VERDANTIX

VERDANTIX.COM

Market Overview: Building Technology For Life Sciences Facilities

SEPTEMBER 2021

BY BENJAMIN HEXT
WITH SUSAN CLARKE

SMART BUILDINGS

Market Overview: Building Technology For Life Sciences Facilities

Business expansion plans and growing environmental, social and governance (ESG) pressures are driving life sciences firms to invest in their facilities infrastructure and refresh their building technology strategies. This report provides facilities executives in the life sciences sector with an overview of the evolving landscape of technology solutions for building control, air quality management and energy efficiency. The research finds that recent technology innovation is helping firms use ventilation systems more efficiently, capture more granular data on space and equipment utilization, and run workplaces more flexibly. Heads of facilities and workplace at life sciences organizations should use this report to inform their technology roadmaps for 2021 and beyond.

TABLE OF CONTENTS

TABLE OF FIGURES

ORGANIZATIONS MENTIONED

ABB, Accruent, Agristo, Aircuity, Amazon Web Services (AWS), AstraZeneca, Automated Logic, Bain Capital Real Estate, BioNTech, Blackstone, Boston Properties, Briem Steuerungstechnik, Carrier, CBRE, CrystecPharma, Cytiva, Develco Pharma, DEXMA, Eaton, EcoEnergy Insights, Emerson, Energisme, ENERGY STAR, ENGIE, Envizi, eSight Energy, Fiix Software, FM:Systems, Food and Drug Administration (FDA), Fresenius Kabi Oncology, G-CON, GlaxoSmithKline, Guangzhou Biopark, Honeywell, IBM, iOFFICE, Jackson Laboratory, Johnson & Johnson, Johnson

Controls, Kieback&Peter, Lonza, Mataura Valley Milk, Merck, Merrill, National Renewable Energy Laboratory, Neuberger Gebäudeautomation, Novartis, Nuvolo, Occupational Safety and Health Administration (OSHA), Openpath, Pfizer, Phase 3 Real Estate Partners, Phoenix Controls, Planon, Precision Science, Sanofi, SAUTER, Schneider Electric, Schneider Elektronik, Siemens, Spacewell, Thermo Fisher Scientific, Thor Equities, Translate Bio, Triatek, TROX, UL, Ultimo, University of California, University of Nottingham, Ventas, Vertex Pharmaceuticals, WALDNER, Yili Group.

Market Overview: Building Technology For Life Sciences Facilities

This report provides an overview of the evolving landscape of building technology solutions for the life sciences sector. For this study, we conducted interviews with technology executives from Carrier, Honeywell, Johnson Controls, Nuvolo, Phoenix Controls, SAUTER, Schneider Electric, Siemens and WALDNER. We also interviewed 30 customers of building technologies within the life sciences industry in roles such as engineering, facilities and sustainability. Heads of facilities and workplace at life sciences organizations should use this report to inform their technology roadmaps for 2021 and beyond.

The life sciences industry covers a vast range of sub-sectors, such as pharmaceuticals, biotechnology, chemicals, healthcare and food and beverage. This report focuses on building technologies for research environments, such as biocontainment rooms, cleanrooms and labs (see **Figure 1**). We have excluded technologies used in large-scale manufacturing facilities, which we cover in separate research (see Verdantix Smart Innovators: Digital Twins For Industrial Facilities; and Verdantix Smart Innovators: Maintenance Analytics For Heavy Asset Industries).

The Global Pandemic Is Fuelling A New Phase Of Growth For The Life Sciences Sector

The life sciences industry has received considerable attention over the last 18 months as a result of the COVID-19 pandemic. Multiple life sciences firms have dedicated significant resources to developing equipment, treatments and vaccines to help deal with the disease and have been supported by extensive funds from governments and investors. Over the past year:

