

DIGITALIZATION OF BUILDINGS IN THE NORDICS & BALTICS

How IoT and data insights are transforming buildings



TEMP: 21°C



HUMIDITY: 54%



CO2: 772 PPM



Arthur D Little

PREFACE

The coronavirus pandemic dramatically changed the landscape of the real-estate industry. In a matter of weeks, work-from-home became the norm for many and established behavior and business patterns changed. How permanent these changes are will only be seen as the pandemic subsides and lease cycles come up for renewal. One thing, however, is clear: building owners and managers will need to offer greater flexibility, cost-efficiency and tenant satisfaction than ever before. Digitalization provides many of the tools that will be needed to do this.

This report examines the goals, trends and pain points of the real estate industry in the Nordics and Baltics. It also explains how IoT and data insights are already starting to address them. The report is

the latest in a collaboration between Arthur D. Little and Telia on how digitalization and the Internet of Things are changing industries in our region.

The findings of this report are based on in-depth interviews with over 30 facility owners in the Nordics and Baltics as well as subject matter experts across the region. Recent global and local reports have been reviewed for complementary perspectives on the insights captured in these interviews.

We are tremendously grateful for the generous contributions of our own customers and other external advisors.

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Arthur D Little

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of facility managers believe digitalization has very big potential. However, only 30% of them have started to digitalize their buildings.

EXECUTIVE SUMMARY

While the role of buildings is in focus due to Coronavirus; the industry's main challenges already existed before the pandemic began. Building owners and managers in the Nordics and Baltics identified four primary goals: reduce operational costs, identify new revenue opportunities, satisfy the digital expectations of their tenants, and reduce their environmental impact. They also identified the five main pain-points they must overcome to achieve these goals. By reviewing the technologies currently available, we identified a number of digitalization tools based on IoT and data insights that are being used to address these pain points.

ENERGY & RESOURCE WASTAGE

With buildings consuming 39% of the world's energy and creating 36% of its CO2 emissions, this is both a pain-point and an opportunity. Remote real-time monitoring of temperature sensors within buildings is being used to optimize tenant comfort while reducing energy wastage and corresponding costs and emissions.

LACK OF BUILDING OVERSIGHT

Visibility when not onsite has long been an industry challenge. Remote real-time monitoring of a building and its electronic systems (such as HVAC and elevators) enables problems to be identified and proactive and predictive maintenance to be carried out. The Digital Twin is the extension of this and provides a virtual representation of the whole building and its component systems.

SECURITY & ACCESS MANAGEMENT

Digital locks enable new tenants secure access without needing to change physical locks. Access monitoring also offers significant security potential. However, as with anything involving residents' data, this should be approached with a privacy-first focus.

INEFFICIENT USAGE OF FACILITIES & ASSETS

On a micro level, presence monitoring can show which meeting rooms are in use. On a macro level, crowd movement insights can be used to measure foot traffic near a retail location and to predict and model the impact of new facilities on surrounding services such as parking and public transport.

NEW DIGITAL NATIVE COMPETITORS

87% of facility managers believe digitalization has very big potential. However, only 30% of them have started to digitalize their buildings. This presents the opportunity for digital-first competitors to cherry-pick high-value parts of building management. While incumbent building managers have a number of advantages over these competitors, they need to act quickly, before it is too late.

Digitalization provides new ways to solve old problems and tools to create new value. To make the most of it, the industry as a whole needs to take a collaborative, open, focused and aligned approach. The potential of digitalizing buildings is high. Who will take this opportunity remains to be seen.



REAL ESTATE: A CONSERVATIVE INDUSTRY IN NEED OF CHANGE

After years of effortless returns from increasing facility prices, the real estate industry is now experiencing a setback triggered by the Coronavirus pandemic. Facility owners, with their instrumental role in driving changes in the ecosystem, must step up their game to meet their tenants' new digital expectations, reduce their environmental impact and identify new sources of revenue, all while attempting to reduce their own operational costs. With otherwise limited options, IoT-enabled solutions and data insights offer an opportunity to meet these challenges in the decade ahead.

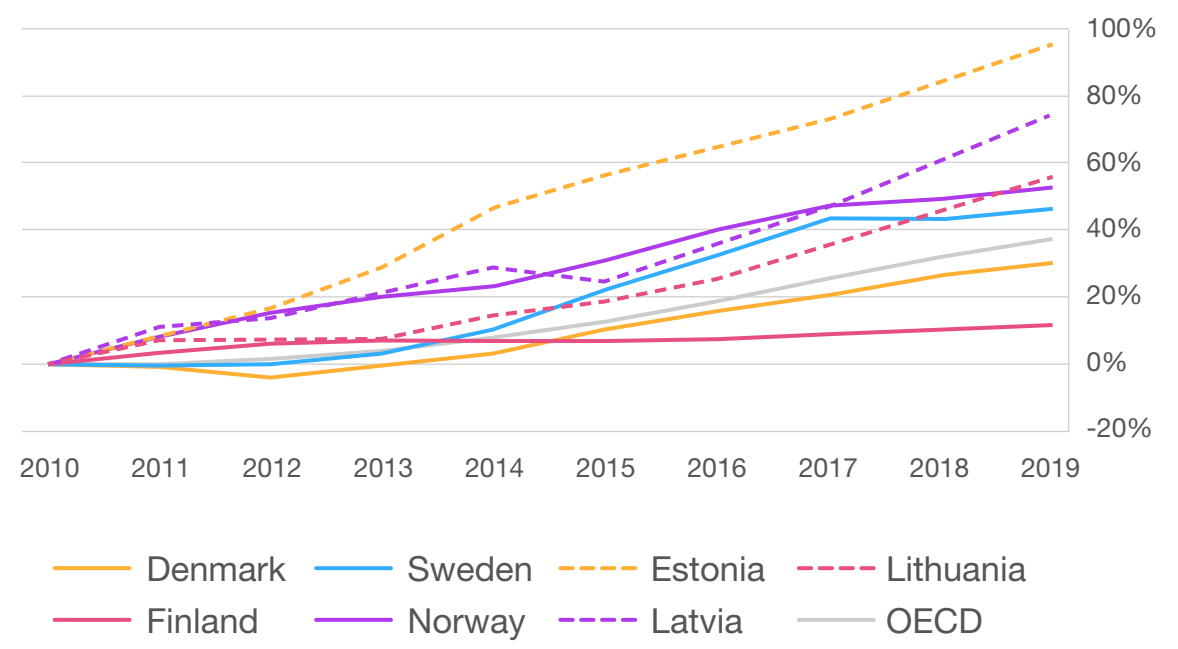
TIME TO END THE STATUS QUO
The real estate industry in the Nordics and Baltics has generated substantial returns over the last decade, following exceptionally favorable market conditions. The trend has been driven by strong market demand combined with limited supply, especially in urban areas. With the exception of Finland, real estate prices across all countries have increased in the ranges of 30 to 80 percent over the ten-year period. As such, facility owners' incentives to transform have been low. The trends in Nordic, Baltic and global residential property price indices are shown in the graph on the right.

As a new decade begins, it is becoming increasingly clear that this status quo cannot continue. In fact, the price index has shown a stag-

nation over the last few years. With interest rates at a record low there is limited price upside from monetary policy – rather, a decline has gradually become more likely. Meanwhile, the long-standing expansion of the business cycle since the end of the financial crisis in 2008-2009 has quickly turned into a recession triggered by the pandemic. Some of the region's economies are expected to shrink by more than three percent in 2020, placing significant strain on the industry. Tenants, be they businesses renting commercial spaces and offices or residents with substantial mortgages, are ending up with constrained budgets and are in some cases unable to make payments. **With previously effortless returns taking a hit, facility owners must act.**

*Source: Swedish National Institute of Economic Research, 2020

Residential property prices
(index year 2010)

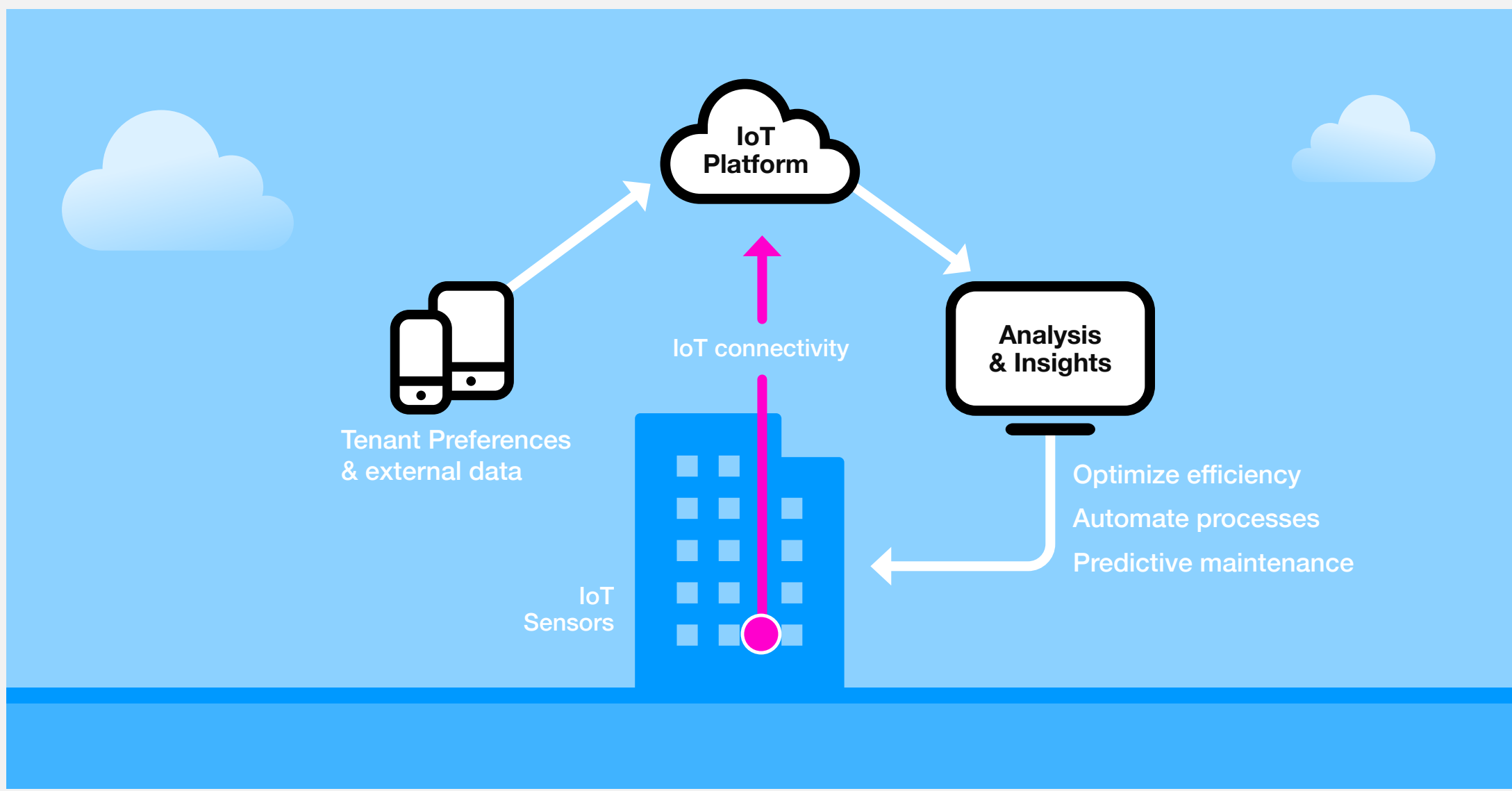


DIGITALIZATION TO THE RESCUE

“The real estate industry experiences a setback triggered by the COVID-19 crisis. Facility owners must now to meet new digital expectations, reduce environmental impact and identify new sources of revenue, all while attempting to reduce operational costs. Digital solutions offer an opportunity to meet these challenges.”

