be tied together with FDD to better optimize performance. The solution also uses AI to provide energy prediction models that estimate consumption and demand, factoring in a diverse set of variables such as outdoor conditions, historic consumption data and calendar information. The solution applies AI for comfort control, where HVAC setpoints are actively managed to optimize energy consumption based on aspects such as comfort requirement and occupancy schedules drawn from meeting calendars.

- **Balancing occupant wellbeing and energy efficiency, through varied recommendations.**
  Within JCI's Space Performance application, building managers can track utilization of spaces, rooms and desks. The app also provides infectious disease risk and indoor air quality scores for these spaces, as well as alerts and recommendations to improve the scores. Rather than delivering a single recommendation, OBEM offers a multi-recommendation tool. Building managers are presented with three options for recommended actions related to an alert, with different implications for comfort conditions and energy efficiency. The first option looks to improve the risk score; the second aims to optimize energy efficiency; and the third tries to balance these two priorities. Each option highlights the expected change in score and associated energy cost, allowing building managers to either balance objectives or skew to what they believe is more important.

- **Space booking and comfort management for occupants.**
  JCI scores 2.1 out of 3.0 for workplace services, primarily driven by the capabilities offered through its occupant-facing Companion app. Occupants can use the app for room or desk booking, wayfinding and check-in, as well as for more sophisticated use cases such as managing comfort by changing light and heat settings, submitting tickets for faults or incidents, and access control. Occupants can also select spaces that meet specific needs by filtering spaces or rooms by equipment required, such as a printer. Companion has a calendar integration with Microsoft Office 365 Exchange, simplifying the booking process for users.

- **Building security capabilities spanning access control and video surveillance.**
  JCI achieves a market-leading score of 2.3 out of 3.0 for building security, reflecting the breadth of its security offering. Within OpenBlue Cloudvue, users can utilize access control and video surveillance functionality. Beyond simply recording and storing closed-circuit television (CCTV) footage, the Cloudvue Video Surveillance solution is capable of sifting through large volumes of footage and retrieving and storing important moments, so that security teams can quickly access and view key incidents. The Risk Insight and Active Responder solutions enable security teams at global security operations centres (GSOCs) to remotely monitor and manage security for large portfolios in a more effective manner, including by digitizing standard operating procedures (SOPs), so that security teams can cut response times to incidents through dynamic responses.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that JCI could improve on:

- **Strategic space management.**
  While OBEM provides building managers with the ability to track space metrics such as utilization and trends in usage, it does not offer functionality to drive strategic decisions related to space redesigns and real estate changes. In a similar manner to the intelligent recommendations of its multi-solve tool, JCI should work on developing its functionality to support building and portfolio managers with their strategic workplace efforts. This will be particularly helpful as firms begin to settle into their new working models and need to adjust their real estate accordingly.

- **ESG reporting and analysis.**
  Although OBEM supports energy monitoring and can ingest data from utility bills, it currently does not collect data on the social or governance elements of ESG. Moreover, the Energy Manager tool has limited sustainability-related functionality, primarily concentrating on energy consumption and offering the ability to track solar energy production and usage. To meet growing demand in the market, JCI should focus on providing a dedicated application for ESG that can help firms target, track and meet their long-term sustainability goals, such as net zero carbon (NZC), and also factor in the social and governance elements. Other vendors in the market have expanded on their energy monitoring heritage by enabling customers to run social and government surveys, with a single dashboard for monitoring.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that JCI should be included on shortlists by the following buyers:

- **Large facilities looking for a comprehensive IoT platform.**
  Large facilities seeking a broad solution to tackle several major aspects of building management should consider JCI's OpenBlue suite of solutions. Firms can call upon these solutions to provide asset and energy management, building security, occupant health and wellbeing, and workplace services. Customers can roll out these solutions to their large buildings with the support of JCI during and post-implementation.

- **Businesses managing a diverse set of building assets.**
  JCI's heritage means that it offers strong capabilities to monitor and manage building assets. Large buildings, hospitals and universities with sizeable on-site plants or complex energy centres could consider OpenBlue to help track and optimize the performance of these assets, leveraging JCI's FDD capabilities to stay on top of maintenance issues and even automate the operation of some assets through the

provider's AI capabilities. JCI boasts thousands of customers, of various sizes, who leverage these asset monitoring capabilities across their systems to optimize performance and operation.

- **Organizations across industries seeking a modern, user-centric security solution.** Businesses seeking a wide-ranging security management platform to provide coverage for many sites should consider selecting JCI's offerings. With Cloudvue, Risk Insight and Active Responder, firms have access to video surveillance, access control and remote security management capabilities, enabling centralized security teams at GSOCs to manage portfolio-wide security in an efficient manner. These solutions can be deployed across different industry verticals and building types, as exhibited by some of JCI's current customers. These include Google, which uses JCI security offerings for its retail stores; T-Mobile, which has deployed solutions at critical infrastructure sites; Northbay Healthcare; and Shaw University.

LTTS Focuses IoT Efforts Around Enhancing The Occupant Experience

L & T Technology Services (LTTS) is an engineering services firm headquartered in Gujarat, India. It is a subsidiary of the conglomerate Larsen & Toubro. In the last financial year, LTTS recorded building Internet of Things (IoT) software revenues of $4 million. In terms of IoT solutions, LTTS offers the i-BEMS platform, formed of modules covering functionality such as energy management, workspace management and workplace services. The wider LTTS outfit has offices all over the globe, with customers of its IoT offerings hailing from Asia-Pacific, Europe and North America.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that LTTS has strengths in:

- **Experience management.**
  As part of the i-BEMS platform, LTTS offers a wide range of applications related to the occupant experience. These encompass workplace services tools for wayfinding of desks and individuals; a Cafeteria and Pantry module that offers food ordering and payment capabilities; parking management; and booking of amenities such as gyms. All experience-related capabilities are available for building occupants through the i-BEMS mobile app. Users can also provide feedback in the form of fault tickets through the Virtual Concierge module.

- **Sensor-enabled occupancy monitoring.**
  The i-BEMS platform also offers users the ability to track footfall and occupancy by collecting data from IoT sensors. The Occupancy module enables building managers to track the utilization of floors, spaces or rooms and automatically raise alerts if occupancy limits are exceeded. This helps building managers ensure that policies around occupancy are followed and provides a high-level understanding of usage that can be factored into space optimization efforts. Current users of this functionality from i-BEMS include Intel and Maersk.

- **Partnerships with software and hardware vendors.**
  LTTS boasts a large roster of software and hardware vendor partners, enabling the firm to extend its platform to support new use cases. Software partners include Microsoft and the IoT-based indoor positioning vendor Indolytics. On the hardware side, i-BEMS is integrated with Irisys and PointGrab for occupancy; Neptune Automatic and Quercus Technologies for parking; Airthinx and Leapcraft for air quality; and SmartClean Technologies for toilets – amongst other partners. This healthy set of partnerships helps LTTS deliver workplace services and occupant experience use cases by leveraging innovative solutions on the market.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that LTTS could improve by:

- **Extending space monitoring capabilities to support strategic efforts.**
  LTTS's current space monitoring capabilities are limited to real-time occupancy tracking. LTTS should look to expand its functionality to provide richer insights into how spaces are used, collecting more granular data, such as dwell time. Providing insights and dashboards with this information will enable users to leverage the IoT data for more strategic activities, such as space design and real estate planning.

- **Targeting a more comprehensive energy management platform.**
  The i-BEMS platform currently offers an energy monitoring module with some basic capabilities around energy management, such as comparing an energy baseline to actual consumption, after efficiency projects have been implemented. LTTS should develop this to deliver an improved energy management offering that provides other functionality, such as utility bill management, energy forecasting and energy reporting to standards and regulations. Energy management continues to be a highly sought-after use case for IoT platforms, so it would be beneficial for LTTS to enhance its offering in this space to meet market demand.