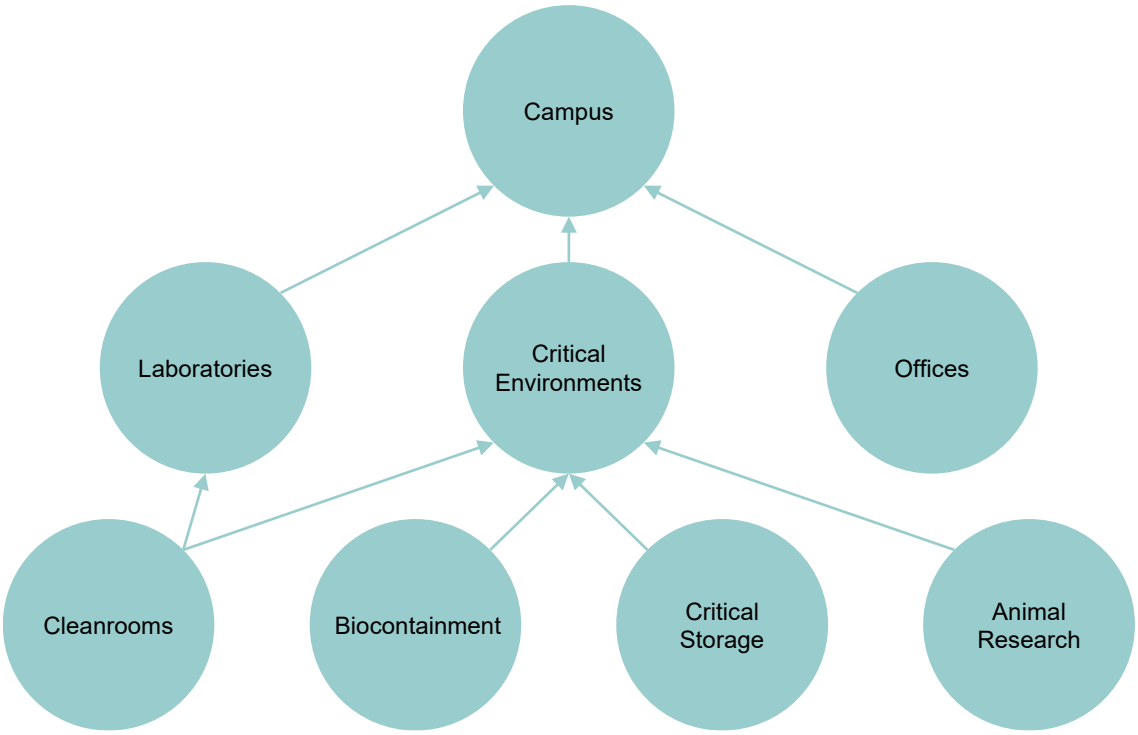
- **Pharmaceuticals firms have taken a central role in COVID-19 vaccine programmes.** The life sciences sector has played a pivotal role in the development and manufacture of COVID-19 vaccines. In mid-2020 there were 320 medicines in various stages of development by organizations such as AstraZeneca, Merck and Translate Bio. Firms were forced to rapidly scale up capabilities to manufacture COVID-19 vaccines, often sharing their facilities and resources with traditional competitors. Witness Sanofi providing BioNTech with access to its infrastructure and expertise to help it manufacture over 125 million doses of its COVID-19 vaccine.

- **Demand for cold chains has grown dramatically to aid the vaccine rollout.** The global COVID-19 vaccine rollout has driven a massive interest in the visibility and expansion of capacity in the cold chain – the system of infrastructure and transport that enables a vaccine to move from production to its final destination whilst remaining at the appropriate temperature. For example, in 2020 Thermo Fisher Scientific opened a new 120,000-square-feet manufacturing facility in Kansas, to meet the increasing demand for viral transport media being used in COVID-19 programmes in the US. In 2020 Carrier announced a multi-year agreement with Amazon Web Services (AWS) to co-develop the new Lynx digital platform, which supports enhanced visibility and actionable intelligence across cold chain operations for temperature-sensitive cargo, including food, medicine and vaccines.

- **Life sciences firms have expanded office footprints in strategic centres.** While many firms across the financial and business services sector shrunk their real estate footprint amidst COVID-19, the life sciences sector bucked this trend in 2020. According to CBRE's research on New York City, the life sciences sector took on its highest volume of leased space since 2011 because of the pandemic, with new venture capital (VC) funding flowing into the sector. CBRE also tracked a boom in demand for office leasing during 2020 from life sciences firms across Bangalore, Beijing, Hyderabad, Shanghai and Tokyo.

FIGURE 1

Life Sciences Research Infrastructure: Domain Types



Source: Verdantix

- **Real estate investors have poured funding into laboratories and research space.** In a struggling commercial real estate sector, investors have shown significant interest in the scientific research space. In October 2020, Blackstone raised $7.5 billion for a new life sciences office real estate perpetual fund, and a fund managed by Ventas acquired a $1 billion life sciences laboratory portfolio from Bain Capital Real Estate and Phase 3 Real Estate Partners. In July 2021, Boston Properties announced that it would acquire an aging office campus in Rockville, Maryland, to convert into Class A laboratory space, to meet the growing demand for life sciences facilities.