DIGITALIZATION DEFINED

Digitalization is defined in different ways depending on the context. At its most simple, it can be defined as: *the collection and utilization of data to optimize, understand and automate processes and decisions.*



In the connected building context, the collection of data is usually done with a combination of:

SENSORS: collect different types of data from both inside and outside the building.

IOT (INTERNET OF THINGS): connects data from sensors to cloud platforms, for remote monitoring and analysis.

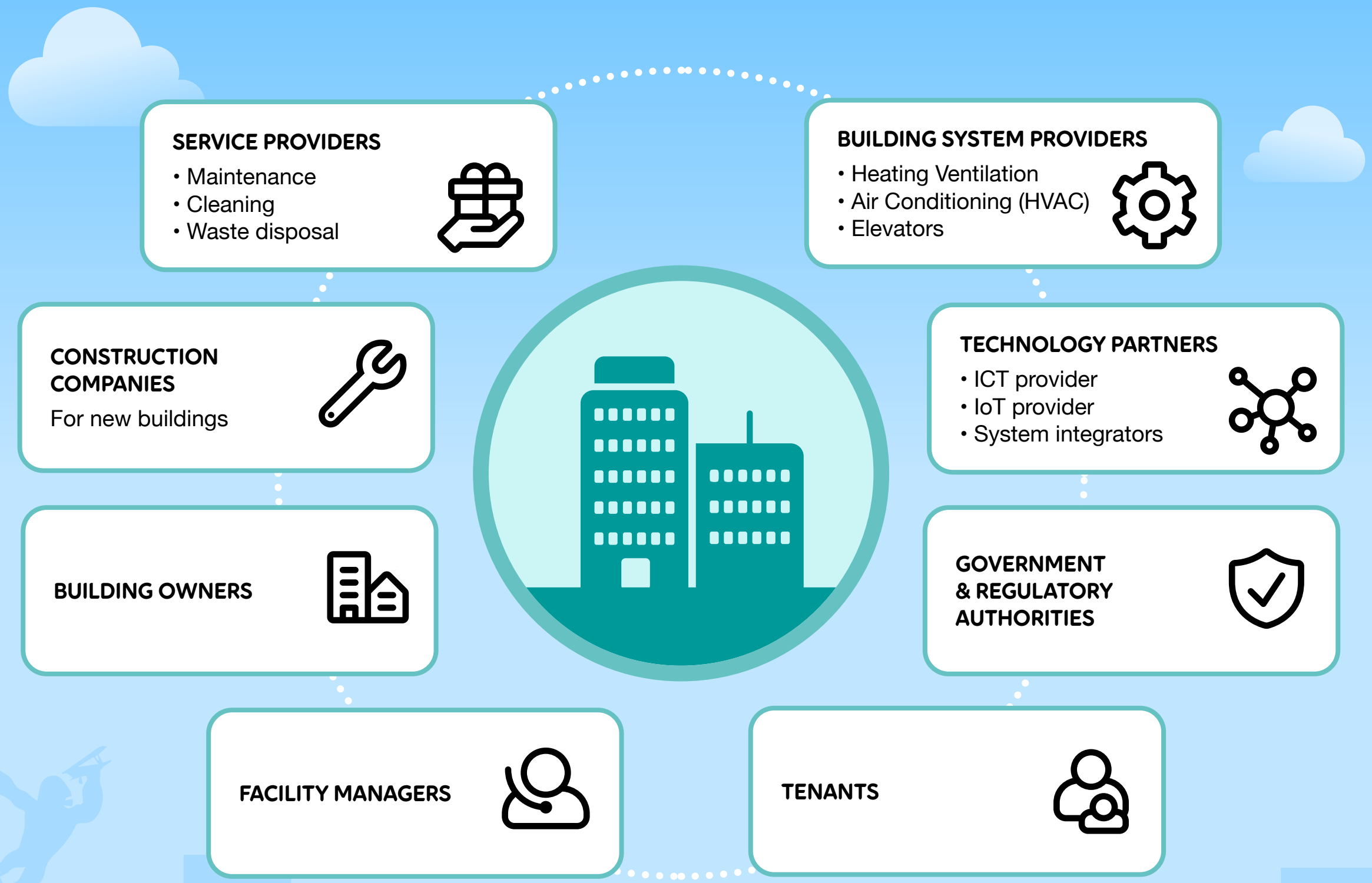
CLOUD PLATFORM: applications that are hosted on remote computers and accessed digitally to enable the analysis of data.

TENANT PREFERENCES: Historical data from apps where people have selected parameters like temperature or ambient light level, enable buildings to 'learn' and adapt the environment to each tenant's preferences.

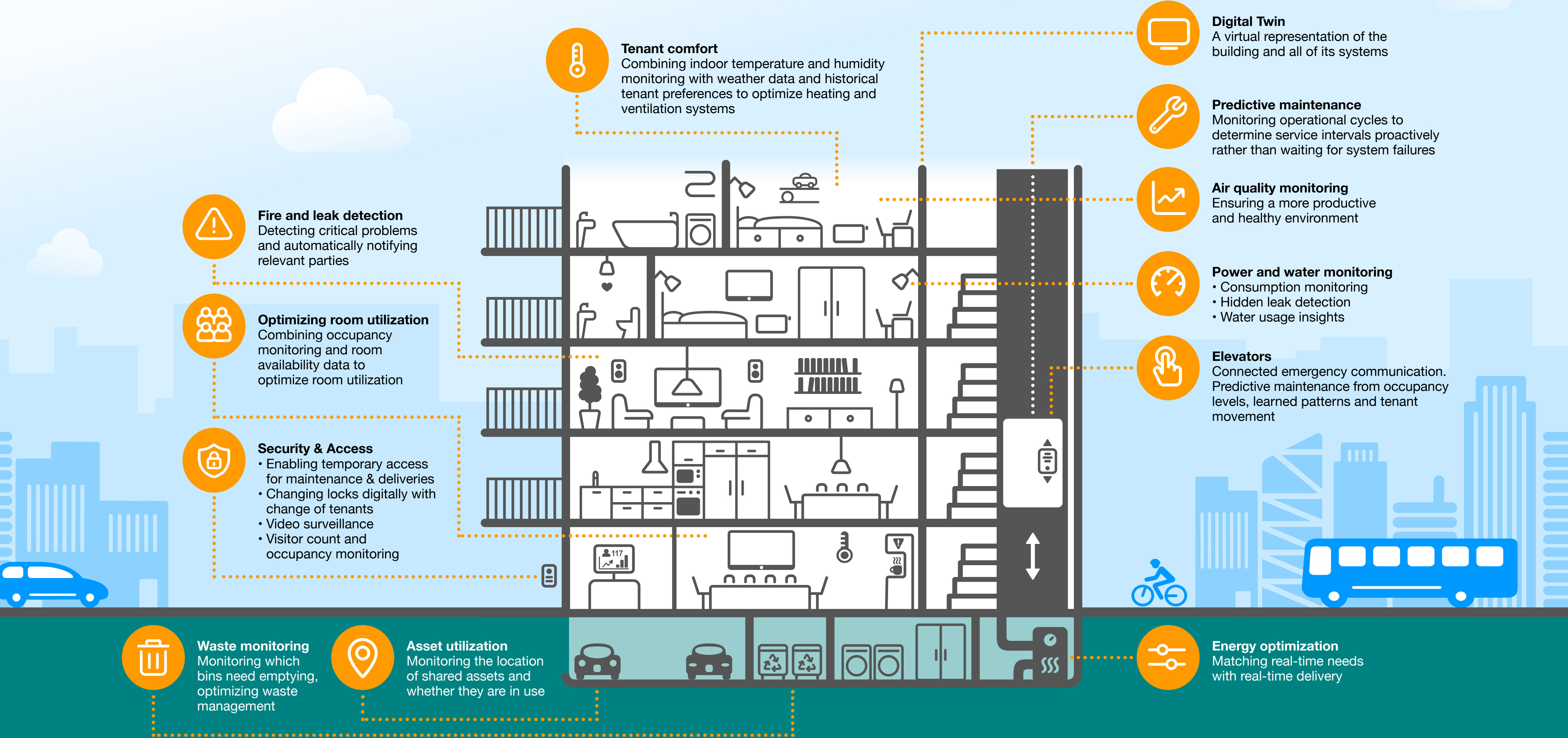
EXTERNAL DATA: External data sources – such as predicted weather conditions or abnormal occupancy levels – make it easier to anticipate future needs.

BUILDING MANAGEMENT ECOSYSTEM

A smart building has many stakeholders who are part of broader ecosystems. We have focused on the main groups who are relevant to this report.

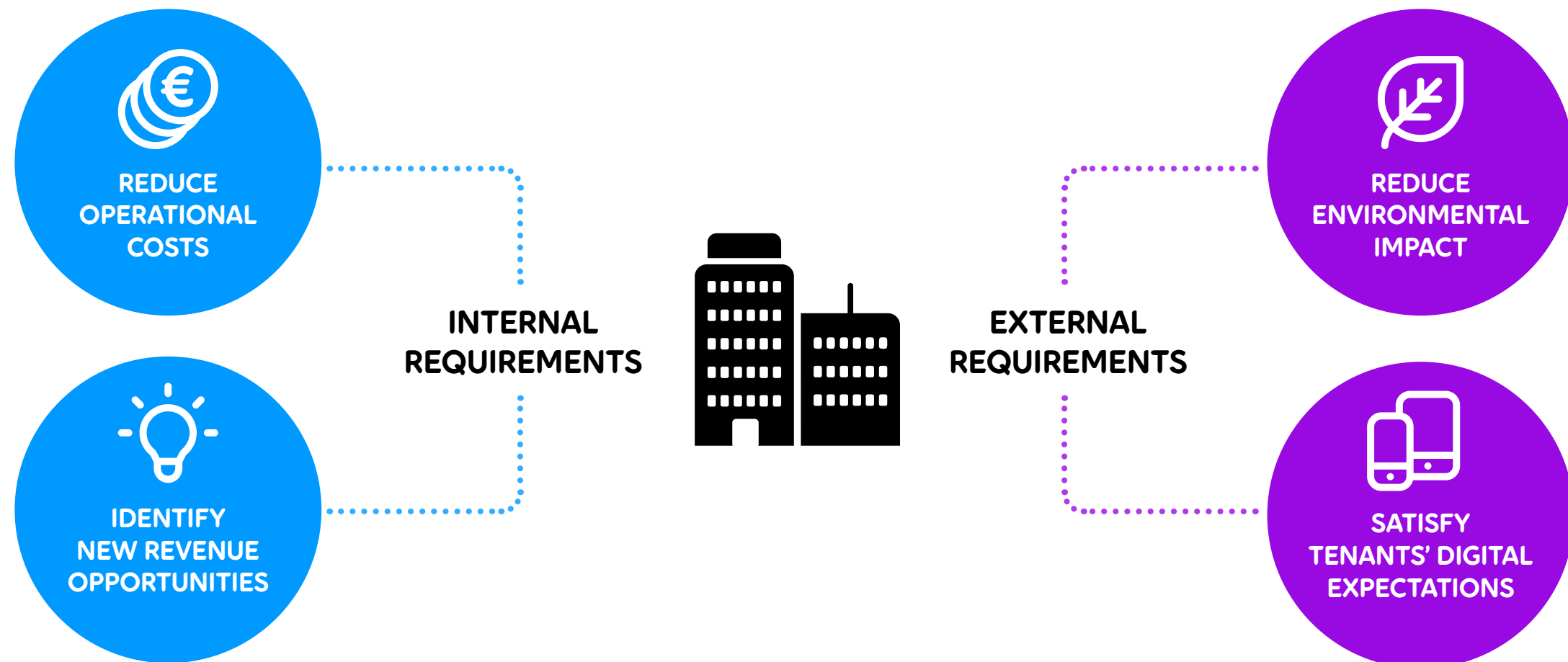


HOW SMART CAN A BUILDING BE?



THE FOUR KEY GOALS FOR THE REAL ESTATE INDUSTRY

As the challenge to maintain profitability is driven both by structural factors and the ongoing Coronavirus pandemic, the sense of urgency is growing. To find stable ground and pull the right levers, facility owners must consider four goals. These relate to satisfying both internal and external requirements.