- **Supporting more expansive client portfolios.**
  The i-BEMS platform is primarily targeted at single sites. LTTS should work on developing the platform for improved scalability, enabling its strong experience management proposition to be marketed to larger organizations that are looking to deliver a modern occupant experience through IoT across a set of locations. This scalability would also empower LTTS to pursue more high-value clients by offering a consistent experience across their corporate real estate portfolios.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that LTTS should be included on shortlists by the following buyers:

- **Firms targeting a services-rich occupant experience for their corporate real estate.**
  Organizations that are looking to enhance their occupant experience should consider the i-BEMS platform, with its mobile app that provides functionality spanning wayfinding, amenities booking and food ordering for users. Building managers can also use the Fever Detection solution offered by the platform to manage occupant health, particularly as employees return to the office following COVID-19.

- **Building managers looking to enhance individual buildings.**
  Businesses with single buildings can deploy the i-BEMS platform to deliver a set of workplace services related to occupant experience. Customers can take advantage of the amenities functionality, as well as features such as parking management and the Smart Toilet module, to help direct cleaning efforts. The platform also enables employee feedback on faults, feeding these to maintenance teams and tools for action. Building managers can use the i-BEMS platform to deliver workplace services to a previously underserved or poorly digitized office building.

Planon Leverages Strategic Integrations To Enhance Its IoT Offering

Founded in 1982 and headquartered in the Netherlands, Planon is a real estate and facilities management software provider. The integrated workplace management system (IWMS) vendor has 880 in-house staff for its software business, of whom approximately 30 are dedicated to its Internet of Things (IoT) platform business. In June 2021 the vendor boosted its IoT platform capabilities by acquiring low-code IoT platform vendor Axonize, which has 100 customers. Going forward, Planon will continue to offer the Axonize platform as a standalone solution, as well as an integrated offering in the Planon Universe. Planon has also developed platform connectors with other third-party platforms, most notably, Schneider Electric's EcoStruxure Building Advisor, leveraging this for asset monitoring and management purposes. This analysis takes into account the functionality of the Axonize IoT platform, as well as the IoT capabilities of the Planon Universe, and those delivered through the integration with Building Advisor.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Planon has strengths in:

- **Low-code rule and workflow configuration.**
  Within the Axonize platform, users can create business rules and workflows in a low-code fashion, with minimal technical expertise. Building managers are able to easily create rules, set threshold conditions and define responses and notifications so that alerts are escalated accordingly. Planon applications also allow for the creation of rules and workflows, with a graphical workflow editor further simplifying the process. This capability empowers facilities operators to manage their buildings in a self-service fashion, allowing responsibility to be passed down to individuals with the best understanding of their buildings and therefore of the rules and alerts that should be in place.

- **Asset monitoring and maintenance.**
  Thanks to an out-of-the-box integration with Schneider Electric's EcoStruxure Building Advisor solution, Planon scores a strong 2.2 out of 3.0 for asset management and monitoring. The Building Advisor solution enables predictive maintenance by leveraging digital twin tools to perform fault detection and diagnostics (FDD) of building HVAC assets. In addition, the Axonize platform offers machine-learning-based anomaly detection, for further asset management coverage. Building managers can use these insights and alerts to respond to maintenance issues, as well as to control assets remotely with bi-directional communication. Planon's Asset Management module enables firms to manage assets holistically, such as managing warranty and spare parts data, as well as permitting lifecycle management, such as the removal, replacement and sale of assets.

- **Work order management processing.**
  Supported by its heritage in IWMS, Planon offers a strong work order management processing capability through the Planon Universe. Diagnostics and alerts extracted from Building Advisor, or another third-party solution, are pushed into the Planon platform, where the decision model calculates the best course of action. The model applies a criterion to assess the next steps, factoring in the impact on other metrics, such as energy, avoidable costs and comfort. Diagnostics are then approved, triggering an automatic work order, or are set for further assessment. As part of this process, service-level agreements (SLAs) can be applied to ensure that certain diagnostics are pushed through for resolution. In addition to being able to track and allocate work orders, Planon offers a dedicated Mobile Field Services app to support technicians with their field work when resolving issues.

- **Environment and occupancy monitoring.**
  Planon recently launched its Workplace Insights module, which can be deployed quickly in the field, typically in under a week, thanks to out-of-the-box connectors with four sensor vendors and pre-defined reports, processes and roles. The Workplace Insights solution allows users to track occupancy of spaces, including by different space types, such as offices and meeting rooms. Live and historical views of data are available, allowing building managers to view trends and use this occupancy information to inform space designs, as well as drive services such as cleaning. Workplace Insights also offers environmental monitoring, tracking seven metrics, including temperature, noise, light and CO_2. These conditions can be tied into the work order platform, where business rules are created to ensure that conditions remain within safe operating windows.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Planon could improve on:

- **Energy forecasting and project verification.**
  While firms can leverage the Axonize low-code platform to build out applications for energy analysis and project tracking, the Planon proposition currently lacks out-of-the box applications in this area. With 41% of real estate executives ranking the reduction of energy expenditure as a high priority for the next 12 months, Planon should consider boosting its off-the-shelf capabilities to better meet the growing demand amongst buyers (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences).

- **External reporting and benchmarking capabilities.**
  Planon should improve its automated external reporting functionality for energy consumption and sustainability against common reporting standards. Currently, the firm offers the ability to build and distribute reports internally, leveraging the rich datasets collected, but is unable to facilitate the creation and submission of these data to voluntary standards such as CDP or GRESB. Planon should work on developing reporting functionality that leverages energy data into pre-defined reporting templates for major external standards to round out its reporting capabilities.

- **Advanced occupant health and wellbeing functionality.**
  Planon currently offers core tools to help firms monitor and manage occupant wellbeing, such as COVID-19 health questionnaires and space utilization monitoring. To position itself at the forefront of this market, Planon should develop more advanced capabilities in this space to further empower and enable occupants and building managers. For example, Planon recently launched functionality that facilitates the use of quick response (QR) codes for building entry, which act as entry credentials after users have filled out health questionnaires. Planon is also developing functionality to enable occupants to provide input on the conditions of spaces or rooms through the mobile app.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Planon should be included on shortlists by the following buyers:

- **Facilities management firms investing in digital transformation programmes.**
  Facilities service providers looking for a robust IoT platform and workflow engine to support their service provision should consider the broad suite of Planon products – Axonize, Planon Universe and the integration with Schneider Electric. Not only do Planon's offerings empower facilities managers to create and edit rules and workflows, but the integration with Schneider Electric's EcoStruxure Building Advisor,

combined with Planon's decision model, brings greater efficiency to maintenance. The decision model allows automation of work order escalation, factoring in SLAs, while the Mobile Field Services app enables technicians to deal with issues promptly. The Planon offering digitizes the facilities management process and leverages the firm's heritage to provide efficient orchestration of tickets. As such, Planon is one of the top scorers for facilities management services in this study.

- **Firms looking for a lightweight space solution for their commercial real estate.**
  Businesses with a large proportion of commercial real estate offices should consider Planon as a viable solution for their building technology needs. Through Workplace Insights, Planon delivers occupancy and environment monitoring capabilities, which can help building managers track and control the operation of their spaces. Building managers can ensure that environmental conditions remain acceptable, whilst using trend data on space occupancy to understand patterns and adapt working models and space designs according to this demand. Planon already boasts a strong set of customers from industries with commercial offices, such as financial and business services firms.

- **Businesses in asset-rich industries such as education and healthcare.**
  Organizations in asset-heavy sectors, such as education and healthcare, should consider Planon's offering to support their asset monitoring, management and control requirements. The combination of the maintenance capabilities provided by EcoStruxure Building Advisor, and Planon's Asset Management module and IWMS work order management functionality, offers a strong proposition for businesses looking to minimize maintenance costs and business disruption. Demonstrating its suitability in this space, Planon has a vast number of existing educational institutions and healthcare facilities currently using its solution.