Long-Term Strategic Goals Centre On Driving Expansion In Emerging Markets And Enhancing Sustainability Performance

In 2020 the life sciences sector played a pivotal role in the development and manufacture of COVID-19 vaccines. Looking beyond the pandemic, what are the key strategic goals towards which life sciences organizations are working? To remain competitive and drive long-term growth, life sciences firms are:

- **Expanding market reach and opening production facilities abroad.** European- and US-headquartered life sciences firms are looking to open new facilities in Asia and Australasia, to access new markets with large populations and to cut operational costs. To attract life sciences firms to their countries, governments in Australia, China, India, Japan and Singapore are offering financial incentives to firms, such as relocation costs, research grants, start-up funding, subsidies and tax breaks. In November 2019, UK-headquartered AstraZeneca announced the opening of a new global R&D centre in Shanghai, China. In March 2021, UK-headquartered CrystecPharma declared the opening of a new R&D centre in Haimen City, China.

"We are expanding quickly into China from Europe. If we want to expand to a new region, we will set up a new facility." (Pharmaceuticals, China)

- **Optimizing the operations of existing brownfield sites.**
  Life sciences facilities are highly regulated and complex, making them expensive to design and build, due to the inclusion of multiple domain types, such as critical environments, laboratories and offices. It is therefore not financially viable to rely on greenfield development to support upgrade plans. Instead, life sciences firms are using facility upgrades to reduce research timelines, remain efficient and adhere to regulations. Another trend is the conversion of offices to lab spaces. Thor Equities repurposed the 95 Greene Street building in New Jersey used by banking firm Merrill (previously Merrill Lynch) into a multi-tenant life sciences building, bringing in enhanced ventilation systems and service elevators.

  "We are currently completing renovation of our laboratory facilities, which is a major capital project. We are using this renovation opportunity to create more efficient lab processes, analysis and product development." (Chemicals, US)

- **Meeting the sustainability demands of major stakeholders.**
  Life sciences facilities are very energy-intensive, given their high use of HVAC systems, and as a result, they are under pressure from investors, customers, employees and regulators to reduce carbon emissions. In March 2021, the UK announced an industrial decarbonization strategy, pushing net-zero targets for various industry sectors, including pharmaceuticals. GlaxoSmithKline, for example, has reduced carbon emissions by 34% since 2010 and aims to reach net-zero carbon emissions across Scopes 1, 2 and 3 by 2030. Due to the energy intensity of laboratories and cleanrooms, small gains in efficiency can offer significant energy savings, cutting both costs and carbon emissions.

  "Our CEO is very environmentally conscious, so our leadership on sustainability comes from the top. In some sites we have 100% renewable energy sources. We also are looking at other aspects like packaging and waste production." (Pharmaceuticals, UK)

- **Accelerating construction times and regulatory approval of new facilities.**
  Designing, building and commissioning new life sciences facilities is traditionally a five-plus year affair, hindering firms that need to rapidly open new research or manufacturing plants. In our interviews with engineering executives in the pharmaceuticals industry, we heard that the pace of change in the sector is pushing firms to shorten the construction timeframe from five years to 18 months. Firms are turning to new construction technologies such as building information modelling (BIM), prefabrication and modular/podular environments to compress build times. In January 2021, life sciences technology firm Cytiva finished installing a modular biologics factory in the Guangzhou Biopark for Lonza, a global chemicals manufacturer. The 17,000-square-metre site took less than two years to complete, from site selection to handover.

  "We are moving towards prefabricated solutions. The cleanroom is planned out and wall panels are fabricated off site. Once on site, it goes up very quickly." (Engineering and Consulting, US)

Life Sciences Firms Turn To Building Technology To Drive Cost Savings Across Expensive Regulated Environments

In a new era of growth, life sciences firms must refine their real estate and facilities strategies to support expansion plans and growing environment, social and governance (ESG) expectations. To achieve their goals, firms need to invest in their infrastructure. This will allow them to:

- **Reduce energy expenditure, cutting costs and reducing carbon footprints.**
  Life sciences facilities are moderately large consumers of energy, with laboratories typically consuming over twice the energy used by a standard office on a square foot basis, according to ENERGY STAR. These sites require energy-intensive HVAC systems to maintain a safe and compliant atmosphere and often include power-demanding equipment, such as extreme temperature refrigeration. As a result, firms need to consider control systems that drive the more efficient use of assets, as even small efficiency gains can reap significant cost savings through reduced energy usage. Life sciences firms are also under increasing pressure to improve their sustainability credentials and to cut carbon emissions.