The two **internal requirements** – lowering operational costs and identifying new revenues – are more important than ever as profits sink due to the pandemic. Our interviews with industry leaders confirm that **cost saving is the primary reason to invest in digitalization**.

The **external requirements** demand a balance between higher-quality services and lower environmental impact and cost. The former involves effortless and flexible digital services to tenants who want their IT solutions installed and up and running from day one, but who also want to monitor and manage their own bookings, rents and other facility-related issues.





COVID-19 and its impact on the real estate industry

When the COVID-19 pandemic began, it drastically changed the way people lived in a very short period of time. The impact was felt head-on in the real estate industry. As the “second wave” and knock-on effects to economies and ways of doing business continue to be felt, real estate owners should not sit idle and wait. Embracing IoT and digitalization provides new ways to manage operations and achieve adaptability in times of crisis

Since the crisis began, building owners and managers **have faced unprecedented challenges** in terms of securing the health and safety of those who use their premises as well as economic challenges such as deferred lease payments as a result of tenants’ liquidity issues. Beyond the

immediate effects, the pandemic may also have lasting consequences by altering perceptions of how much we rely on buildings.

While analysts predict that the European real estate industry is better equipped to tackle a crisis now than in 2008*, the effect is clear, although it

varies between different facilities. For example, **commercial buildings took the most substantial hit**, as the pandemic had a heavy impact on both the hospitality traditional retail industries. It remains to be seen when the former will recover – and if the latter ever fully will, as shop-from-home quickly became the norm for so many people.

Industrial and office buildings have been less affected. But the crisis could trigger changes in the way companies operate, as supply chains change, and employees assimilate to working from home. When it comes to the “new normal” of working from home, businesses may look to downsize when it comes to physical offices, for example, by discontinuing planned expansions or not renewing

“Commercial buildings took the most substantial hit as the pandemic had a heavy impact on both the hospitality traditional retail industries. It remains to be seen when the former will recover – and if the latter ever fully will”

leases. Today, in the midst of the pandemic, distance work is commonplace, with research showing that 47% of Finnish workers, 59% of Danish workers and 36% of Swedish workers work remotely. Another global study showed that 41% of workers claim they will likely work remotely at least part time, compared to 30% pre-pandemic. In the long term, we may see a paradigm shift in which we move away from centralized offices.

Beyond safety and financially-oriented measures, many facility owners have also halted investments to minimize exposure in the uncertain future. Property developments have been delayed or suspended due to national lockdowns and revised budgeting. In addition, the industry saw a brief stagnation in the number of transactions and average property prices during the second quarter. However, it didn’t take long before the markets returned to normal levels.

IoT-enabled solutions offer immediate relief through their cost-saving potential. Furthermore, while the possibility of future outbreaks is uncertain, facility owners who look beyond the crisis and consider how to leverage a changed real estate environment are those who will come out on top. By accelerating their digitalization journey, facility owners can stay on top of industry trends and diversify their income sources. **Real estate has been one of the least digitalized industry sectors, but the pandemic has amplified the pace at which digitalization can transform it.**

* Kepler Chevreux, 2020

CROWD ALERTS

- MAKING INDOOR SOCIAL DISTANCING EASIER



The COVID-19 pandemic changed the way we think of crowds. Social distancing was identified as an important way of reducing contagion. However, this can be hard to achieve when people don't know how crowded a building or indoor space actually is. Telia Crowd Alerts provides a tool for measuring crowds in real time, making it easier to maintain safe levels.

By monitoring the number of people in a given location – and comparing this with pre-defined limits – Telia Crowd Alerts can notify customers, visitors and employees if an area is becoming too crowded. This enables personnel to take remedial action (such as limiting entry) and enables visitors to make better-informed decisions about when to visit.

This solution is ideal for areas that experience variations in visitor or occupancy levels. These include shopping malls, office buildings, hotels, arenas and public transport hubs. As recommendations continue to change, Telia Crowd Insights provides a valuable tool for planners, site managers or building owners to balance business continuity with public safety.

HOW IT WORKS

Telia Crowd Alerts are based on wifi probe signals. Mobile phones with wifi activated normally emit signals between 7 to 15 times a minute to search for wifi networks. By measuring these, the sensors collect information about the approximate number of people in a given area. When the activity is higher than a pre-determined limit, the person responsible for a site receives a notification by text message or e-mail and can then take appropriate action. The service can be used on an existing wifi network or with external wifi sensors that can be placed in the area to be monitored. The service can also be integrated into visitor apps so that the public can get real-time indications of crowding.



HOTEL AT SIX

Before the outbreak of the Coronavirus, Hotel At Six, the 2000+ sq.m. hotel in Stockholm, hosted large, international conferences and meetings as well as operating its hotel business, in-house restaurants and bars. When the pandemic hit and Government restrictions on the number of people in the same space were put in place, the impact on the hospitality sector was massive. The hotel sustained a devastating loss in occupancy and event bookings, and 75 percent of the workforce had to be let go. Immediate changes in the commercial strategy, service delivery and ways of working had to be implemented to maintain a safe environment for staff and guests.

One of these was to implement Telia Crowd Alerts. The aim is to enable guests to see, in real time, the number of people in different areas of the hotel. This enables guests and visitors to avoid crowded areas and helps hotel staff to follow social distancing recommendations. Secondly, it enables data to be collected over time in order to identify trends when it comes to particularly crowded areas and times. This data is visualized for guests and visitors to make it easier to avoid peak times. The Crowd Alerts service gives the hotel a tool to manage their operations and people flows in a safer and more efficient way. Guests are able to plan their stay and activities in the hotel while avoiding crowds, making the hotel a safer place to visit.

At Six is operated by Nordic Hotels & Resorts, part of Nordic Choice Hotels.



BUILDINGS ON THE RISE

Here we explore trends in housing prices, urban populations and newbuilds over the past decade in the Nordics and Baltics.










HOUSING PRICES
Nominal house prices, absolute increase, 2009-19



URBAN POPULATION
Inhabitants in urban areas, absolute increase, 2008-18



NEW-BUILDS
Absolute increase, 2009-19

	HOUSING PRICES Nominal house prices, absolute increase, 2009-19	URBAN POPULATION Inhabitants in urban areas, absolute increase, 2008-18	NEW-BUILDS Absolute increase, 2009-19
 SWEDEN	→ 71%	→ 14%	→ 35%
 NORWAY	→ 65%	→ 17%	→ 44%
 DENMARK	→ 33%	→ 7%	→ 22%
 FINLAND	→ 18%	→ 7%	→ 38%
   BALTICS	→ 65%	→ -9%	→ 49%

COMMENTS

- All countries have shown strong growth in housing prices the last ten years – between 20 percent and 70 percent
- Sweden and Denmark are the most urbanized countries (~87 percent), while Norway has the biggest urbanization increase
- Urbanization in the Baltics has gone down over the past decade, mainly due to economic migration following EU accession
- The volume of newbuilds has increased heavily over the last decade; by almost 50 percent in the Baltics, with some Nordics countries not far behind



ENVIRONMENTAL INITIATIVES IN THE REGION

In March 2020, the European Climate law was proposed to make European economies and societies climate-neutral by 2050. The real estate industry has a key role in reaching this goal, as buildings account for the highest share of the total energy consumption in the European Union, with over 70 percent of the final energy use accounted for by heating and cooling. Moreover, roughly 75 percent of buildings were built before energy performance standards existed. As a result, the EU estimates that 97 percent of all buildings pre-dating 2010 need to be upgraded to achieve the goal.

The energy performance of buildings will therefore be driven mainly by the ability of Member States to improve the performance of existing buildings. However, since new buildings will represent 10-25 percent of the total building stock by 2050, in recent years, the EU has introduced measures to promote more sustainable newbuilds. One key goal is that all new buildings should be classed as “nearly-zero energy”, which is defined as having very low energy consumption through the use of renewable sources produced onsite or nearby.

To reach the goal, the EU has recognized the high potential of “smart buildings”, and several studies have confirmed that: “the increasing built-in intelligence of appliances and buildings will help automate and optimize energy consumption decisions

and actions (...), thereby increasing the overall energy efficiency in buildings”.

Several EU policies on the development of urban environments encourage cities to implement policies for sustainable urban planning and design. These include innovative approaches to urban public transport and mobility, sustainable buildings, energy efficiency and urban biodiversity conservation. Action is already being taken. In May 2019, for example, eight leading European cities committed to an initiative called “Build Upon2” – aimed at reducing all CO2 emissions from existing buildings by 2050.





LOCAL SUSTAINABILITY INITIATIVES



In Estonia, the annual public-private partnership event organized by the Ministry of the Environment exemplifies how to involve stakeholders and the public in addressing environmental issues. In addition, buildings are one of the eight priority areas in the Estonian national strategy on climate change.



In Lithuania, 15 municipalities are involved in the EU Covenant of Mayors, a coalition of city leaders in the EU that cooperate to achieve climate and energy goals. For example, there is a common commitment to reduce CO2 emissions by at least 40 percent by 2030. Local projects include numerous upgrades of public and residential buildings.



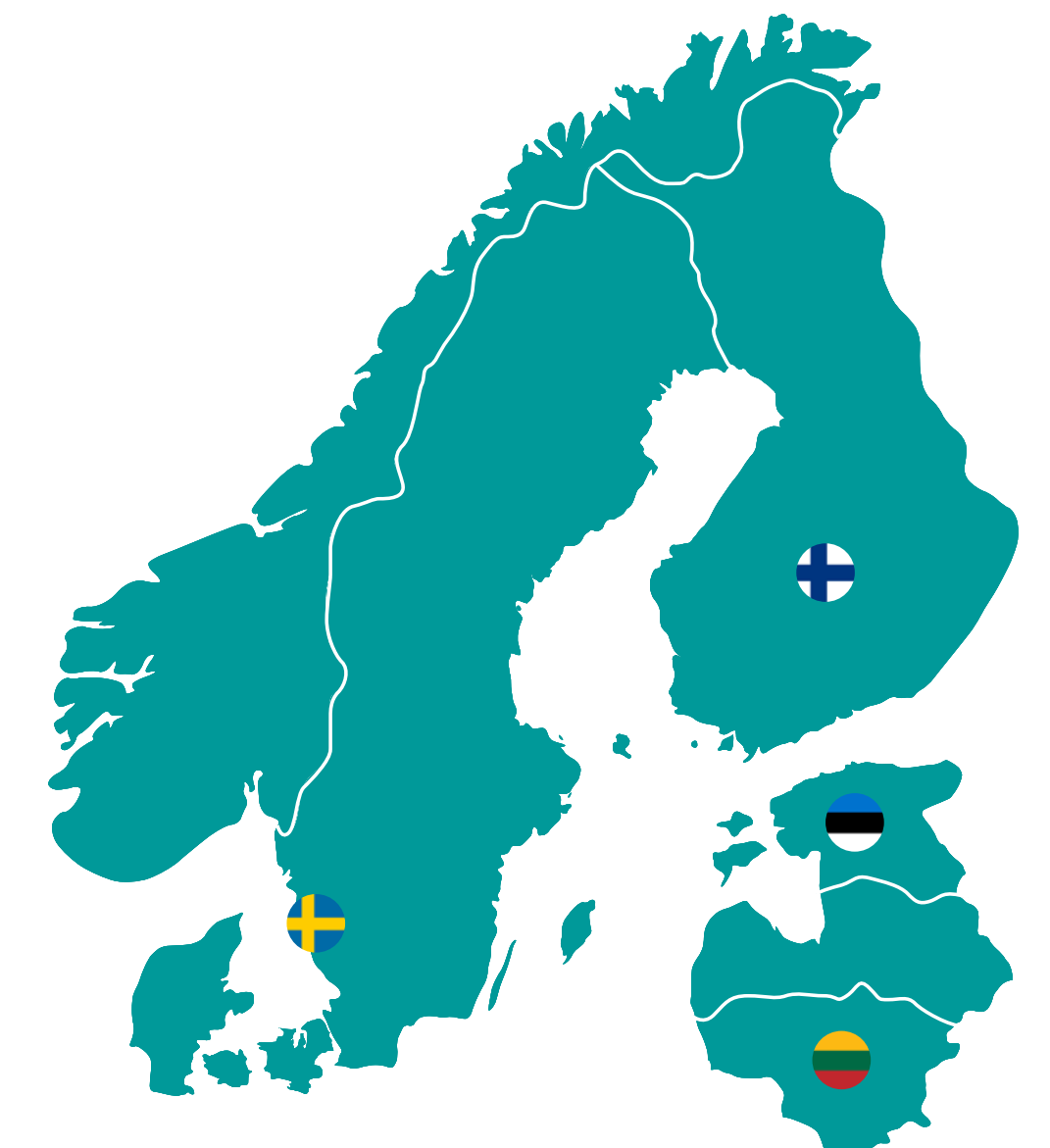
Finland has adopted the EU goal related to new buildings and set an even more ambitious target, aiming for “nearly-zero energy” in buildings dating from 2017 onwards.