PointGuard Promotes Elevated Building Efficiency And Smarter Capital Expenditure

Based in Charlotte, USA, PointGuard offers an Internet of Things (IoT) platform that focuses on extracting data from building control systems and applying analytics that foster greater energy efficiency, an improved occupant experience and better asset performance. PointGuard's core products are the PointGuard Pro+ and PointGuard Enterprise offerings, which provide broad functionality across building management system (BMS) monitoring, comfort management and fault detection and diagnostics (FDD). The firm also offers Insights Report, a monthly service offering; The Snapshot, a rapid 30-day report into potential building savings; and Assurance, which monitors building performance and maintains operational customizations developed during the savings phase after using one of the full platform offerings. PointGuard's customers are exclusively based in the US market; the vendor saw building IoT revenues grow by 80% in 2020 compared with 2019.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that PointGuard has strengths in:

- **Energy monitoring at different granularities.**
  The PointGuard platform enables users to track building energy performance at a portfolio, building and equipment level. Building managers can quickly view the comfort and asset health scores of a building, and can leverage data extracted from the US Department of Energy's ENERGY STAR programme to view the building's ENERGY STAR score. Users can view trends and analysis on key metrics such as energy costs and GHG emissions. The platform produces intuitive energy reports and also performs anonymous benchmarking, where building performance is compared with others in the same area using ENERGY STAR data, giving users an effective contextualized metric for comparison. Based on performance, the solution provides actions designed to improve energy efficiency, producing an estimated cost saving associated with each action, which helps prioritize corrective activities.

- **Reports to inform capital expenditure planning.**
  One of the standout features of the PointGuard platform is its functionality across asset management, monitoring and control, where it achieves a strong score of 2.2/3.0 versus an average of 1.7/3.0. The platform provides asset health scores for each system in a building and enables users to create rule-based alerts for fault response, either by using pre-configured templates or by configuring their own. The PointGuard platform also provides capital expenditure reports that aggregate data such as equipment condition, maintenance spend and life expectancy, to deliver insights to support capital replacement decisions. These reports list recommended actions under three categories – immediate needs, short-term needs, and non-critical assets – and provide an estimated replacement cost and projected asset health score of pursuing these actions. In some cases, actions drill down to a sub-component level, avoiding the need to replace entire assets.

- **Accommodating firms at different stages of building performance management.**
  The PointGuard offering is designed to support customers at different stages of their smart building journeys. Typically, customers will choose either the PointGuard Pro+ or PointGuard Enterprise offerings to find all the savings available. Customers can alternatively choose PointGuard Insights Report, which delivers monthly reports with one action to improve performance and generate operational savings – which PointGuard guarantees will cover the cost of the subscription. Customers starting out can try The Snapshot, which provides a report assessing current conditions and one action within 30 days. This can highlight potential savings associated with a building, allowing customers to make an informed decision on whether to choose a more comprehensive PointGuard package. Once savings have been maximized,

customers can choose PointGuard Assurance to lock in efficiencies realized with the full platform and to eliminate building drift.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that PointGuard could improve on:

- **Capabilities related to building occupants.**
  The current crop of solutions offered by PointGuard are exclusively targeted at roles such as building, facilities and portfolio managers. Despite having capabilities related to occupant comfort, occupants themselves are currently unable to view comfort scores or provide feedback to influence equipment operation. PointGuard should look to evolve its solution to better serve occupants, primarily through a mobile application. PointGuard is currently working on relaunching its Goldilocks native mobile app, which will be able to tackle some of these issues around building occupant engagement.

- **ESG data capture and reporting capabilities.**
  The PointGuard platform has a strong focus on improving energy efficiency to reduce operational costs, but corporate strategies around energy are no longer restricted to costs. Forty-seven per cent of real estate executives are planning on new investment to support the reporting of ESG data to stakeholders and investors in 2022 (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). As the platform already collects and aggregates data around energy consumption, utility bills and GHG emissions, PointGuard should focus on extending its capabilities around ESG, including supporting GRESB reporting, to respond to growing market traction in this space.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that PointGuard should be included on shortlists by the following buyers:

- **Firms seeking a long-term partner for building efficiency.**
  Thanks to the range of functionality offered, customers can engage PointGuard to support them at different stages of maturity in their performance and energy efficiency strategies. For example, firms making their first foray into improving efficiency can use The Snapshot to quickly understand the types of savings that can be achieved. If they choose to pursue an IoT approach, they can select a full platform to maximize savings. Alternatively, an organization can select the monthly Insights Report package, which might work better with budgetary constraints. As PointGuard guarantees a return on investment (ROI), the Insights Report subscription can help build a business case for purchasing the full platform. Once savings have been maximized, customers should choose Assurance to maintain performance levels in the long term.

- **Businesses looking for capital expenditure planning support.**
  PointGuard's capital expenditure reports are a valuable tool for a range of stakeholders involved in capital expenditure planning, such as portfolio managers, facilities managers and even investors. The recommended actions, combined with the estimated cost, categorization of urgency and projected impact on asset health, inform these stakeholders in their decision-making processes. Users can combine these insights with other contextual information, such as budgets, to direct investment where it is most needed or even to develop business cases for new investment.

- **Asset-intensive organizations wishing to drive facilities optimization.**
  Organizations such as hospitals or higher education campuses, which typically have a large number of HVAC systems and building management systems (BMSs), should consider deploying PointGuard to improve their energy efficiency and building health. Portfolio and building managers can use the PointGuard platform to get a quick overview of asset health, comfort and energy ratings, as well as other key metrics, such as energy costs and emissions. Actions recommended by the platform can be pushed down to ground-level staff to improve the operation of buildings and deliver tangible cost savings. PointGuard has a growing list of successful deployments within healthcare and educational facilities, illustrating the impact of the platform in these sectors.

Schneider Electric Delivers Advanced Energy Management And Market-Leading Sustainability Functionality

Headquartered in France, Schneider Electric has offices in over 100 countries and customers that span the globe. Within the Internet of Things (IoT) space, Schneider Electric offers the EcoStruxure Building solution suite, which comprises connected products; edge control solutions such as Schneider's EcoStruxure Building Operation – the building management system (BMS) that aggregates data from its layer of connected products; and the Advisor product line, which includes apps, analytics and services. Schneider Electric currently offers six products as part of the Advisor line: EcoStruxure Asset Advisor for electrical distribution; EcoStruxure Building Advisor for facilities and energy management; EcoStruxure Microgrid Advisor to control on-site energy resources and loads; EcoStruxure Resource Advisor – an energy and sustainability data platform; the EcoStruxure Engage Enterprise mobile application; and the EcoStruxure for Retail Integrated Management Platform, targeted at retail customers. Through its partnership with Planon, Schneider Electric also offers Planon Workplace Insights for space and workplace management. Approximately 250,000 buildings across more than 10,000 customers currently leverage Schneider Electric's IoT offerings.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Schneider Electric has strengths in:

- **Comprehensive energy management, spanning power consumption and generation assets.**
  Through EcoStruxure Resource Advisor, Schneider Electric offers a strong energy management proposition, scoring a joint market-leading 2.4 out of 3.0. EcoStruxure Resource Advisor enables portfolio managers to monitor energy across portfolios of any size. Users can easily drill down to individual sites and customize dashboards to track desired metrics. With the support of Schneider Electric services, users can create energy forecast models, whilst the EcoStruxure Microgrid Advisor solution uses machine learning to optimize the performance of microgrids for those clients who have them, including managing responses to peak energy demands. Users can also produce or configure energy reports, including reports that incorporate factors such as comfort alongside energy.

- **Sustainability and carbon reporting.**
  EcoStruxure Resource Advisor delivers strong sustainability tools, scoring 2.4 out of 3.0 for this criterion. The solution collects and manages utility data and provides emissions data through sustainability dashboards, allowing users to track market- or location-based emission summaries. CarbonMaps facilitates carbon reporting by providing reports for carbon data management, as well as the ability to adjust reports to meet new requirements. Schneider Electric's operations team works with clients to map reports to the requirements of sustainability standards such as CDP and GRESB. This approach again allows flexibility when changes are made to reporting requirements. Users can submit GRESB reports directly, thanks to an application programming interface (API). The solution also supports sustainability goals, as users can closely track progress and performance against targets, such as Scope 3 GHG emissions or Science Based Targets initiative (SBTi) goals.

- **Predictive maintenance for assets.**
  Schneider Electric's EcoStruxure Building Advisor solution provides comprehensive asset monitoring and predictive maintenance (see Verdantix Schneider Electric Leverages Digital Twin Capabilities To Enhance Facilities Optimization). EcoStruxure Building Advisor, powered by Clockworks Analytics, exploits digital-twin-based operational insights to analyse energy consumption and HVAC performance, as well as perform continuous fault detection and diagnostics (FDD) to drive energy savings. This FDD pre-empts faults and empowers facilities managers to address issues before they disrupt business operations.