- **Optimize regulated space and equipment usage, boosting employee productivity.**
  Laboratory spaces and equipment are expensive to build, run and maintain. Therefore, it is essential for life sciences firms to fully optimize the use of these resources by employees to maximize productivity. Colorado's National Renewable Energy Laboratory recommends that lab owners conduct thorough space planning and management to reduce the build and run costs for laboratories. A growing number of firms are using specialist software to optimize space usage, replan space and understand usage analytics (see Verdantix Market Size And Forecast: Space And Workplace Management Software 2020-2026 (Global)).

- **Ensure regulatory compliance of facilities across multiple regions with a clear audit trail.**
  Life sciences firms that want to expand their global footprints are faced with the challenge of navigating varying legislative restrictions while producing high-quality, consistent products. China, the European Economic Area (EEA), India, Russia and the US all have separate regulatory bodies maintaining different standards for products such as pharmaceuticals and chemicals. It is therefore critical that firms implement clear audit trails across their research and manufacturing facilities to remain compliant and avoid penalization. In February 2021, Indian drug manufacturer Fresenius Kabi Oncology pleaded guilty and was fined $50 million by the US Food and Drug Administration (FDA) for failing to provide the correct documentation at one of its manufacturing facilities. In 2018, the second most common compliance issue observed by the FDA was for below-spec laboratory controls that failed to provide accurate and trustworthy lab data.

- **Adapt specialized facilities to meet fast-changing scientific requirements.**
  Life sciences firms need to quickly adapt their facilities for new purposes, such as by converting offices into laboratory space or upgrading cleanroom classification. One strategy that firms are pursuing is making buildings flexible, with modular rooms and furniture that can be moved and installed easily, and futureproofed infrastructure such as upgradable building management systems (BMSs) and HVAC systems. Merck installed modular, flexible cleanrooms by G-CON at its new $300 million FLEx centre in the US. The cleanrooms can be set up in multiple configurations to meet various use cases, from formulation and development to manufacturing.

- **Increase the reliability of critical assets to protect research and production schedules.**
  The failure of critical assets – halting production or bringing down a facility – is extremely costly to life sciences firms, both from an operational and a maintenance point of view. In addition, failures within dangerous environments can lead to severe health and safety consequences. Therefore, it is vital for life

sciences firms to run strict maintenance schedules, to prevent unprecedented facility downtime and avoid dangerous situations for staff. Firms need to consider solutions such as remote facility monitoring, maintenance management software, predictive maintenance and digital twins, to keep a close watch on their critical assets and to predict and avoid major failures and emergency maintenance costs. For example, food and beverage manufacturer Agristo deployed Ultimo's enterprise asset management (EAM) system to control its maintenance process, resulting in a 5% increase in plant uptime.

- **Maximize facility safety and security for occupant wellbeing**
  To protect sensitive information and the physical security of employees, life sciences firms are starting to implement innovations across access and security control, helping to boost occupant security in the workplace (see Verdantix Smart Innovators: Smart Workplace Technology). For example, Precision Science deployed Openpath's access control solution at its Phoenix, Arizona campus to increase system flexibility, enable touchless access and provide remote security control. Regarding employee health, firms are familiar with enhanced ventilation strategies in critical environments, such as demand response ventilation and greater air filtration, to protect staff from dangerous substances and reduce the risk of contamination. However, there will need to be a greater focus on the air quality in office space – with life sciences firms in an ideal position to transfer their knowledge of ventilation and indoor air quality (IAQ) from laboratories and critical environments to these areas.

Introducing Building Technology For Life Sciences Facilities

Business expansion and sustainability pressures are forcing life sciences firms to refresh their facility management strategies and invest in technologies that enhance the management of buildings. These technologies can help firms realize valuable business and operational benefits, such as reduced operating costs, increased resiliency and better flexibility. This section of the report provides a strategic overview of building technology solutions for life sciences research facilities and a segmentation of the key vendor categories competing. Firms should use this analysis in conjunction with the Verdantix facilities optimization technology roadmap, which analyses the investment case for a further 27 smart building technologies (see Verdantix Tech Roadmap For Facilities Optimization Technologies).

Life Sciences Research Facilities Are Complex To Design And Manage

The life sciences industry covers various sectors, such as pharmaceuticals, biotechnology, chemicals, healthcare products and food and beverage. Within research facilities – the focus of this report – these domain types can be segmented into:

- **Laboratories for research and experimentation.**
  Laboratories used for research purposes often account for 40% to 60% of a life sciences firm's real estate footprint. Such environments are subject to specific standards and regulations from organizations such as the FDA and the US Occupational Safety and Health Administration (OSHA), depending on the nature of the materials used or produced and the equipment contained within the environment. Infrastructure technologies for laboratories will focus on indoor environment controls, energy efficiency, workplace intelligence and occupant safety. Some laboratories also require increased water supply and sewerage capacity, if there is on-site production in addition to research.