In Gothenburg, Sweden, an urban innovation project with a budget of EUR 4.7 million is promoting FED, or fossil free energy districts. The project demonstrates scalable and replicable solutions for energy efficiency and smart energy management in public infrastructure and the housing sector. The aim is to encourage adoption of low-carbon energy production, to moderate demand for heating and cooling, and deploy innovative, renewable-based solutions for heating and cooling buildings and neighborhoods.

Additionally, several eco-labeling and certification schemes, such as BREEAM, Green Star, LEED and the Nordic Swan Ecolabel promote local sustainability. These certification bodies set standards and common targets for the design, construction and maintenance of buildings. They allow facility owners to step up their sustainability agenda and can be used as a verification tool for stakeholders to compare and evaluate sustainability performance.

Source: World Bank, OECD, Eurostat, European Commission, Arthur D. Little analysis




MACRO TRENDS IMPACTING THE INDUSTRY

Facility owners are at the center of multiple trends impacting the industry. While the industry has grown conservatively as a result of its favourable long-term conditions, an effective response to the new trends calls for new ways of working in all phases of a building’s lifecycle.

Firstly, the long-standing trend of **urbanization** continues to impact the facility owners’ core assets – the buildings themselves. The densification of urban areas means that the space available needs to be used more effectively. Meanwhile in non-urban areas the trend is the opposite – with a shrinking population the need for housing and office space declines as well. Facilities then remain unused, are sold off at a discount or demolished, not least if renovations or updates have been deprioritized. Facility owners need to prioritize wisely, but also build up their data intelligence in order to monitor supply and demand development. Companies like Airbnb, the world’s biggest accommodation-sharing site, and WeWork, providing shared workspaces, have pioneered new ways to match the market.

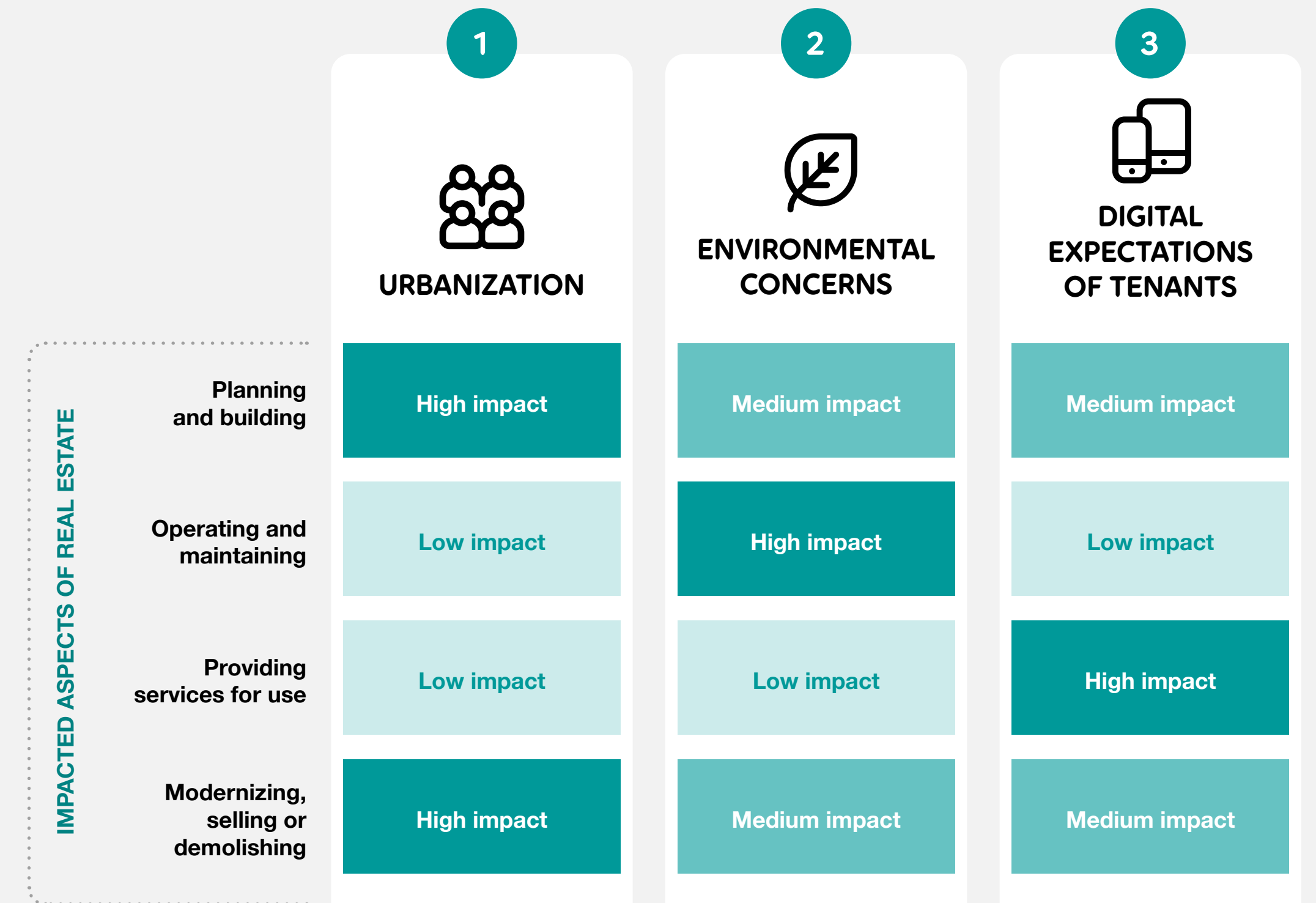
Secondly, as 39 percent of the world’s CO2 emissions and 36 percent of energy consumption is related to buildings, the industry is also made awa-


 “39 percent of the world’s CO2 emissions and 36 percent of energy consumption is related to buildings”

re of its role in reaching **sustainable environmental targets**. Pressure on facility owners is increasing from regulators implementing new policies on the one hand, and from end users seeking to lower their environmental footprint on the other hand. As lower energy consumption also leads to lower costs, environmentally and economically sustainable solutions for operating buildings go hand-in-hand.

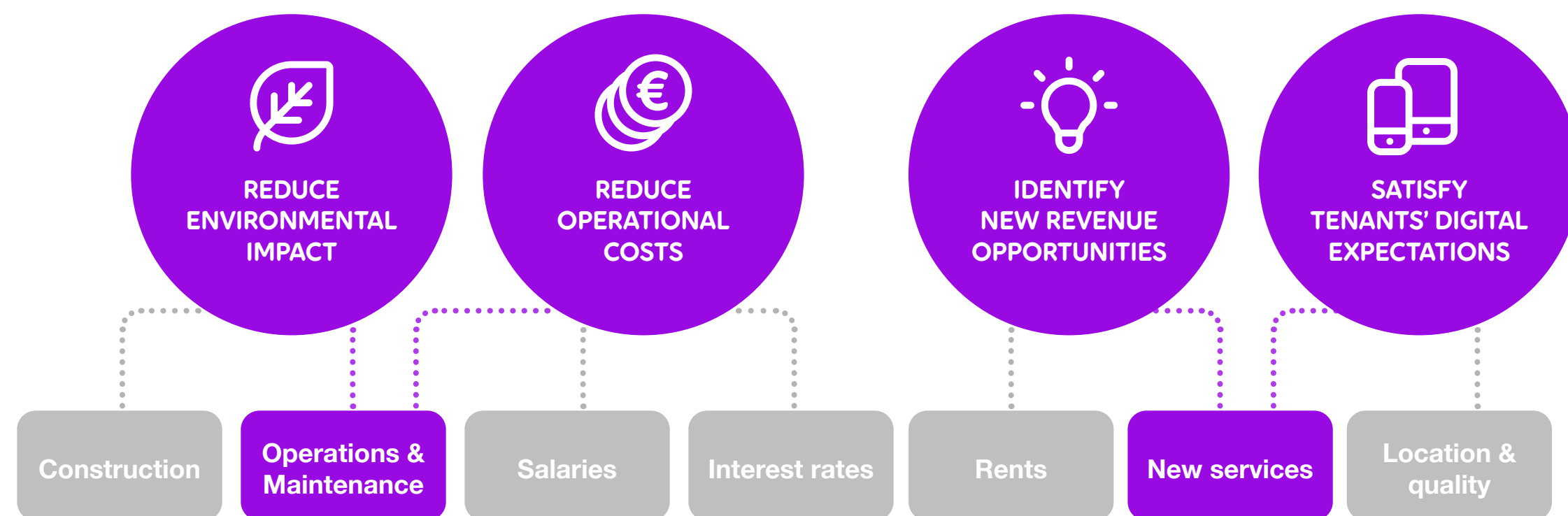
Thirdly, facility owners are increasingly obliged to adapt their provided services to the **evolving digital expectations of tenants**. The Digital native disruptors such as Airbnb and WeWork reinforce this trend, as do the digital services tenants use in other areas of their daily lives. As tenants get accustomed to user-friendly digital solutions for managing, renting and leasing facilities, traditional facility owners need to adapt. As a knock-on effect, with more frequent rentals and more home delivery services and home care, easier facility access is needed. This poses yet another challenge – easier access increases the risk of unauthorized entry. Facility owners must find a balance.

KEY EXTERNAL MARKET TRENDS



 Impact of trend on facility owners. Trends also affect external stakeholders ranging from construction companies and suppliers to policy makers and citizens, as well as internal stakeholders such as facility managers and tenants, but facility owners are focal in this analysis by virtue of their pivotal position in the ecosystem.

WHERE CAN DIGITALIZATION HAVE THE BIGGEST IMPACT?



The areas where digitalization has most potential to transform industry

Faced with both profitability challenges and trends likely to reshape the industry, we find that real estate has turned its attention to digitalization. 87 percent of the interviewed facility owners in the Nordics and Baltics rated the potential of digitalization as “very high” and the remaining 13 percent rated it as “high”. Consequently, a majority also expect their investments in the area to increase in the next few years.

Fundamental industry dynamics explain why this is the case. Facility owners have limited options for achieving their four key goals. As shown in the illustration above, most areas are difficult to influence, leaving operations and maintenance and new services:

1. **Operations and maintenance costs** account for roughly 50-80 percent of facility owners’ to-

tal costs. While interest rates and salaries are largely fixed, there is undoubtedly great potential to lower costs and reduce environmental impact by reducing energy and water consumption.

2. Approximately 98 percent of facility owners’ revenues come from rents, which are difficult to change, in some cases due to rent regulations. As location and physical design are unlikely to



change significantly after construction is completed, **new services** will be the key path forward to generate new revenues, as well as to satisfy tenants’ digital expectations.

Digitalization in general and IoT-enabled solutions and data insights in particular are great enablers for both operational efficiency and new services, and a broad set of use case areas is readily available. Some players have already made substantial investments. One example is **Rikshem**, a large Swedish facility owner, which is now implementing IoT solutions and a common platform in all of its 30,000 apartments, half of which will be connected by 2021. This will provide a means of monitoring and analyzing the facilities, and thereby enable more efficient operations, reduce energy consumption and generate insights for predictive maintenance.