EcoStruxure Building Advisor leverages digital twin models of 22 types of building assets; thanks to its deployment in over 200,000 pieces of equipment, system performance is compared anonymously via the cloud with other similar assets, ensuring that modelling accuracy is high and false diagnoses are minimized.

- **Retail portfolio management.**
  Schneider Electric targets retail customers through its EcoStruxure for Retail Integrated Management Platform. The solution provides portfolio managers with a global view of all their sites, and allows them to drill down to more granular levels to track metrics such as footfall and conditions, as well as manage alarms and setpoints remotely. The solution can highlight key metrics such as the worst performing stores from an energy perspective. Based on customer requirements, additional features such as three-dimensional (3D) walkthroughs to understand systems locations and electric vehicle charging information can also be configured into the solution. With a clean and intuitive layout, portfolio managers can use this solution to remotely manage and track their retail sites, empower their building and store managers to handle faults, and track energy consumption and cost savings.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Schneider Electric could improve on:

- **Consistency of user interface (UI) across offerings.**
  Reflective of Schneider Electric's product development history, which includes integrations and partnerships such as with Clockworks Analytics for EcoStruxure Building Advisor, certain offerings in its suite of solutions require UI improvements for more consistency and easy navigation. Whilst the EcoStruxure Engage Enterprise mobile app and the EcoStruxure for Retail Integrated Management Platform offer modern and intuitive UIs, Building Advisor's aged UI requires some enhancements, whilst EcoStruxure Security Expert – Schneider Electric's security solution – offers a poor interface for security teams. Despite its strengths in various aspects of IoT functionality, Schneider Electric needs to ensure more consistency in user experience between solutions, even if they are used by different stakeholders.

- **Leveraging of AI and machine learning for more advanced capabilities.**
  To further enhance its offering, Schneider Electric should look to extend its use of advanced technologies such as AI and machine learning. The firm should consider applying AI to bring greater automation to the development of FDD alerts, automating the update of rules based on fault history for better alerts, rather than requiring users to manually perform this task. Machine learning could also be leveraged more fully to enable the automatic optimization of assets and BMSs.

- **On-demand facilities services such as cleaning.**
  To round out Schneider Electric's strong functionality for hard facilities management, it should consider building out functionality to support smart cleaning services that match the usage of facilities. With returning to the office a high or medium priority for 87% of executives in the next 12 months, and workplace cleanliness a major concern for employees, firms are seeking more targeted cleaning services (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). Schneider Electric should look to meet this demand, combining utilization and occupancy data with work order management.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Schneider Electric should be included on shortlists by the following buyers:

- **Firms with a strong operational decarbonization agenda.**
  Businesses pursuing ambitious sustainability goals should strongly consider leveraging Schneider Electric, and in particular, the EcoStruxure Resource Advisor solution, to help set and track performance against targets such as reduction of Scope 3 carbon emissions. We rate Schneider Electric's IoT capabilities for sustainability management as market-leading, as it can support firms with their data collection and aggregation, as well as their sustainability reporting efforts to standards such as CDP or GRESB. With focus on sustainability intensifying, the most progressive firms can rely on Schneider Electric to support their green efforts.

- **Facilities management firms and customers striving for higher value maintenance services.**
  Facilities service providers looking to drive greater efficiency in the delivery of their services should consider utilizing EcoStruxure Building Advisor to provide systems monitoring, predictive maintenance insights, prioritization of alerts and the creation of work orders through integrated workplace management system (IWMS) and computerized maintenance management system (CMMS) integrations. Working with Schneider Electric's services team, facilities managers can identify common maintenance issues and design more targeted services contracts that place greater emphasis on offending systems. EcoStruxure Building Advisor is already leveraged by large facilities management firms such as CBRE, Cushman & Wakefield and JLL.

- **Businesses managing a diverse mix of building assets.**
  Organizations with diverse or global portfolios that comprise a wide range of assets should consider selecting Schneider Electric to deliver several of the necessary elements of building management. The firm can provide solutions spanning asset monitoring, energy management, sustainability and security across a portfolio of sites, connecting to legacy and modern systems, and its presence in countries around the world enables deployment on a global scale. Schneider Electric also supports a wide range of building types, with successful deployments in education (such as the University of Iowa), airports (such as Melbourne Airport), and healthcare institutions and life sciences facilities (such as Boston Scientific).

- **Retail customers with dispersed sites.**
  Retail organizations with a distributed mix of sites should consider using Schneider Electric's EcoStruxure for Retail Integrated Management Platform – one of the very few IoT offerings in this study dedicated to retail – to manage locations centrally. The solution allows portfolio managers to gain a global perspective of all their stores, as well as track and manage these at a more granular level. With role-based permissions, portfolio managers can also empower store managers to better track and manage building performance. The solution has already been deployed by a leading fast food restaurant chain and a household goods retailer.

Siemens's Comfy App Deepens Space Monitoring And Workplace Services Offerings

Siemens is a global industrial powerhouse that targets the building Internet of Things (IoT) space through its Siemens Smart Infrastructure group, headquartered in Zug, Switzerland. Siemens offers a comprehensive suite of IoT solutions for smart buildings. Navigator is a cloud-based analytics platform that collects, organizes, visualizes and analyses building data, mostly for energy, sustainability, space management and asset performance. Siemens also offers Comfy for workplace experience and analytics; Enlighted for smart sensors; the Siveillance product line for building security and access control; the Desigo CC building management system (BMS); and Building Operator for remote monitoring and operations of small to medium-sized buildings. Building Twin is the common layer for building information data from construction plans and live building data, such as from sensors, delivering digital twin capabilities. The MindSphere IoT operating system, designed to connect assets and support the integration and analysis of monitoring data in the cloud, complements these solutions. With its software portfolio and digital services offering, Siemens supports several thousand customers globally with tens of thousands of facilities and handles hundreds of millions of building data points daily.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Siemens has strengths in:

- **Energy management of buildings and assets.**
  Siemens's Navigator offering, which scores 2.1 out of 3.0 for energy management in our benchmark, is an energy analytics platform that firms can use to manage energy data. In addition to supporting the ingestion of utility bill data, Navigator allows users to perform energy monitoring and targeting, such as cost and budgetary comparisons for usage, and analysis of asset performance and faults affecting consumption. The solution also provides a Performance Assurance dashboard, where costs savings can be measured and verified, which can be used to track the success of energy management projects.

- **Workplace services delivered through an intuitive mobile app.**
  Driven primarily by its Comfy solution, Siemens scores highly for its space monitoring and analysis capabilities (1.9/3.0). Comfy is an intuitive workplace mobile app offering users easy access to workplace services. It delivers an advanced level of space booking, where users can book space based on equipment availability and reviews provided by colleagues. With the Neighborhoods feature, occupants can book an area and add co-workers, so that teams can sit in proximity. The app also offers the ability to book parking spots, provide wayfinding capabilities, manage the lighting and temperature of spaces and submit work order requests. Building managers can also configure health questionnaires and other forms to manage occupants.

- **Space monitoring and analysis functionality.**
  Siemens scores 1.9 out of 3.0 for space monitoring and analysis. With its Enlighted IoT solution, users can install a sensor network in lighting fixtures or on surfaces. Once connected to the cloud, these sensors collect and stream real-time data on motion, which can be provided on heat maps, as well as data on lighting and power consumption. Comfy can track utilization on a granular level, using both sensor and booking data to understand how spaces and resources are being used. By combining these insights, building managers can tackle strategic elements of space management, such as portfolio right-sizing and workspace redesigns. Comfy also offers the ability to designate 'Space Traits', where building managers can create trait labels, such as 'close to toilets', which can be tagged to spaces. Combining utilization and booking data with these traits can identify patterns in employee preferences, providing further opportunities to improve space design.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Siemens could improve by:

- **Providing more extensive ESG functionality.**
  Despite strong energy management capabilities, Siemens has room to improve its ESG offering. Although Navigator is capable of handling energy data and providing tracking of Scope 3 carbon emissions, Siemens currently lacks extensive capability to collect and manage social and governance data – the importance of which is growing as the momentum behind ESG increases. Forty-seven per cent of real estate executives plan to newly invest in tools to support the reporting of building ESG data to stakeholders and investors in the next 12 months (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). Siemens should look to enhance its ESG offering to match this market intention.