- **Critical environments, to maintain highly regulated conditions.**
  Highly regulated environments are often required in the life sciences industry for domains such as biocontainment, animal research, critical storage and cleanrooms. Such areas require exact environmental control for scientific and regulatory purposes, as well as segregated air-conditioning and

exhaust systems. Building technology for critical environments will therefore focus on precise indoor environmental monitoring, specialist airflow control, air handling and treatment, access and security, and room automation.

- **Large campuses consisting of multiple domain types.**
  Life sciences firms often combine multiple domain types into large campuses, bringing numerous firms and employees together to fuel innovation and collaboration. In July 2021, GlaxoSmithKline announced plans to open a £400 million ($550 million) campus in the UK to host new life sciences firms. Infrastructure technologies for campuses will focus on energy management, energy generation and storage, maintenance, BMSs, remote monitoring and control, and automated control. Firms developing campus environments will also need to run exhaust gas studies to understand how exhaust plumes affect neighbouring areas.

- **Offices that enable increasingly agile and flexible work.**
  Modern life sciences facilities will usually include a substantial amount of office space to cater to research workers needing to conduct non-laboratory-based work and for non-research roles such as sales, marketing and finance. Infrastructure technologies for offices will focus on space management, employee engagement, energy efficiency, access control and HVAC control. The operation of office space is changing rapidly following COVID-19, as firms across all sectors adopt new flexible and hybrid working models (see Verdantix Five Best Practices For Success In The Hybrid Working Era).

Five Key Vendor Categories Converge On The Life Sciences Building Technology Market

Life sciences research facilities are complex, given their need for precise environmental control for scientific and regulatory purposes. The need for greater levels of building optimization has driven a huge amount of interest in life sciences firms amongst the building technology sector. This market is covered by a range of provider types (see **Figure 2**). The building technology providers that play into the life sciences industry can be grouped into the following segments:

- **Global building technology providers.**
  This grouping consists of incumbent building technology providers that operate across multiple technology types, such as building controls, energy management systems, Internet of Things (IoT) and operational technology (OT) platforms, safety and security systems, HVAC and ventilation systems, refrigeration systems and workplace software. Example providers are Carrier, Honeywell, Johnson Controls, Schneider Electric and Siemens, who all have dedicated offerings for life sciences customers.

- **Building controls providers.**
  This grouping consists of building technology providers that specialize in building controls systems such as BMSs, HVAC control systems and energy management systems, and operate in the life sciences market. Example providers are Automated Logic (a Carrier Company), Kieback&Peter, Neuberger Gebäudeautomation and SAUTER.

- **Air monitoring and ventilation specialists.**
  This grouping consists of providers offering specialized HVAC solutions for laboratories and critical environments, such as air-handling units, air filtration and sanitation systems, airflow controllers and HVAC control systems. Example providers are Aircuity, Phoenix Controls, Schneider Elektronik, Triatek and TROX.

FIGURE 2

The Building Technology Provider Landscape For Life Sciences Facilities

Source: Verdantix

- **Laboratory infrastructure providers offering smart building technology.**
  This grouping consists of providers that specialize in laboratory infrastructure, but which also offer smart building technology, such as room controllers and fume hood controllers. Example providers are Briem Steuerungstechnik and WALDNER.

- **CMMS and IWMS providers offering life sciences functionality.**
  This grouping consists of providers that specialize in workplace software for managing real estate assets, employee engagement, integrated services, maintenance, space usage and space planning, such as computerized maintenance management systems (CMMSs) or integrated workplace management systems (IWMSs). Example providers that offer specific functionality for life sciences are Fiix Software, iOFFICE and Nuvolo.