On the next page you can read about a number of **global examples** of facilities that have implemented digitalization and IoT solutions with great results. While these landmark cases show the extent to which buildings can be made intelligent and sustainable, most facilities can do a lot with less. IoT-enabled solutions can be deployed almost anywhere and on an initially small scale and still provide immense benefits. In the next chapter, we outline what solutions are available and which pain points they can alleviate.



We realized that we had to act now to handle the increasing digitalization in the coming 10-20 years. We want to be proactive rather than reactive

- Lena Franzén Lindfors, CDO, Rikshem

Global case studies

Broadening our perspective globally, we find that digitalization has led to impressive results. Here are some examples.



BEE'AH

The “Most Intelligent Building in 2019” IBcon Digie Award was awarded to the new headquarters of the environmental management company Bee’ah in the United Arab Emirates. Dubbed a “fully AI-powered smart building”, it integrates a wide range of modern digital solutions ranging from smart security and lobby-visitor management to functional systems such as HR administration and mechanical, electrical and plumbing-related maintenance systems.



SALESFORCE TOWER

In San Francisco, the Salesforce Tower was designed with sustainability in focus by employing smart HVAC systems and water recycling systems to collect rainwater and water from showers and sinks etc, saving over 80,000 liters/day. It also uses a digital twin – a digital replica of the facility – to model the use of conference rooms for enhanced efficiency.



THE EDGE

Another European example, often cited as the “smartest building in the world”, is The Edge. This Dutch office building is equipped with 28,000 sensors that enable office workers to interact directly with the building through their smartphone and benefit from services to locate colleagues, adjust temperatures, and more, all inside a facility that actually produces more energy than it consumes. BREEAM awarded the building a sustainability score of 98.4 percent, the highest ever at the time, showing how “green” and “smart” go hand in hand.

DIGITAL FOUNDATIONS FOR BUILDINGS OF THE FUTURE

Facility owners have traditionally relied on non-digital means to address their pain points, but these means now provide marginal improvements at best. By contrast, IoT-enabled solutions and data insights have potential to deliver sustainable value and meet external requirements.

Among a plethora of use case areas, the industry considers energy-saving solutions as the most relevant use case area in the short term. For example, smart thermostats have been shown to cut energy usage by up to 40 percent.

The long-term potential of scaling IoT lies in combining and integrating IoT data, which enables solution synergies and improved solution intelligence – setting the foundation for the fully-integrated smart building.

INDUSTRY PAIN POINTS REQUIRE NEW INNOVATIVE SOLUTIONS

The IoT and data insight solutions that are most capable of enhancing operations and maintenance or enabling new services are those that also directly alleviate the industry's key pain points.

Industry interviewees highlight five pain point categories:

1. Energy & resource wastage – unnecessary energy usage from electricity, water, heating, ventilation, etc. leading to increased costs and environmental impact.

2. Lack of oversight of building infrastructure – reducing the efficiency of modernization programs and daily operations and maintenance, resulting in inability to unlock efficiencies.

3. Security & access management – creating an administrative burden that prevents quick and secure access for visitors, potentially compromising security.

4. Inefficient use of facilities & assets – limited overview of vacancies, capacity, room utilization, facilities etc.

5. Digital native competitors – arising from new digital-native companies building businesses with a value proposition of reducing the barriers of renting, leasing and providing flexible facility related services.

We find that facility owners have relied on various means, typically non-digital in nature, to address these pain points. These now need to be complemented or replaced with IoT solutions and data insights.



Pain Point 1
ENERGY & RESOURCE WASTAGE



Pain Point 2
LACK OF OVERSIGHT



Pain Point 3
SECURITY & ACCESS MANAGEMENT



Pain Point 4
INEFFICIENT USE OF FACILITIES & ASSETS



Pain Point 5
DIGITAL NATIVE COMPETITORS



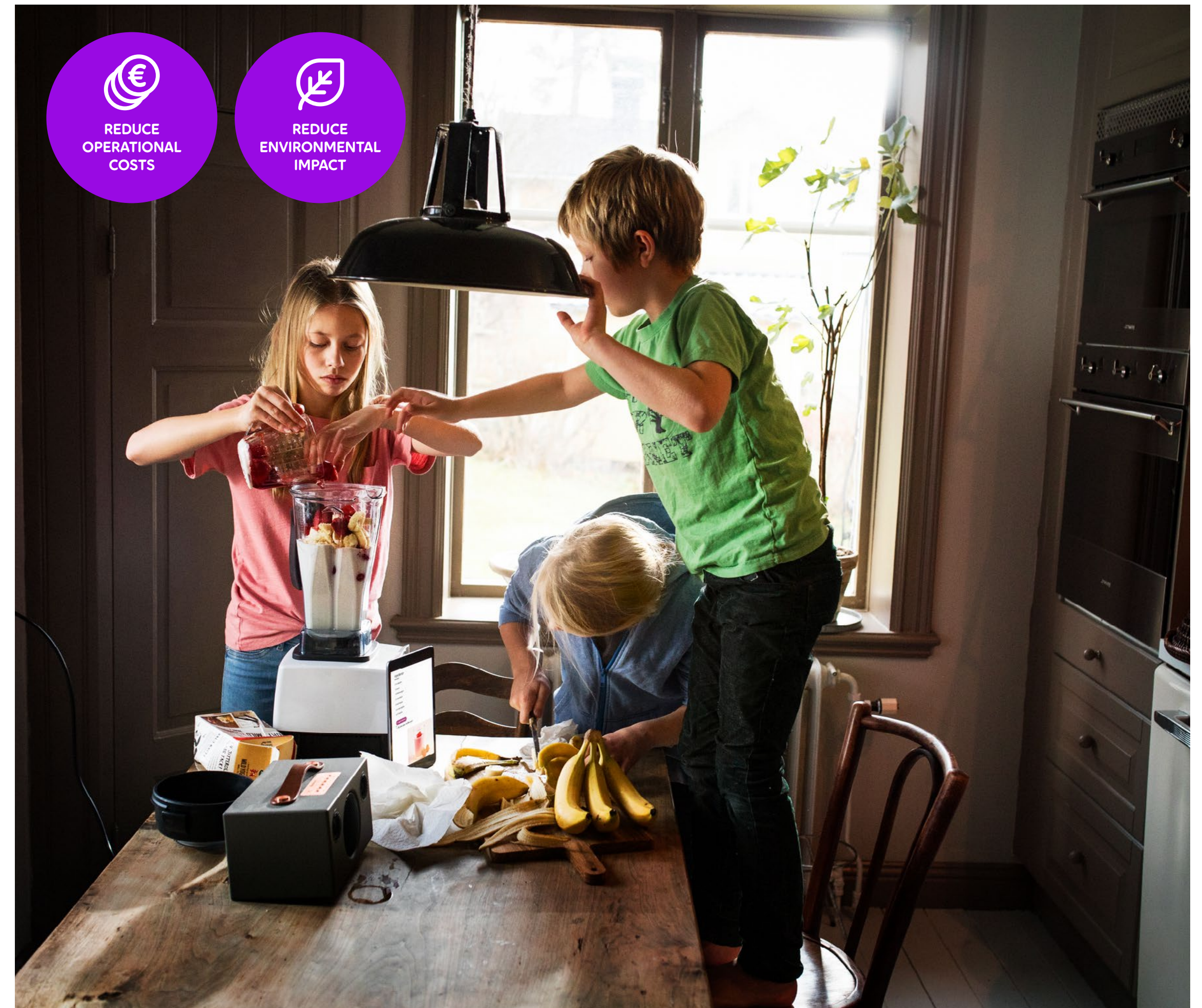
FIVE PAIN POINTS FOR FACILITY OWNERS

PAIN POINT 1:

ENERGY & RESOURCE WASTAGE

Energy is one of the largest variable costs in any building. In the Nordic and Baltic climates, heating is viewed as the main cost driver. Inefficient Heating Ventilation Air Conditioning (HVAC) systems can be very expensive.

PAIN POINT	DESCRIPTION	NON-DIGITAL APPROACH
INEFFICIENT HVAC SYSTEM	HVAC systems set at fixed levels leading to unnecessarily high heating costs and wasted energy consumption	<p>Single thermostats that trigger on/off HVAC upon localized changes in temperature</p> <p>Predefined temperature levels based on best guesses of tenants' preferences, changed seasonally</p>
HIGH SPEND ON ELECTRICITY COSTS	Increasingly electrified assets (e.g. electric charging stations, roof panels, heat pumps, battery storage capacity) account for a large share of the cost base	<p>Reducing intensity of high consuming devices</p> <p>Scheduling usage of devices in certain time intervals</p> <p>Investing in energy efficient assets, e.g. LED lights, motors and heating pump controls</p>
WATER LEAKAGES/ HIGH CONSUMPTION	Leakages in water pipes and excessive water consumption (e.g. gardening, sinks, showers and sewage) lead to low water efficiency and high costs	<p>Reactive and planned maintenance intervals to assess conditions, detect failures and remedy leakages</p> <p>Reduce the power of water flow (in e.g. dispensers, nozzles and sprinklers) to reduce the water consumption per unit of time</p>



Traditionally, heating has been regulated by a combination of 'best-guess' and resident feedback. Thermostats allow for automatic adjustments based on predefined thresholds but lack the intelligence to adapt to real-time changes in occupancy. The result is that the heating is on at all times – wasting energy during times when there is nobody in the premises.

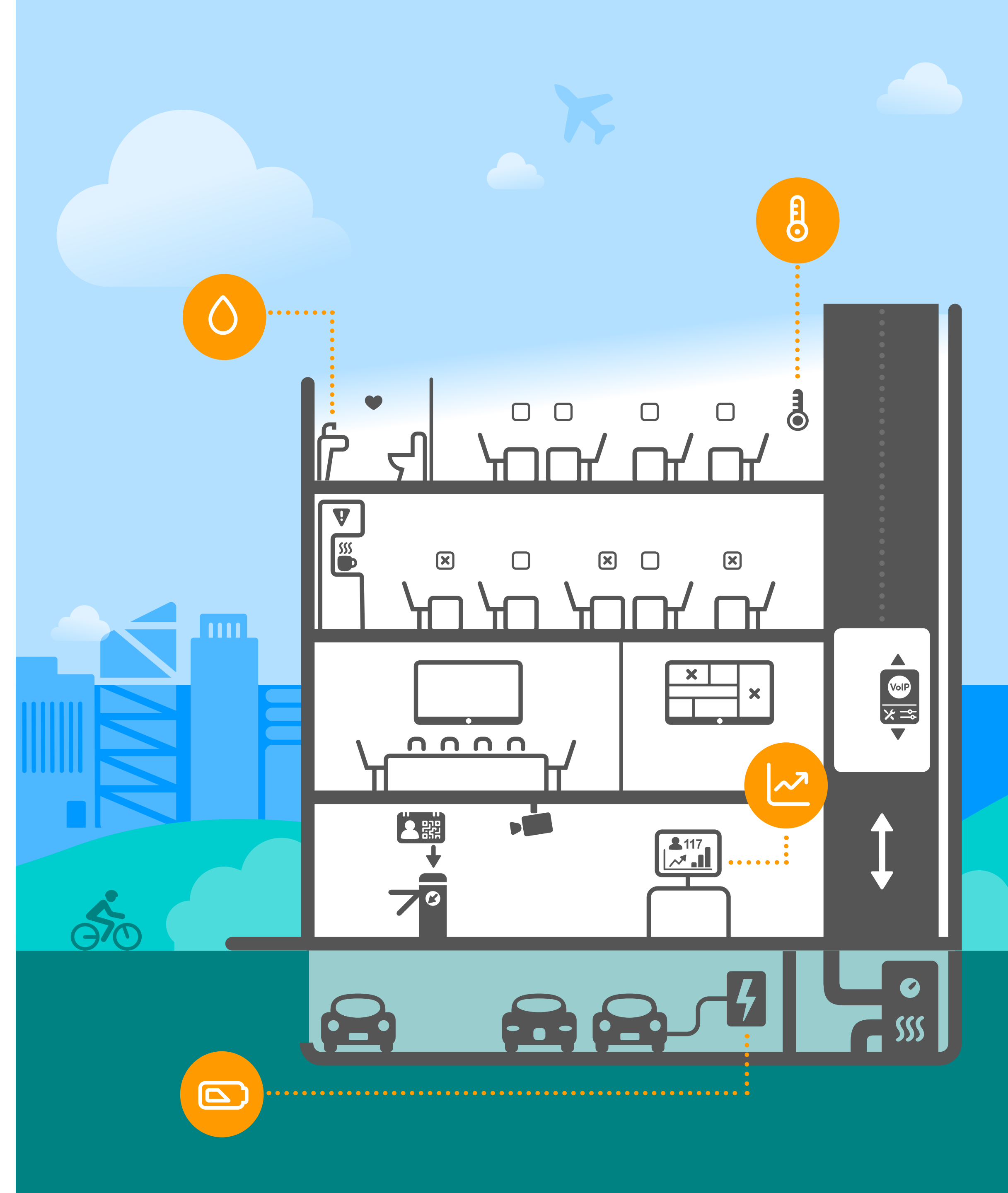
In the following section we outline currently available digital solutions that can help to address energy and resource wastage. →

DIGITAL SOLUTIONS TO REDUCE ENERGY AND RESOURCE WASTAGE

By connecting sensors within a building to monitor real-time requirements, it is possible to optimize resource consumption to reduce wastage and increase comfort. This has a positive effect on both cost reduction and sustainability.