- **Developing its environmental condition monitoring features.**
  Although building occupants and managers can control climate conditions such as temperature and lighting within workspaces, Siemens could improve its environmental monitoring capabilities further. In the past 18 months, the impetus behind healthy buildings has grown significantly and many vendors are building dashboards and aggregated scoring systems to track and manage building health on temperature, humidity, airflow, volatile compounds and CO_2 levels. To complement the space monitoring and workplace service features of Comfy, Siemens should look to build out a comprehensive environmental monitoring tool, which could be used by building managers and occupants alike to track indoor conditions.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Siemens should be included on shortlists by the following buyers:

- **Firms looking to drive more value from their office portfolios in the hybrid era.**
  Organizations that hold large amounts of corporate real estate, such as firms in business services, finance and technology, should consider leveraging Siemens's Comfy for their space management and workplace services needs. In addition to empowering employees with services through their own mobile devices, features such as utilization insights and the 'Space Traits' tool help building managers understand how their workspaces are being used. As businesses return to the office, these tools enable building and portfolio managers to make more informed real estate decisions, optimizing space usage whilst boosting worker productivity.

- **Complex organizations such as life sciences and healthcare institutions.**
  Firms with complex building portfolios, such as healthcare institutions, hospitals and life sciences firms, should consider Siemens's suite of solutions to deliver comprehensive building management capabilities. The vendor's offering provides tools to support asset monitoring and maintenance, energy management, space management and building security at an enterprise level. For firms in healthcare, Siemens offers specific capabilities such as real-time location tracking of assets (through Enlighted) and control capabilities (primarily through Desigo CC), to ensure that specialized areas – such as operating rooms, patient rooms and pressurized rooms – are kept in the right conditions. Siemens also provides targeted tools for laboratories and other life science facilities.

- **Educational campuses seeking to optimize energy and maintenance processes.**
  University campuses and other educational facilities should consider Siemens's IoT-enabled building management tools. By leveraging Siemens's offerings, these organizations can track their energy consumption, including their Scope 3 carbon emissions, manage building maintenance through fault detection and diagnostics (FDD) and configured alerts, and implement robust security solutions. Siemens already has a history of success in this space. Witness the University Properties of Finland, which owns and maintains the buildings of Tampere University, and leveraged Siemens's offerings to improve building maintenance, leading to 70% of visual inspections being replaced by data analytics, and 50% fewer user complaints. The University of Birmingham also recently began an engagement with Siemens, rolling out 23,000 Enlighted IoT sensors from August 2021, to support its modernization efforts.

Spacewell's DEXMA Acquisition Drives Strong Energy Management Functionality

Headquartered in Belgium, Spacewell was founded in 1989 as MCS Solutions. Nemetschek Group acquired the firm in 2018 and it rebranded as Spacewell early in 2019. Spacewell is the Operate & Manage division of the Nemetschek Group and provides software solutions and advisory services to help firms optimize the performance of their building portfolios. Spacewell's Internet of Things (IoT) offering comprises three major components: Cobundu, a Software as a Service (Saas) solution – its IoT smart building platform; DEXMA, its smart energy platform offering; and Axxerion, its integrated workplace management system (IWMS) offering. These applications also integrate with each other. Around 6,000 firms use Spacewell's IoT software, deployed at over 90,000 buildings. Spacewell also boasts a strong roster of both software and hardware partners, allowing it to provide a more comprehensive IoT offering with a greater range of capabilities.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Spacewell has strengths in:

- **Energy management, leveraging AI.**
  Spacewell achieves a strong score of 2.4 out of 3.0 for energy management, thanks to its acquisition of the DEXMA smart energy platform in 2020. The DEXMA solution leverages AI to optimize energy performance on a proactive and continuous basis. Portfolio and building managers can use the platform to track and analyse building performance, including comparing buildings with similar buildings in the Spacewell database and scoring them to identify improvements. The solution also provides recommendations for potential savings, with financial projections of these actions and implementation details. The solution offers a robust measuring and verification tool to enable tracking of energy management projects and has extensive reporting capabilities. Users can build templates to automatically send to different stakeholders, such as executives, portfolio managers and investors.

- **Workplace services.**
  Spacewell scores a market-leading 2.3 out of 3.0 for its workplace services functionality, reflecting both the usability and breadth of its solution. With a clean and intuitive user interface (UI), the Workplace app empowers building occupants to utilize a range of services. Occupants can book rooms and spaces – a feature that can be broadcast to digital signage platforms such as tablets and meeting room displays. In addition to filters for space traits, such as if a space has a projector, the app provides live floor maps and tags such as 'empty', 'quiet' or 'crowded' for spaces, to give more context. Team managers can book a zone and send notifications to other members. Occupants can also leverage the app for wayfinding of co-workers, spaces and amenities; to provide feedback through service requests, complaints and star ratings; to change environment settings, such as the shading of window blinds and room temperatures; and to order catering.

- **Space monitoring and analysis, drawing on data sets.**
  Across the vendors included in this benchmark, Spacewell offers some of the most robust capabilities to capture space data from legacy systems such as access control, building management systems (BMSs) and sensors, drawing on its rich set of application programming interfaces (APIs). Spacewell tracks real-time and historic data on space, such as occupancy and footfall, and provides dashboards with potential savings and square foot reduction opportunities. These recommendations are highly valuable to businesses looking to rationalize real estate and maximize space utilization. By combining space reduction with the associated savings, users can easily quantify the impact of actions and use this to inform their strategic decisions on space and real estate. Ameriprise used the Space Simulator tool to

optimize its Boston office, saving 30,000 square feet and $2 million a year on its lease. AXA leveraged the Space Monitor tool to demonstrate how its headquarters could shift from a 0.7 to a 0.5 desk ratio, without affecting productivity or comfort, before the business executed its redesign.

- **Support for facilities management services.**
  Thanks in part to its IWMS capabilities, Spacewell offers functionality to support facilities service providers in managing workflows for maintenance and cleaning. Leveraging its space monitoring capabilities, Spacewell's solution can correlate cleaning activity with usage, with optimized schedules sent to cleaners through the dedicated service mobile app for facilities management staff. Occupants can also submit requests through the Workplace app, which are then escalated to cleaning staff. With Spacewell's asset maintenance capabilities, work orders can be triggered and sent to field engineers through another dedicated mobile app, enabling prompt responses to faults and greater adherence to service-level agreements (SLAs).

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Spacewell could improve by:

- **Offering building security functionality.**
  Workplace and physical security technology are converging, with functionality such as access control becoming more user-centric. Spacewell's weakest area of functionality is building security; it should begin extending into this area by developing integrations with a wider range of security systems, including video surveillance and access control systems. The incorporation of the latter would allow security credentials to be accessed via the Workplace app, further centralizing and enhancing the occupant experience. By expanding its building security capabilities, Spacewell could better fulfil all the key use cases of building IoT platforms.

- **Improving asset management with the application of IoT and advanced analytics.**
  There are opportunities for Spacewell to extend its application of AI and machine learning from energy to maintenance management to provide more sophisticated recommendations on asset optimization and lifecycle management, such as when assets should be replaced and the impact of these decisions. This would help building and portfolio managers with their capital expenditure planning, going beyond the operational perspective of asset management that is currently covered.

- **Extending energy management to support ESG efforts.**
  Taking advantage of the strengths of the DEXMA offering, Spacewell provides some functionality that extends to sustainability, such as the ability to ingest utility bill data and tools to track energy consumption and emissions. Within the reports tool, users can build reports for metrics such as Scope 1 and 2 carbon emissions. There is, however, room to grow to meet the rising demand for ESG capabilities. Spacewell currently does not support functionality to collect social and governance data, and although report customization is available, there are no tools for formatting reports to standards such as CDP or GRESB. Spacewell should look to enhance its offering here to target the 47% of executives who are looking to newly invest in reporting of ESG data in the next 12 months (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences).