Building Technology Firms Offer Solutions For Precise Monitoring And Building Control

Five key vendor groups are targeting opportunities across the life sciences sector. What are the solutions categories available on the market today? The building technology market for life sciences is varied, but can be segmented into three core groups: 1) building control and management; 2) air quality management; and 3) energy efficiency (see **Figure 3**). The key building technology solutions available today are:

- **BMS modules designed for life-sciences-specific applications.**
  BMSs are commonplace in large commercial buildings. Life sciences firms need specific functionality from these systems, such as precise environmental monitoring and controls; the ability to integrate data from multiple sources, such as fume hoods and room controllers; data reporting to monitor compliance; and a

high level of cybersecurity. For example, in April 2021, Automated Logic (a Carrier company) released its WebCTRL building automation system for life sciences that enables the control of temperature, humidity, pressure and airflow in facilities, as well as document compliance with FDA 21 CFR Part 11 regulations by validating system performance through electronic records. At its Institute of BioMedical Research in Shanghai, Novartis installed SAUTER's BMS system, which has over 45,000 BACnet object connections and integrates with more than 60 other systems. Other providers of BMSs for life-sciences-specific applications are Honeywell, Johnson Controls, Neuberger Gebäudeautomation, Schneider Electric and Siemens.

- **IoT platforms that collect granular space and equipment utilization data.**
  Laboratory space and equipment is relatively expensive compared with other forms of real estate, and it is therefore important to ensure optimal utilization by staff, to avoid unnecessary expenses and to maximize productivity. IoT platforms and sensors can be used to monitor equipment and space usage, asset energy consumption, air quality, temperature, humidity and pressure, to ensure the safe and optimal use of space and equipment. Johnson Controls offers an Intelligent Laboratories solution within its OpenBlue solution. This solution is targeted towards flexible laboratory environments; it uses Bluetooth low energy beacons to collect granular data on occupant location and equipment and space utilization, to optimize layout planning, equipment location and maintenance schedules. For example, if a section of a laboratory is underutilized, the space can be repurposed, and expensive equipment moved to more suitable locations.

- **IWMS platforms that can cope with office, lab, cleanroom, campus and storage functions.**
  IWMS software is a relatively mature area of the smart buildings market, with established vendors such as Accruent, FM:Systems, IBM, iOFFICE and Planon offering comprehensive solutions for workplace management. Nuvolo has developed life-sciences-specific IWMS functionality covering equipment calibration tracking, laboratory equipment management, and maintenance management, while ensuring that firms meet FDA 21 CFR Part 11 regulations and industry quality guidelines (GxP). Vertex Pharmaceuticals deployed Nuvolo's IWMS to manage equipment maintenance in its offices and laboratories, resulting in improved technician resourcing and enhanced maintenance scheduling.

- **Employee engagement apps across multiple worker roles.**
  The last 12 months have seen a growing number of organizations, such as GlaxoSmithKline, Novartis and Pfizer, announce plans to accelerate their implementation of hybrid working strategies (see Verdantix Five Best Practices For Success In The Hybrid Working Era). Mobile apps that engage employees and enable workspace booking, space planning, visitor management, access control, occupancy management and space usage analysis across multiple domain types are key to managing hybrid activity-based working in the life sciences sector. Vertex Pharmaceuticals rolled out iOFFICE's Hummingbird workplace app at its Boston, Massachusetts HQ, which consists of office space and laboratories. The iOFFICE solution enables occupants to book office and laboratory space and equipment and facilities managers to manage and plan space.

Air Quality Specialist Vendors Are Driving Innovation Across Airflow Management And Ventilation

Building technology offerings for life sciences consist of BMS modules, IoT platforms, IWMSs and employee apps that include specific functionality to cover the varied domain types present in research facilities. Over the past 18 months, IAQ and ventilation have received renewed interest as part of the wider healthy buildings trend (see Verdantix Positioning For Growth In The Healthy Buildings Technology Market). In laboratories and critical

FIGURE 3

Overview Of Building Technology Solutions For Life Sciences Facilities

Building Control And Management	Air Quality Management	Energy Efficiency
Building automation	**Monitoring**	**Energy management**
• Occupant comfort • Room automation/control (e.g., HVAC, temperature, humidity, pressure, lighting) • Building management systems • Compliance with FDA 21 CFR Part 11 regulations • Fire safety	• Gases (CO_x, NO_x) • Volatile organic compounds • Particles and airborne contaminants • Temperature, humidity	• Demand response • Energy cost management • Energy data capture, analysis and reporting • Energy performance
Space/workplace intelligence	**Instrumentation**	**Energy generation**
• Equipment/room booking • Wayfinding • Utilization monitoring • Visualization and BIM • BI and analytics • Access control and security	• Fume hood monitoring • Auto sash closer • Air lock valves/controllers • Filter fan units controllers	• Microgrid controllers • On-site generation management • Transformers • Storage (batteries, thermal)
Facility maintenance	**Room automation**	**Power grid supply**
• Maintenance management (e.g. CMMS) • Maintenance history/database • Scheduling and tracking • Work order management	• HVAC (exhaust systems, ventilation) • Humidity control • Lighting • Pressure control	• Advanced distribution/energy management systems • Resilience of supply • Smart grid analytics