ENERGY MONITORING

USE CASE	EXAMPLE SOLUTION	OTHER SIMILAR SOLUTIONS
WATER MONITORING & MANAGEMENT	Smart meters enable remote measurement of water consumption to detect water loss from leaks and help tenants understand and reduce their own usage	Smart water taps Automated irrigation
ELECTRICITY MONITORING & MANAGEMENT	Smart electric vehicle charging systems enable monitoring and management of charging and may influence prices and restrictions that optimize energy use, given demand and usage patterns	<ul style="list-style-type: none"> • Smart meters (electricity) • Smart outlets • Load control and outage mitigation
HVAC MONITORING AND MANAGEMENT	Smart thermostats typically use sensing abilities to detect and even predict when they need to trigger temperature adjustments, which in turn means energy savings	Smart vents



MONITOR & OPTIMIZE

Solutions that enable a **building's component systems to be monitored in real time**, make it possible to optimize their efficiency. Given that many of these solutions align with cost saving and environmental sustainability goals, they appeal to industry players. In fact, over 95 percent of our interviewees highlight energy-saving solutions as their most prioritized area.

Another use case area, **HVAC monitoring and management**, includes the example of smart thermostats that sense different parameters within a building ranging from air temperature and humidity to room occupancy and air quality. At room level, this enables temperature to be kept at pre-determined comfort levels set by occupants. The thermostats can also sense when rooms are empty and reduce the temperature accordingly. At building level, HVAC monitoring and management makes it possible to combine multiple sources of data to fine-tune energy consumption. As well as current temperature, current and predicted occupancy are taken into account. How will a

95%

Over 95 percent of our interviewees highlight energy-saving solutions as their most prioritized area.

high-occupancy rate affect the temperature? Are there areas where the heating can be turned down during weekends or holidays? Current and predicted weather conditions can also be factored in to take advantage of natural heating or cooling.

Air quality monitoring can sense hazards or levels of carbon dioxide and organic compounds in the air in office buildings or apartment buildings to ensure health and comfort as well as regulatory compliance.

Even fully manual systems can provide valuable insights when connected. **Connected water mixers** can show how much water runs through each tap and determine the daily usage patterns. This enables efficient cleaning schedules and may point to other problems. For example, if toilets in some areas of a building are used less during evenings, it may be because people feel less safe using them during this time. Perhaps additional lighting is needed in those areas.

Global studies indicate that energy consumption and associated costs can be cut by up to 40 percent by integrating digitalized systems, such as smart thermostats.

Solutions that facilitate more efficient use of water include various water leakage detection systems that reduces water waste. This is achieved by monitoring assets such as taps, blenders, toilets and sinks for leaks. Implemented solutions have reduced water usage above 30 percent by connecting taps.



FM MATTSSON'S CONNECTED TAPS DELIVER MORE THAN WATER

FM Mattsson is at the forefront when it comes to connected water mixers. Each tap has a sensor that can be connected to a centralized gateway in the building or directly to the mobile network using cellular IoT connectivity. Usage and water volume data is collected and monitored in the Telia IoT Platform. Data such as when the taps are used and how much energy they consume are collected.

Two implementations, in Odense (Denmark) and Idre Fjäll (Sweden), have resulted in a reduction of water consumption by 30%. This helps both Idre Fjäll and Odense Municipality Odense municipality to fulfil their sustainability objectives.

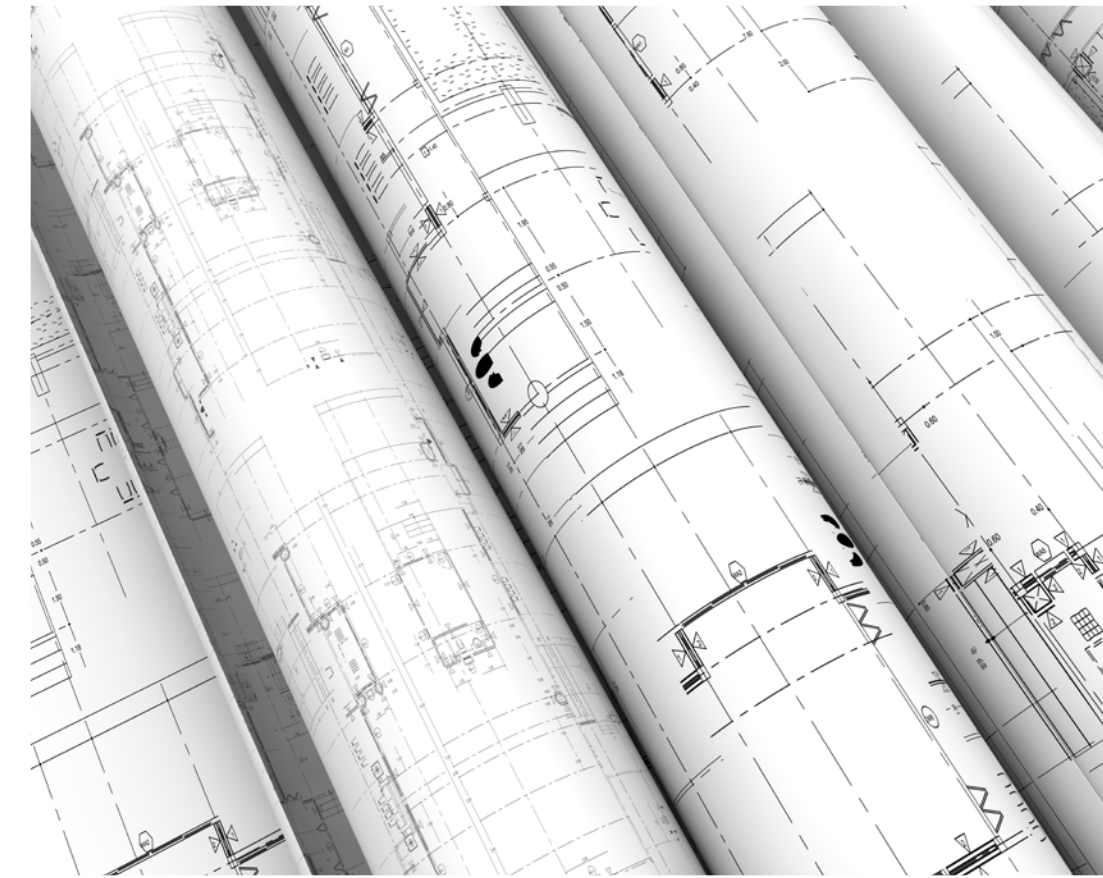
Another use case is to ensure that water is flushed regularly in hospitals in order to decrease the risk of bacteria and diseases such as legionella. Previously, all taps in hospital facilities were manually flushed. Now, visibility of which taps need to be flushed enables this to be done on an as-needed basis. Data on the usage of taps can be analyzed and provide input on housekeeping and maintenance needs and by extension improve resource planning.



PAIN POINT 2:

POOR OVERSIGHT OF BUILDING INFRASTRUCTURE

Buildings contain multiple systems that are altered or updated continuously. That makes it difficult to retain full oversight of the systems within the building and the infrastructure itself.



There is a lot of information about a facility that could be useful. Unfortunately that information is often not documented in a good way. There is no database with historic data and changes made are not documented. Moving forward, we need to become better at putting up requirements on standards for the documentation format and structure of data”

– CXO, facility owner

PAIN POINT	DESCRIPTION	NON-DIGITAL APPROACH
LACKING DOCUMENTATION	Absent information on existing infrastructure (e.g. specifications on dimensions and materials) slow down progress during modernization programs	Analog documentation (e.g. building permits, contractual agreements, blueprints and drawings) Electronic correspondence (e.g. emails and field reports)
INEFFICIENT MAINTENANCE	Maintenance timing uncertainties result in either too early maintenance (wasteful time spent) or too late maintenance (asset non-functional for a period of time)	Mathematical formulas to optimize maintenance intervals based on historical asset failure statistics Reducing the means for tenants to report facility issues and failures
NON-OPTIMAL BUILDING PERFORMANCE	Unknown changes in performance and functionality of assets limits insights into what modernisation efforts and upgrades should be prioritised	Reviewing supplier documentation and specifications to gauge performance levels over time Expert inspections to create snapshot performance tests on key metrics (e.g. energy efficiency, indoor air quality, temperature and moisture)

In lengthy construction projects with many stakeholders, records or documentation administration is a challenge. As many buildings are expected to remain in operation for over 100 years it is not surprising that data and documents go astray along the way.

For facility owners preparing modernization programs and maintenance work, the only way is to go through whatever documentation is available: emails, blueprints, property inspections and so on. The consequences are challenging. Firstly, it is time-consuming to locate and analyze information as well as to make repeated, ad-hoc inspections. Secondly, unexpected technical failures are more frequent when building managers don't have access to technical data.

Digital copies of all prior documentation make a big difference. It is even better to have real-time data on the facility infrastructure to be able to improve processes and customize performance.

Connecting infrastructure allows effective management and repair by providing access to technical

data that can enable predictive or even prescriptive maintenance. Typically, maintenance is done in a reactive manner whereby technicians monitor a daily list of service requests, identify failure causes and remedy failures accordingly. Predictive maintenance on the other hand uses historical data to predict when a failure will occur. Prescriptive maintenance adds an additional layer of intelligence and recommends relevant corrective actions.

In addition to increasing employee productivity and reducing the frequency of failures, predictive and prescriptive maintenance help extend the equipment lifetime by identifying potential failures before they occur. Some sources have indicated savings of up to 30 percent when transitioning from reactive maintenance to predictive maintenance using data from sensors.

In the following section we outline currently available digital solutions that can help create better oversight of building infrastructure →

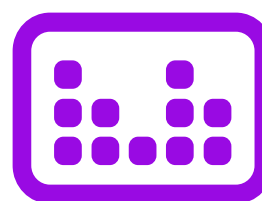
DIGITAL TWINS SHOW THE BIG PICTURE

A digital twin is a digital representation of physical things. In buildings, it enables full oversight of the status of the building and its component systems. The detail and granularity of this representation vary widely, from simple digital 2D models of a building to advanced 3D models containing granular data on the smallest of facility modules and their interactions. What they all have in common is that they are built on data. By using a live, digital replica of the real thing it is possible to monitor, model and simulate different scenarios and test new ideas without disrupting the physical environment.