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Spacewell should be included on shortlists by the following buyers:

- **Large firms looking to drive new efficiencies across space.**
  With strong energy and space management capabilities, coupled with a leading occupant-facing mobile app for workplace services, Spacewell's IoT offerings are well-suited to businesses with large corporate real estate portfolios, such as firms in business and financial services. In particular, as firms return to the office, they will be keen to optimize their space usage, as well as to provide tailored cleaning based on this usage. Spacewell already has a strong set of customers in this space – notably, ABB, Accenture, BigBasket, Deloitte, ING and Santander – demonstrating its competency to support firms in these sectors.

- **Organizations with diverse and asset-rich portfolios.**
  Spacewell's broad capabilities can also support businesses with dispersed portfolios or a variety of building types, such as educational campuses, hospitals, hotels and retail firms. Firms in these spaces can support various stakeholders in the building management process through Spacewell's web and mobile offerings. Once again, Spacewell has a strong set of existing customers in these spaces, including AZMM Hospital, Carrefour, Homebase, the Polytechnic University of Catalonia, Primark, Radisson, Travelodge and the University of Westminster.

- **Facilities management providers.**
  Forty-eight per cent of executives consider getting more value out of facilities contractors as a high priority in the next 12 months (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences). With its facilities management capabilities for maintenance and cleaning, including dedicated mobile apps for field engineers and cleaning staff, Spacewell's offering can support facilities management firms with the optimization of their service provision. The smart cleaning use case is especially pertinent as businesses look to optimize hygiene processes as offices become busier.

Spica Technologies Delivers An Enhanced Occupant Experience Through Smart Cleaning And Mobile Services

Established in 2015 and based in the UK, Spica Technologies is a specialist Internet of Things (IoT) solutions provider. It offers the GemEx Engine platform (previously called Devicepoint), which provides functionality for workspace management, environment monitoring, smart cleaning and healthy water monitoring. Spica also offers the Luna mobile application for building occupants. The platform ingests data from IoT sensors as well as external systems such as IBM TRIRIGA, Kontent and Office 365 and delivers analytics and insights to support building processes. Spica also provides its own hardware for legionella monitoring as part of its healthy water offering.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Spica Technologies has strengths in:

- **Space monitoring and analysis.**
  Leveraging IoT sensor data from the integration partnerships that Spica has with the likes of Haltian, PointGrab and Yanzi, the GemEx Engine provides real-time data on occupancy and footfall, with users empowered to build alerts to manage overcrowding, for example. The ability to configure spaces with categorizations and specific traits means that key metrics can be tracked at a granular level across different types of spaces. Other tracking use cases are washroom visits and canteen queues. Data on footfall can be broadcast to kiosks and television screens, to inform occupants. The GemEx Engine also provides analytics around space utilization, such as trend data and reports on usage of different types of workspaces. These insights help firms with strategic elements of space management, such as real estate right-sizing and space redesigns.

- **Workplace services, primarily delivered through the Luna mobile app.**
  Spica's offering performed well for workplace services in our study, scoring 1.9/3.0, significantly higher than the average of 1.3/3.0. The GemEx Engine offers a reservation system that supports not just desks and meeting rooms, but other types of spaces, such as lockers, parking and showers. If a firm already has a reservation system, GemEx can integrate with that solution and augment it by enabling the booking of spaces that are not covered, such as lockers. The Luna app also offers wayfinding of spaces and people; a food and beverage module that supports ordering and payment; content integrations that allow for targeted employee communications; and tools for employees to submit feedback – all of which contribute to an enhanced occupant experience.

- **Smart cleaning work orders and mobile apps.**
  Through the GemEx platform, building or facilities managers can configure smart cleaning alarms, leveraging data on space utilization to indicate when a work order should be triggered to clean a space or desk. The scope of these alarms can be changed to apply to different granularities, such as buildings or spaces. Once an alarm is triggered, the relevant parties will be notified, such as by a cleaner seeing a work order on their tablet screen. This helps direct cleaning services in a prompt and measured manner for more effective cleaning. Cleaners can close off actions or provide feedback, adding to a full audit trail to which building managers have access.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Spica Technologies could improve by:

- **Offering connectivity to more diverse data sources such as BMSs and HVAC systems.**
  Although Spica offers comprehensive functionality to aggregate sensor data, the GemEx platform currently fails to connect to other key sources of building data, such as energy meters, building management systems (BMSs) and HVAC equipment. Spica should consider expanding its connectivity capabilities to extract data from these systems, which customers often have in place, to help produce insights with greater context that combine a wider range of datasets. This would be especially useful in expanding functionality around healthy buildings to contribute to occupant health and wellbeing – a key use case for firms looking to encourage employees back into the office. Spica currently services this use case through retrofitting IoT.

- **Enhancing the occupant experience through access control and visitor management.**
  The GemEx platform and Luna app provide a host of capabilities around occupant experience, which could be enhanced by a greater focus on access control and visitor management. The Luna app can integrate with access control systems, but fails to capture any data, whilst visitor management is currently under development. Developing these solutions would complement the existing set of workplace service capabilities provided and deliver more consistency, with occupants experiencing all aspects of the user journey, such as parking, access control, booking and food ordering, through one mobile app.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Spica Technologies should be included on shortlists by the following buyers:

- **Facilities service providers targeting smart cleaning.**
  Facilities managers looking to deliver more efficient cleaning should consider Spica's offering. Facilities managers can configure rules to trigger cleaning work orders based on IoT data and can track tasks until completion, delivering more efficient and targeted services. On top of offering its own work order management system for these actions, Spica integrates with third-party work order management systems IBM TRIRIGA and Jira (from Atlassian). Spica is seeing demand from both facilities managers and from businesses mandating the Spica solution to their facilities managers. This can provide large firms and facilities management organizations with a consistent experience across sites or customers. For example, ISS is using Spica's smart cleaning solution across 18 clients in Norway.

- **Firms pursuing an enhanced user journey.**
  On the occupant side, the Luna app and GemEx Engine provide a range of workplace functionality that supports a modern workplace experience. With the ability to white-label the Luna app, organizations can have their own branded mobile app, allowing occupants to access a range of building amenities and services in one location. Integration with client catering systems and digital wallets, the opportunity to book different types of spaces such as parking and showers, and the functionality for wayfinding all contribute to a highly modernized experience that facilitates a seamless occupant journey.

- **Businesses encouraging employees back to the office.**
  The enhanced occupant experience delivered by the Luna app also supports firms looking to return to the office. The mobile approach to workplace services appeases employees who are keen to reduce touchpoints, whilst information on footfall, which can be broadcast to kiosks and television screens, helps employees self-regulate social distancing and overcrowding, such as avoiding the canteen at busy

periods. Spica's solution also allows targeted communications and empowers occupants to provide feedback, which can be converted into work orders for smart cleaning, helping instil greater confidence amongst the workforce. Reporting on reservations can also be leveraged for contact tracing efforts.

Switch Automation Brings Data Connectivity Strengths To Facilitate Digitization

Founded in 2012 and headquartered in Denver, Switch Automation offers an Internet of Things (IoT) platform that aggregates building data from systems and equipment to deliver analytics and insights into building and portfolio performance. The offering comprises two major components – the Switch Dx^3 solution, used for system connectivity and assessment of digital readiness; and the Switch Digital Layer, which underpins the Switch Platform and utilizes real-time data to monitor and manage building performance. Switch Automation received $5 million in funding in April 2020, led by Hong Kong private equity fund Gaw Capital, to support its growth in the Asian market. Its customer base covers organizations with large commercial portfolios across industries such as commercial real estate and financial services.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Switch Automation has strengths in:

- **Data connectivity capabilities.**
  One of the standout features of the Switch Automation offering is its data capture capabilities, for which it scores 2.1/3.0 against an average of 1.7/3.0. Connectivity to devices is achieved either through Switch Automation building system drivers, application programming interfaces (APIs) or file transfers. The vendor also offers Switch Dx^3, an IoT software solution that connects and integrates with existing building systems such as building management systems (BMSs), HVAC equipment, lighting, metering, cameras and access control. The user receives a Digital Readiness Score, demonstrating system connectivity, data quality, network integrity and overall digital maturity. As part of this digital connectivity and audit process, Switch Automation enforces strong tagging conventions in line with the Brick schema.