Source: Verdantix

environments, it is vital to measure and control airflow and quality to avoid health incidents and to increase the efficiency of HVAC units. Specialist air quality vendors are producing innovative solutions which life sciences firms can use for:

- **Obtaining precise environmental monitoring in hazardous areas.**
  IAQ monitoring has risen to prominence in the commercial real estate sector, due to health concerns and a fall in the price of wireless IAQ sensors (see Verdantix 10 Exciting Indoor Air Quality Technologies To Watch In 2021). However, cheaper wireless sensors are often unsuitable for hazardous areas where IAQ monitoring is critical for safety, due to limited precision and contaminant range. Aircuity offers a mechanically integrated air quality sampling system, where air packets are sent from room probes to a centralized sensor suite for testing. Unlike distributed wireless sensors, this enables easier calibration and maintenance.

- **Driving efficient demand-based use of ventilation systems.**
  Demand-controlled ventilation adjusts the air volume flow rate into buildings based on the number of people or volume of air pollutants in a space. IAQ data are a key input for HVAC control as part of a more energy-efficient, demand-based control strategy. The Jackson Laboratory for Genomic Medicine installed the Aircuity solution over approximately 42,600 square feet of its laboratory space in Connecticut, resulting in improved IAQ and annual energy savings of $80,000, with a return on investment (ROI) of three years (see Verdantix 10 Smart Building Technologies With A Measurable Financial Return).

- **Maintaining closely controlled regulated environments.**
  Regulated environments, such as laboratories and cleanrooms, require very precise airflow control to remain compliant and safe. Variable air volume (VAV) systems are used in most HVAC systems to adjust airflow to a space, but are pressure-dependent and require frequent maintenance, resulting in delayed response to static pressure changes and a propensity to falling out of calibration. Phoenix Controls, Siemens and Triatek offer Venturi valve airflow controllers, which offer very precise, mechanically pressure-independent airflow control, with fast response times to changing demands and much-reduced maintenance needs. The University of California in Irvine installed a demand-based ventilation system in its laboratory buildings from Aircuity and Phoenix Controls to improve energy efficiency and IAQ. The Aircuity sensor system monitors IAQ and adjusts airflow quickly and accurately through the Phoenix Controls valves. The University achieved energy savings of 62% and an ROI of six to eight years through improved airflow control.

- **Integrating internal laboratory airflow controls with BMSs.**
  Regulated environments such as laboratories and cleanrooms are often pressurized and contain internal airflow devices such as fume hoods or extractors. To maintain controlled conditions, such as positive air pressure, whilst using internal airflow devices, the internal control systems need to integrate with the wider building control systems. Develco Pharma wanted to ensure its production facility in Germany was fully compliant with good manufacturing practice (GMP) and good automated manufacturing practice (GAMP 5) requirements. The firm installed a Siemens integrated laboratory controls system that connected to the Desigo CC BMS. The system continuously monitors fume hood usage and adjusts room airflow via the BMS to protect precisely defined environmental conditions and remain compliant. Schneider Electric, Schneider Elektronic, TROX and WALDNER also offer integrated control solutions for fume hoods and rooms to maintain regulated environments.

Energy Management Vendors Are Offering Systems To Reduce Consumption And Enhance Power Quality

Building technology solutions for critical environments focus on monitoring and managing indoor environmental conditions to maintain safe and compliant working conditions for occupants. Life sciences firms need to decarbonize their energy-intensive facilities whilst maintaining reliable, high-quality power access. To achieve energy management goals without hindering operations, firms should consider:

- **Energy management systems for large campuses.**
  Reducing facility energy consumption and quickly gathering energy data are key focuses for life sciences firms looking to cut costs and improve their carbon footprint. A comprehensive energy management system can quickly consolidate data from multiple sources and domain types to provide real-time and historical insights into energy consumption, in order to identify inefficient areas, optimize reporting and drive improvement strategies. Yili Group, a Chinese dairy producer, installed an energy management system from Schneider Electric at multiple sites. The system monitors hundreds of sensors and meters

and has enabled Yili to reduce energy consumption by 5%. Energy management systems that cover multiple facilities and domain types are available from Eaton, EcoEnergy Insights (a Carrier company), Emerson, ENGIE, eSight Energy, Honeywell, Johnson Controls, Schneider Electric and Siemens.