In the construction phase, a digital twin can be used to control the work and later verify that the installations have been completed according to the original plan. Once the facility is operational, it can help optimize systems by testing different settings under different conditions. When selling a facility, a digital twin provides a layer of management granularity that can raise the potential value of the property.

While the value of a digital twin is clear, realizing its value requires high-quality data from a number of sources which may not currently be connected.

An initial data set is required to build the digital representation, and then continuous data flows are



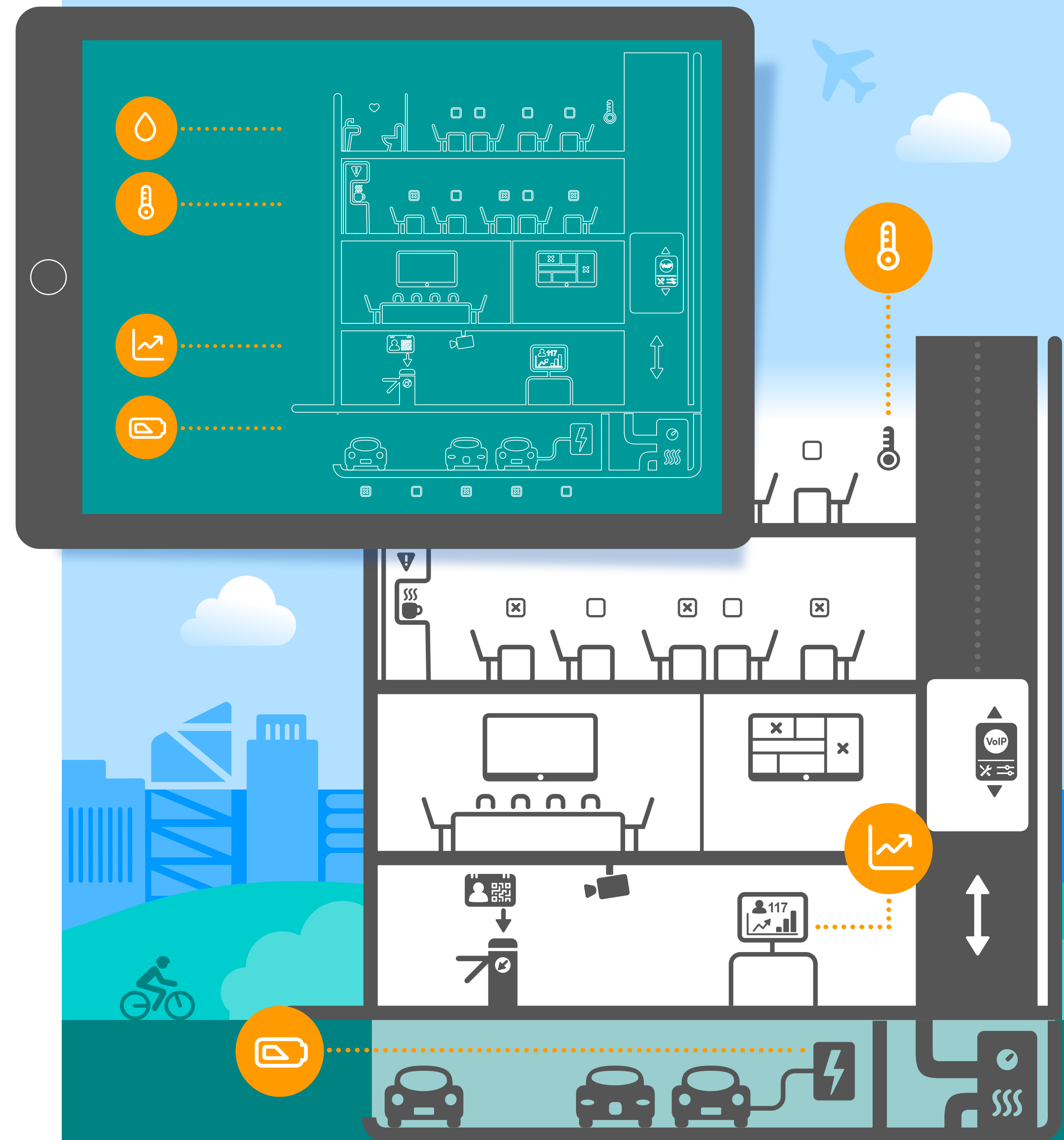
“By using a live, digital replica of the real thing it is possible to monitor, model and simulate different scenarios and test new ideas without disrupting the physical environment.”

needed to sustain relevance. During construction, the initial drawings provide the foundation for the twin, which can be handed over to the facility owner upon completion. However, information is more commonly not transferred smoothly and seamlessly. Moreover, there is often a lack of routines to update the model from the developer and hand it over to the next owner. During the building’s lifecycle, a lot of information is lost.

Developing digital twins for existing buildings is not any easier, as it takes time and effort to locate all the relevant facility information – dimensions, technical details, repair logs and reconstruction specifications and material and performance standards.

The business value of the digital twin in buildings needs proof, with most of the technology still in early stages. However, when deployed in assembly lines in manufacturing plants, digital twins have been estimated to generate cost reductions ranging from five to 15 percent. The reductions come from increased equipment utilization, less machine downtime and lowered quality costs. Some trials have combined the digital twin with virtual reality technologies allowing the user to step into the digital world and conduct virtual experiments with the surrounding digital objects.

Despite the challenges of this emergent technology, curiosity and expectations surrounding its potentials are high in the industry. Nevertheless, as digital twins rely on data from IoT-enabled solutions, facility owners would be wise to deploy solutions that gradually bring their facilities to new levels of intelligence and connectivity.



Økern Portal – A VIRTUAL GROUND-BREAKER

Illustrations 3D Estate, Lark Landskap and DARK Arkitekter

Companies that has been part of building the smartness of Økern Portal is Newsec, Stema, Tyréns, Telia and Cygate.

By its nature, Oslo Pension Insurance fund (OPF) makes long-term investments. That's why, when they laid out their vision for the Økern Portal building project, they set 'future-proof' as a criteria.

The starting point for OPF was to maximize sustainability and profitability by making it possible to optimize the efficiency of building operations and the comfort and satisfaction of its occupants. This would require building managers and service providers to receive data from all of the buildings systems and have the tools to fine-tune them in real time.

As the first foundations for the building were being laid, so were the foundations for its connectivity infrastructure. It would need the speed and security to meet tenants' business and leisure requirements today, and the flexibility to let them benefit from new possibilities that emerge in the future. As well as this, sensors were embedded throughout the building to

measure parameters such as temperature, humidity, light levels and room occupancy. This would enable each of the building's systems such as heating, lighting and room management to feed data into the building management system (BMS). By combining this real-time data with the digital Building Information Model (BIM) developed during construction, a 'live' digital representation of the building was created. This is what is referred to as a "digital twin".

A digital twin acts as an integration engine that collects, normalizes and standardizes data from each of the building's component systems so it can be used to understand and control the building in the most rational and sensible way.

Even small, seemingly insignificant pieces of data gain meaning at scale, such as which waste bins need emptying and which ones can wait. How many times an elevator door opens and closes predicts when it should be serviced. This enables predictive maintenance rather than risking service outages. It also enables both the building managers and the service providers to measure and assess service levels and KPIs.

It also creates a win-win-win for tenants, building managers and the environment. By enabling energy and cooling solutions to be optimized and automated, it delivers maximum comfort for occupants with minimal resource wastage. The building itself can also advise on smart space utilization – such as shared meeting rooms and how many parking spaces that are available. Locks will be connected to manage security and access. Connected waste management systems will notify when they need emptying.

Even the soap dispensers will be connected to show when they need to be filled.

The data in the digital twin will also enable simulation, prediction and extended analysis. The idea is that it should learn over time and provide more insight and smart recommendations as additional data sources are added. This may provide a basis for brand new business models and services. Oslo Pension Fund has invited other parties to collaborate on future projects with both educational and research environments.

Økern Portal's opens, as one of the most connected buildings in the world, to its first tenants in March 2021. And will be opened to the public later on in the autumn. If you happen to be in Oslo, it's well worth a visit. ■

Read more about the building at www.okernportal.no

PAIN POINT 3:

SECURITY AND ACCESS MANAGEMENT

Every building has occupants, suppliers and guests who each require different levels of access. Facility access management involves ever-changing tenants, lost keys, security concerns and administration while still providing timely access. Many facility owners have renewed their lock systems and replaced keys with tags to resolve some level of the complexity – many challenges remain.

PAIN POINT	DESCRIPTION	NON-DIGITAL APPROACH
GROWING ACCESS REQUIREMENTS	Increasing demands for temporary access to the facility premises from external parties such as grocery deliveries and home care services	No access to external parties, instead requiring tenants to open doors and escort visitors during their stay, or only allowing drop off deliveries outside premises
KEY MANAGEMENT	Cumbersome administration of keys, keeping records, occasional replacements and changed locks when lost	Limiting the supply of keys Charging administration fees to cover costs
SAFETY AND SECURITY	Tenants perceive a lack of security through an increased inflow and outflow of non-residents in and around the facility premises	Locked doors to restrict access Signs and cameras to discourage intrusion Mechanical keys replaced by secure electronic codes or pass tags



In the following section we outline currently available digital solutions that can help establish secure facility access management →

DIGITAL SOLUTIONS FOR SECURITY AND ACCESS MANAGEMENT

Balancing convenience with security in a building security context can be achieved using **smart locks**. These connect physical locks with a software application on end-user devices, usually smartphones.

Smart locks allow tenants to provide temporary access to visitors remotely and instantly. For example – the fast-growing food delivery company Foodora and its peers request brief access to facilities to complete their deliveries – instead of getting a door pincode or waiting for a tenant to open, they could be let in using a smart lock through a smartphone app. The same applies to maintenance crews and tradespeople who need access to carry out repairs.