- **Asset management and monitoring, powered by FDD.**
  The Switch platform offers a Smart Alerts module, which delivers fault detection and diagnostics (FDD) capabilities using rules-based logic and predictive modelling. Once systems are brought into the Switch platform and tagged, they are given an equipment health score, which helps identify degrading devices. Whilst rules-based alerts compare multiple sensor readings in real time and apply logic to identify performance anomalies, alerts that rely on predictive modelling evaluate real-time performance of a system against regression predictions of how that system should perform, accounting for factors such as time of day and average temperature. These FDD insights help building managers get on top of maintenance issues before they cause disruption, by directing targeted interventions.

- **Benchmarking of energy performance.**
  The Switch platform empowers building and portfolio managers to track the energy performance of their estates. In addition to the ingestion of utility bill data, the solution offers energy trend analysis, tracking of energy management projects and energy reporting, including integrations with ENERGY STAR Portfolio Manager and the NABERS rating engine for Australia and New Zealand. The solution also extensively supports benchmarking, drawing on integrations with existing frameworks such as ENERGY STAR and NABERS. This enables users to view which sites are performing poorly against industry standards. Firms can also create their own custom benchmark metrics and apply normalization for factors such as weather or occupancy when collecting data and performing analytics on these metrics.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Switch Automation could improve by:

- **Enhancing comfort in its health and wellbeing functionality.**
  While firms can leverage the Switch Platform to monitor indoor environmental conditions, drawing on sensor and system data, the platform does not accommodate employee feedback or enable occupants to control conditions themselves through a mobile application, limiting the maximum comfort that can be achieved. To enhance its health and wellbeing capabilities, Switch Automation should consider enabling more occupant input into comfort controls.

- **Offering strategic insights on space management utilization.**
  Switch Automation's current space management offering revolves around real-time tracking of space occupancy, as well as some functionality in calculating dwell times and occupancy trends. Verdantix believes that the provider can improve its space management proposition by leveraging these data for out-of-the-box tools that provide more information on space usage, to drive strategy. Some of these use cases are currently possible, but require users to create reports. Analytics and reports on long-term space and desk utilization trends can help direct real estate decisions, particularly as employees return to the office following COVID-19, whilst dwell time analytics can help space redesigns and optimizations.

- **Expanding mobile capabilities for building users.**
  The Switch mobile application is primarily designed for facilities managers, who use it to view asset data and manage faults. There is scope for the supplier to expand its native mobile app functionality to support other use cases and stakeholders, such as portfolio managers tracking the energy performance of their portfolios or building occupants looking to monitor environment conditions and provide feedback on comfort controls. The latter would help customers more proactively improve their occupants' health and wellbeing – the second most important strategic objective amongst real estate executives for the next three years (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences).

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Switch Automation should be included on shortlists by the following buyers:

- **Firms beginning their digitization journeys.**
  Businesses looking to digitize their buildings or portfolios should consider Switch Automation and its Dx^3 solution as a good way to assess digital readiness. The solution enables business executives to understand the scope of work required to successfully digitize, as well as indicating where network vulnerabilities and poorly performing systems reside. Firms can then make a much more informed decision on whether to pursue digitization, and what steps may be required.

- **Organizations pursuing energy improvement strategies.**
  Firms with strong energy management ambitions should consider the Switch Platform, which can provide a range of capabilities, from energy consumption trend analysis to performance benchmarking. The platform also supports project tracking, allowing firms to leverage the solution to track the progress of energy or sustainability projects against goals. Savings (both cost and energy) are demonstrated by comparing performance against weather-normalized predictive models.

- **Businesses with high concentrations of commercial real estate.**
  Switch Automation's commercial success with the Switch Platform offering has centred around commercial real estate portfolios and bank branches. Firms with high volumes of commercial real estate, including real estate investment trusts (REITs) that manage or hold commercial offices, and which are seeking a proven IoT platform, should review Switch. These organizations, as well as banks, could use Switch Automation to support their digitization strategies, offering functionality around asset and energy management, as well as increasing capabilities around space management and occupant health and wellbeing.

Thing Technologies Delivers A Modern Tenant Experience Through Its Mobile Application

Founded in 2016 and headquartered in Germany, Thing Technologies provides a smart building management platform that digitizes building processes for building managers and offers end-user functionality to building occupants through the Thing-it mobile application. Working exclusively with customers in Europe, Thing Technologies rolled out its first project in 2019; it now boasts over 50 customers and saw annual revenues double in 2020. As part of its data connectivity approach, Thing Technologies has developed connectors for more than 50 sensors, enabling data from these devices to stream into the Thing-it platform. Thing Technologies also offers its workplace apps on a standalone basis, allowing firms to implement them on top of third-party cloud platforms such as AWS IoT Greengrass or Siemens's MindSphere.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that Thing Technologies has strengths in:

- **Configuration of business rules.**
  The Thing-it platform allows users to easily configure business rules to set up alerts that support the more proactive management of facilities. Users can aggregate building Internet of Things (IoT) and sensor data into business metrics and apply simple thresholds or more complex logic as trigger events. Some of these more complex rules can leverage AI as a neural network for the correct execution of events. For example, the Thing-it platform learns patterns around occupancy and combines these with weather data to predict when the first individual will enter a building or space, automatically controlling the HVAC system based on this analysis. This use case, driven by a highly flexible rule configuration capability, delivers intelligent automation to a previously manual process.

- **Space and occupancy monitoring.**
  The Thing-it platform offers space monitoring and analysis functionality, leveraging data collected through bookings and from sensors such as people-counting and passive infrared devices. The platform aggregates these data into building dashboards that provide in-depth data on metrics such as occupancy, bookings and duration of use, as well as into heat maps, to visualize usage. The solution also offers a desk arrangement tool, which users can combine with the insights to support their desk planning and design efforts. A large number of Thing Technologies clients leverage its space monitoring and analysis capabilities, including Drees & Sommer, which used the platform to analyse booking patterns at 30 locations, leveraging data from more than 3,000 employees using the mobile app (see Verdantix Thing Technologies Offers An Adaptive Building Operating Platform For Real Estate Portfolios).

- **Facilities management processes around cleaning.**
  Combining rule configuration and space monitoring capabilities, the Thing-it platform also supports demand-driven facilities management processes. As Verdantix saw in a software demonstration, maintenance rules can easily be built into the platform for managing the connectivity of sensors, and both building occupants and services can use the mobile app to submit faults or complaints. Users can also leverage utilization data, such as desk occupancy, to trigger cleaning work orders, allowing for smarter cleaning based on usage. Thing Technologies is also piloting a dedicated application with Siemens to facilitate cleaning services by enabling cleaners to scan barcodes and receive a list of nearby cleaning tasks.

- **Occupant experience.**
  The Thing-it mobile app enables building occupants to access a range of workplace services, with the vendor scoring 2.0/3.0 against an average of 1.3/3.0 for this capability. Through the mobile app, occupants can book resources such as desks, rooms, lockers and parking, as well as perform wayfinding, purchase items in integrated stores and provide feedback on faults. The app also integrates with access control systems, allowing security credentials to be pushed through the platform. The mobile app has an intuitive and clean user interface (UI), which is easy to navigate and contributes to a highly modern building occupant experience, where employees can access many workplace services through their personal mobile devices.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that Thing Technologies could improve on:

- **Reporting capabilities for senior business executives.**
  Although Thing Technologies already offers reporting dashboards summarizing space utilization trends aimed at building managers, there is limited functionality to produce reports around these metrics that could be sent to other stakeholders, such as investors or executives, or leveraged to support more strategic elements of building management portfolio right-sizing. Thing Technologies should look to expand its reporting capabilities across different applications.

- **Functionality around occupant health and wellbeing.**
  Given Thing Technologies' comprehensive functionality to support occupant experience, there are opportunities for it to extend its platform further across occupant health and wellbeing. There is, for example, minimal focus on helping firms track building comfort metrics, which is becoming an increasingly commonplace offering from other IoT platform vendors. Thing Technologies should consider developing a comfort rating framework for buildings, to help landlords and corporate facilities managers get an insight into potential occupant problems before complaints arise.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that Thing Technologies should be included on shortlists by the following buyers:

- **Businesses seeking to deliver an enhanced tenant experience.**
  Organizations looking for a highly modernized occupant experience should consider deploying the Thing-it mobile app to deliver workplace services to occupants through their personal devices. By centralizing a range of workplace capabilities in one app, businesses can give their employees a smooth user journey. Many of Thing Technologies' customers, such as Adidas, ASML and Deloitte, already employ this solution. A mixed-use building in Berlin with 944 units is also leveraging the app across almost 300,000 square feet.