- **On-site renewables generation and storage.**
  Facilities and research campuses are particularly energy-intensive and are often located in suburban areas on the outskirts of cities, where space is more plentiful and cheaper. Renewable generation and storage technologies can be cost-effective in these areas, due to the availability of space and energy requirements. Combining renewable generation, such as solar or wind, with distributed storage offers real potential to cut energy costs, provide clean back-up energy and reduce carbon footprints. For example, the GlaxoSmithKline Carbon Neutral Laboratories for Sustainable Chemistry at the University of Nottingham uses solar power and sustainable biomass generation and is projected to produce enough excess energy during operation to pay back the carbon used in its construction within 25 years.

- **High-quality power systems for business-critical operations.**
  Obtaining reliable, high-quality power is essential for life sciences firms that operate sensitive facilities, as grid outages can damage equipment and cause costly plant downtime. As a chemical plant's Head of Energy told us, "Right now, the main drivers for investment in energy technology are based on reliability; everything must be reliable." For example, food and beverage producer Mataura Valley Milk worked with Schneider Electric to increase power reliability, amongst other things, and achieved an additional 4.5% available energy on the grid and a payback of 28 months for power quality equipment.

Life Sciences Firms Must Align Digitization Programmes To ESG And Building Safety Goals

Rapid change and expansion across the life sciences sector require firms to invest in their infrastructure and refresh their building technology strategies. As smart building technology programmes can be broad in scope, facilities managers should start by prioritizing the investments that align to major strategic goals. Firms should focus on the solutions that:

- **Increase operating efficiencies for cost savings and ESG credentials.**
  The drive to achieve cost savings, partnered with the increasing pressure to cut carbon emissions, is forcing firms to consider building technology solutions that improve operating efficiencies, reduce energy consumption and clean up energy generation. Firms should consider investing in a comprehensive energy management system capable of capturing granular energy data from meters and building systems, such as software from vendors such as ABB, DEXMA (part of Spacewell), EcoEnergy Insights (a Carrier company), Energisme, Envizi, Honeywell, Schneider Electric, Siemens and UL. Notable energy savings can also be made through improvements to HVAC systems, such as demand response operation, precise flow control, and automation of controls.

- **Enhance the future of the workplace for increased productivity.**
  The COVID-19 pandemic has altered the face of the workplace, with firms moving towards a more flexible, hybrid environment for employees. With multiple life sciences firms, such as GlaxoSmithKline, Johnson & Johnson and Novartis announcing new working strategies, firms should invest in innovative workplace technologies to manage their space and maintain an engaging work culture for employees. Firms should consider IWMS and space booking software, integrated with sensors for enabling space and equipment booking, space planning, utilization analysis, employee communication and maintenance management.

- **Improve the safety and security of facility occupants.**
  The healthy buildings agenda has taken centre stage in commercial real estate strategies over the past 18 months, with a significant focus on improving IAQ and ventilation within offices. With a mix of regulated environments that maintain strict environmental conditions, and office space, life sciences firms are in a unique position to transfer their knowledge of environmental controls over to their commercial real estate footprint. Firms should consider investing in campus-wide HVAC systems improvements, with technologies such as IAQ monitoring, enhanced filtration, demand response control, variable airflow and HVAC control automation. Additionally, firms should consider integrated security solutions to protect confidential business information from cyber-attacks, and safeguard the physical security of employees.

VERDANTIX

VERDANTIX CAPABILITIES

RESEARCH, ADVISORY, INSIGHTS & EVENTS

Through our research activities and independent brand positioning we provide clients with:

Research relationships based on an annual research subscription
Confidential advisory services such as commercial due diligence
Thought leadership studies for brand building and lead generation
Executive summits, roundtables and webinars
Advisory workshops to rapidly increase your sector knowledge
Multi-country and complex customer survey projects
Marketing campaign support with analysts and content

VERDANTIX MARKET COVERAGE

Environment, Health & Safety
Focuses on the software and services markets that enable corporations to improve their performance across environment, health and safety including compliance, risk and performance.

Operational Excellence
Focuses on helping managers in operations, asset reliability, process safety and maintenance roles to leverage technologies which enhance production reliability, asset health and operational safety.

Smart Building Technologies
Focuses on software, intelligent building technologies and consulting services that enable real estate and facilities executives to optimize the value and performance of their building portfolios.

ESG & Sustainability
Focuses on the decisions of investors, tech providers, financial services firms and corporate leaders. Conducting in-depth research on the full range of services and technologies required to succeed with ESG and sustainability strategies.

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.

WWW.VERDANTIX.COM