- **Enterprise firms targeting the digitization of workplace management processes.**
  Large enterprise firms should consider Thing Technologies for multi-site rollouts, to digitize portfolio management processes such as asset monitoring, facilities management and space monitoring. These firms can rely on Thing Technologies, as well as its technology partnerships, to bring a data-centric approach to these processes, thereby modernizing their buildings. A Big Four consulting firm is deploying the Thing-it platform at one of its main offices in Düsseldorf, with intentions to cover more than 20,000 square feet. The firm eventually plans to extend Thing Technologies across its global portfolio.

- **Facilities service providers focusing on smart cleaning.**
  Facilities management firms could use the Thing-it platform to complement their work order management tools and direct cleaning service based on utilization data, rather than pursuing traditional cleaning schedules. By doing so, these firms would help to instil greater confidence in workplace safety, whilst also reducing inefficiencies in the services process. We anticipate growing demand for this proposition as facilities management services firms make labour-intensive cleaning services the next focal point of their digitization programmes.

ThoughtWire Exploits Digital Twin And AI Capabilities For Asset Management And Comfort Controls

Headquartered in Toronto, Canada, and founded in 2009, ThoughtWire provides digital twin software for smart hospitals, smart buildings and smart cities. Underpinning the ThoughtWire Digital Twin is a semantic graph database that captures real-time data from building systems, IT systems, Internet of Things (IoT) devices, people and workflows, as well as external data. ThoughtWire's solution is deployed at over 450 locations, with its customers largely based in North America. The vendor has formal partnerships with a range of software and hardware vendors, including Schneider Electric, with which it developed a joint digital facilities solution for healthcare.

Strengths And Differentiators

Based on the Green Quadrant analysis, Verdantix finds that ThoughtWire has strengths in:

- **Energy and comfort management.**
  Using the ThoughtWireOS platform, building managers can track energy consumption at different granularities, ranging from buildings to floors and individual rooms. For buildings or portfolios with multiple tenants, this enables users to track the energy consumption of each renter, as well as other metrics, such as collected rent, late payments, water usage and maintenance tickets. The platform also tracks complaints submitted against tenants or units, and provides unit, tenant and utilities scores, for individual tenants or aggregated. These scores enable building managers to quickly identify 'good' and 'bad' tenants. The platform also provides visualizations of a building, making it easy to locate tenants there.

- **Predictive maintenance, leveraging FDD and digital twins.**
  ThoughtWire's asset monitoring and maintenance functionality draws on the power of its digital twin platform to provide predictive maintenance insights. Accompanied by visualizations of systems, such as HVAC units, the platform monitors the real-time performance of devices and compares this with optimal operating ranges. The anomaly detection feature leverages historical data on equipment performance and defects to automate fault detection and diagnostics (FDD) and predict failures ahead of time. This feature can be triggered by even minor deviations in performance that match past defect criteria. The platform generates work orders, which are routed to relevant teams for resolution via a third-party work order management tool, such as a computerized maintenance management system (CMMS) or computer-aided facility management (CAFM) solution, such as Angus Systems's Angus AnyWhere CMMS. The platform also employs machine learning to develop typical operating profiles for assets, improving its analysis for the future.

- **Mobile-driven workplace services.**
  Via the @WorkApp mobile application, ThoughtWire offers customers an intuitive and well-designed tool to deliver workplace applications. The app supports a range of services, such as reservation of spaces, rooms, desks, lockers and electric vehicle charging stations. Building occupants can also use the app for wayfinding, providing feedback, submitting maintenance and cleaning tickets and accessing third-party services such as ordering food or scheduling yoga classes. In addition, the app allows building managers to communicate with occupants, leveraging location-based data where required to send relevant push notifications for features such as emergency notifications and emergency check-in following incidents.

- **Advanced occupant control of building systems.**
  Building occupants can use the @WorkApp tool to control comfort settings in shared spaces, meeting rooms and private spaces, managing temperature through HVAC units, and lighting. ThoughtWire's offering also includes @Work AI for Comfort. AI for Comfort is a machine-learning-enabled tool that determines optimal comfort based on a set of contextual factors such as occupancy, individual preference, weather and historical data. Based on these factors, comfort settings automatically adjust to the most optimal level, diminishing the need for occupants to manually compete to find the right conditions.

Improvement Opportunities

Based on the Green Quadrant analysis, Verdantix finds that ThoughtWire could improve by:

- **Expanding its building security functionality.**
  There is scope for ThoughtWire to expand its building security capabilities through more integrations with access control solutions, to allow mobile credentials to be moved into the @WorkApp. Although ThoughtWire does integrate with video surveillance systems, the incorporation of these into the ThoughtWireOS platform is limited; there is an opportunity for the vendor to build out its security offering and combine its digital twin capabilities with security to optimize security team workflows.

- **Developing its energy management capabilities.**
  Although the ThoughtWireOS platform provides a strong energy monitoring capability, the solution is lacking in other areas of energy management, which is why it scores just 1.4 overall in this area of our assessment. Functionality around tracking and energy management projects is light, with little emphasis on energy reporting. With 47% of firms looking to newly invest in tools to support the reporting of building ESG data to stakeholders and investors in the next 12 months, ThoughtWire should develop its energy reporting capabilities, which in turn will feed into the establishment of ESG-related tools and functionality (see Verdantix Global Corporate Survey 2021: Smart Building Technology Budgets, Priorities & Preferences).

- **Supporting capital expenditure planning for maintenance.**
  The ThoughtWire platform provides a business intelligence layer to visualize data, including tracking the total cost of ownership for assets. However, although the historical energy consumption of a device can be compared with the expected consumption of a new system, this modelling is currently limited. Building and facilities managers desire as much information as possible when making capital expenditure decisions, and there is room for ThoughtWire to develop its predictive capabilities to model the impact of different capital expenditure decisions. This tool would help facilities managers build strong business cases for capital decisions and effectively prioritize new investment.

Selection Advice For Buyers

Considering all supplier offerings assessed in the Green Quadrant analysis, we believe that ThoughtWire should be included on shortlists by the following buyers:

- **Organizations within healthcare seeking a proven building IoT platform.**
  ThoughtWire already has a significant presence in the medical and healthcare sector, serving over 430 healthcare locations, for firms such as Hamilton Health Sciences, Humber River Hospital and William Osler Health System. Organizations in this industry should strongly consider using ThoughtWire's offering to deliver key use cases such as asset monitoring and management, asset tracking, storage compliance monitoring and condition management.

- **Landlords of residential and commercial real estate.**
  Building owners who are renting spaces to tenants should consider the ThoughtWire solution. For commercial real estate locations, the ThoughtWireOS platform enables building managers to stay on top of asset maintenance, as well as closely monitor the tenant and utility scores of different renters. This information can help building owners relay key information around factors such as energy consumption to tenants, but also identifies which tenants are the most profitable and least disruptive – invaluable information during contract and renewal discussions. Owners of real estate with shared or co-working spaces could benefit significantly from this capability.

- **Firms pursuing an enhanced end-user experience.**
  Organizations looking to offer building occupants workplace services through a mobile app should consider selecting the @WorkApp. In addition to supporting reservations, wayfinding and feedback, its integration with amenity solutions helps deliver a more complete workplace experience. Through the app, users have the ability to change lighting and temperature for spaces or rooms, allowing them to manage conditions to their preferences via their own mobile devices. This is particularly helpful for firms looking to encourage a return to the office, as employees will be able to achieve comfort levels that match those they have when working remotely.

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WHY VERDANTIX?

Verdantix is an independent research and advisory firm with expertise in digital strategies for **Environment, Health & Safety, ESG & Sustainability, Operational Excellence** and **Smart Buildings**. Our mission is to anticipate the insights and data that our clients need so you can succeed with growth strategies, invest wisely and optimize performance.

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