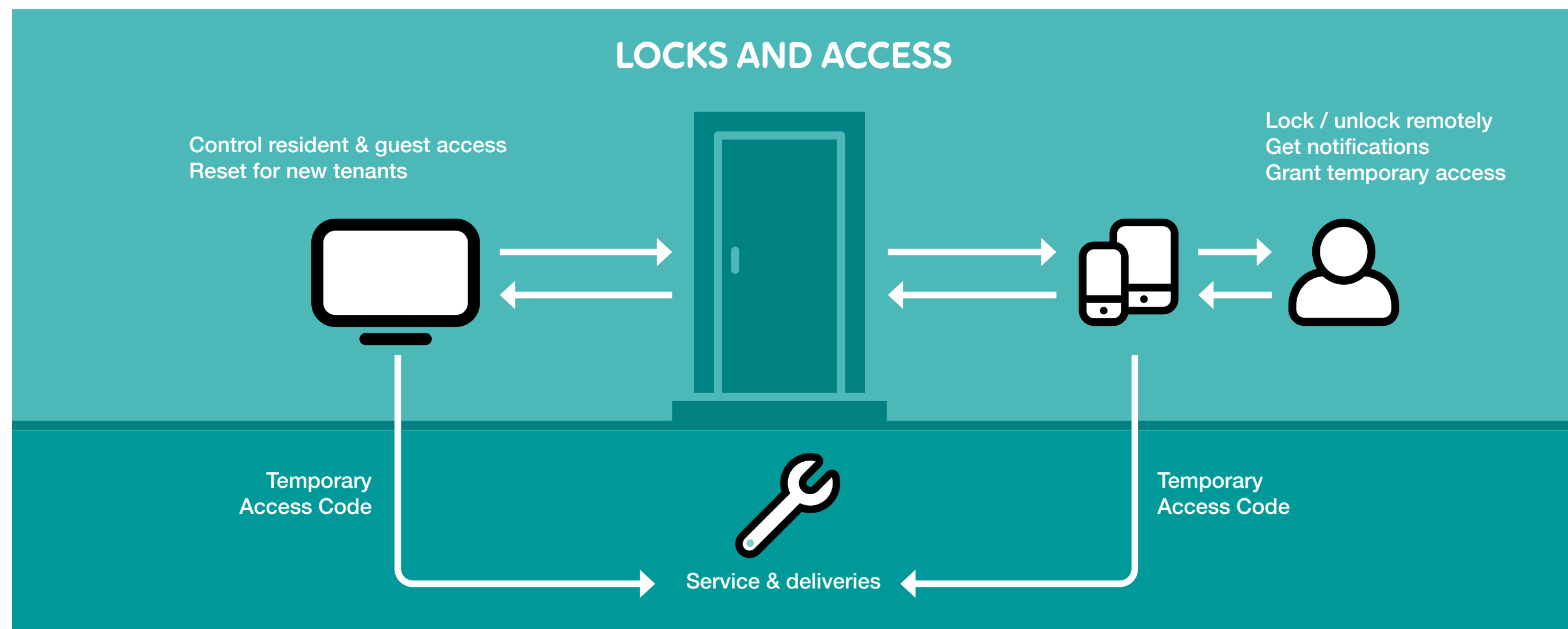
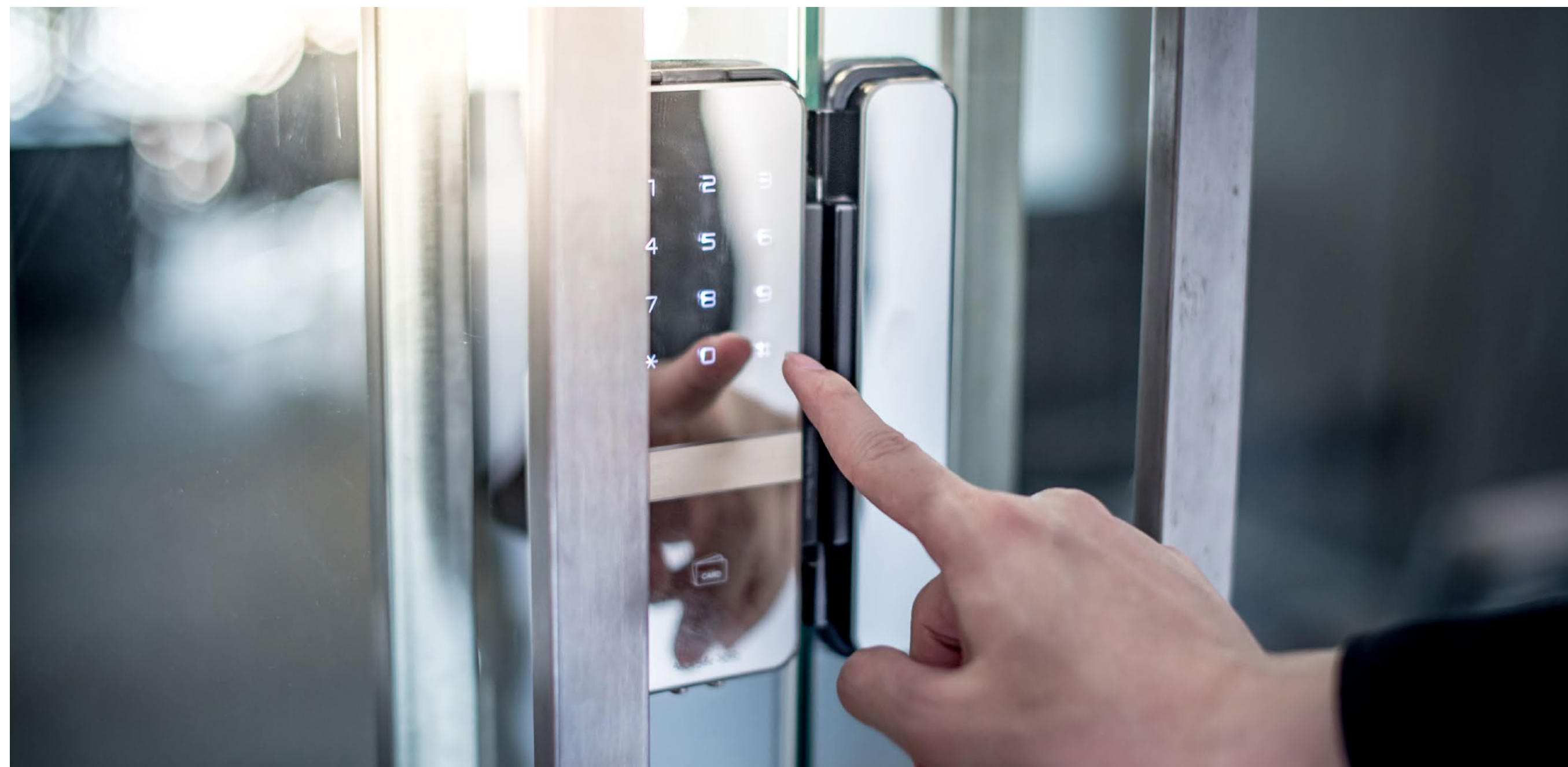
Smart locks also enable the tracking of entries and exits as well as the notifying of break-in attempts. By installing smart locks, facility owners can meet tenant needs at the same time as reducing their own administrative burden. In fact, over 60 percent of interviewees mentioned smart locks as most important in the long term, when comparing digital solutions.

Some facility owners have also opted to install **connected door and window sensors**, intruder motion sensors, and **remote video surveillance** to improve building safety. Some of these solutions can integrate data from all connected things (locks, windows, doors, cameras in hallways etc.) and use intelligent systems to send alerts. With image analysis and pattern recognition, the surveillance can shed light on what, where, and how security breaches occur.



Tenant behaviors are changing. We see more deliveries of both products and services to the home, and more people needing access to the building”

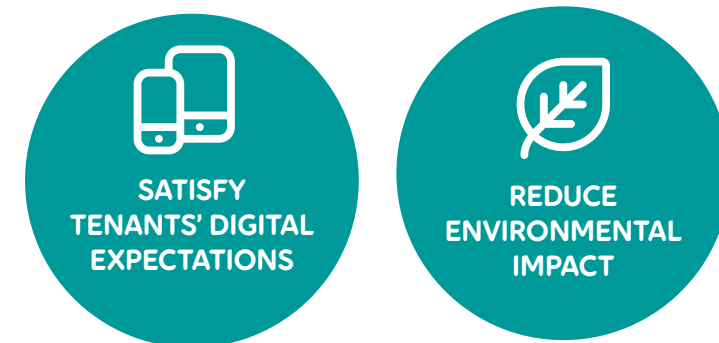
– Scandinavian facility owner



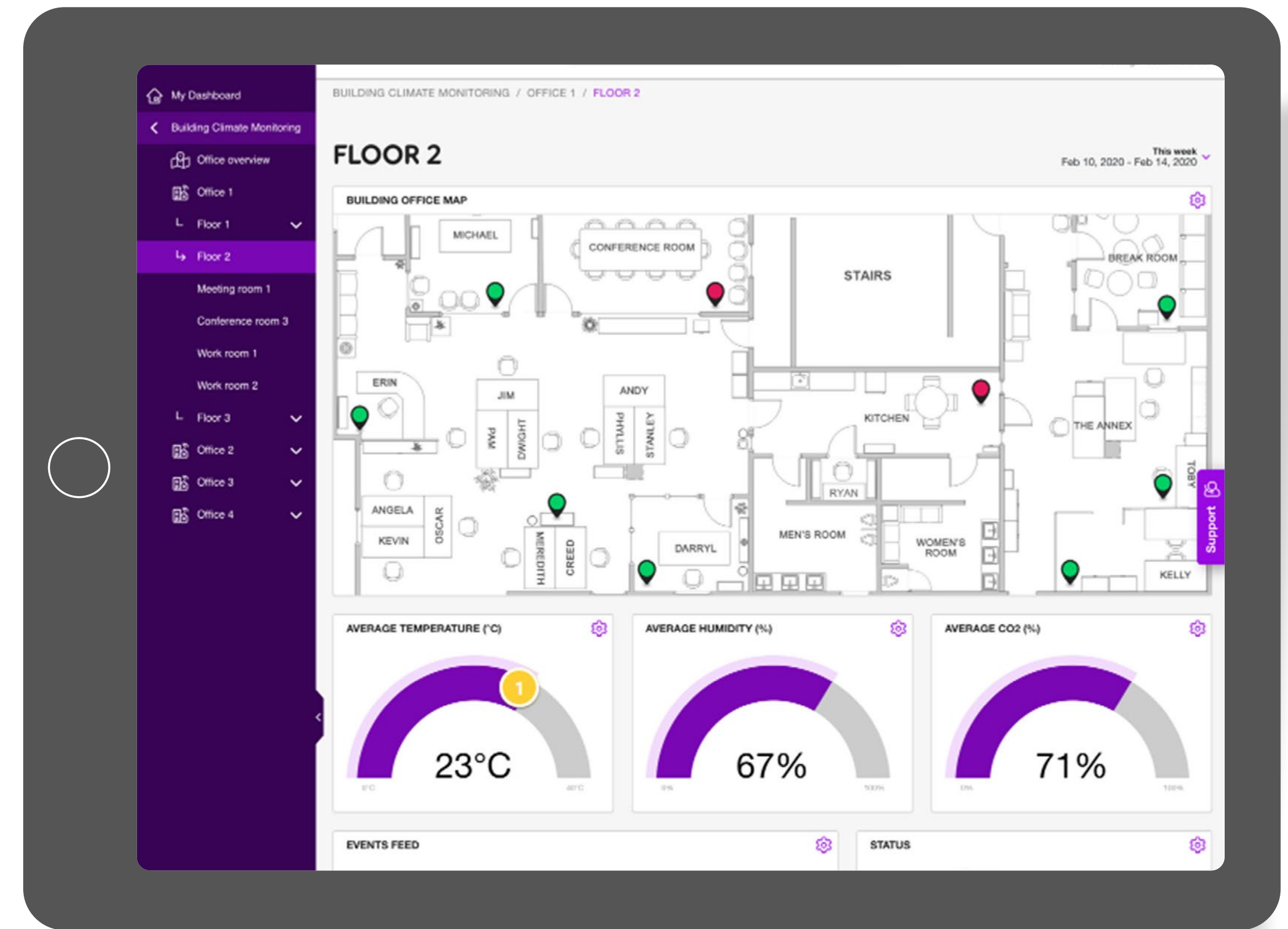
PAIN POINT 4:

INEFFICIENT USAGE OF FACILITIES & ASSETS

From meeting rooms to laundry machines, shared facilities are difficult to manage.



PAIN POINT	DESCRIPTION	NON-DIGITAL APPROACH
MISSING INFORMATION ON VACANCIES	Tenants are unable to access real time information on meeting room vacancies with ease leading to wasted time searching and scheduling	Electronic interfaces or analog paper sheets with monthly schedule printed outside conference rooms Online software with access to scheduling data for an overview of vacancy
(PERCEIVED) INSUFFICIENT ROOM CAPACITY	Ineffective scheduling systems leads to over-booking, where booked rooms remain available while groups are unable to find available rooms at the same time	Dedicated room scheduling software or work-arounds with email scheduling “House rules” to promote mindful scheduling habits Associated fees when booking and rebooking rooms
UNUSED SPACES	Difficulty to leverage existing facility premises as demand is fluctuating, leading to occasional periods of unused spaces	Best effort assumptions on demand to gauge required dimensions and capacity requirements Room “lockdowns” to reduce the need for maintenance and housekeeping



Make the most of what you have got! By connecting your building, its rooms and assets, you can see which meeting rooms or work stations that are being used and identify underused spaces. You will also be able to always keep track of where your valuable goods are – all in real-time.

Many office workers are familiar with the problem of fully booked but still empty meeting rooms. Analog solutions include weekly schedules posted on doors, “house rules” to guide appropriate scheduling behavior and fees associated with room cancellations.

Other shared equipment presents a secondary level of complexity, as the equipment can be moved. From hospital wheelchairs to carpools, it is not just

a matter of knowing if they are available, but also where they are.

Again, we find that a lack of data is the core problem when it comes to optimized scheduling and utilization.

In the following section we outline currently available digital solutions that can help optimize the usage of the building and its assets →

DIGITAL SOLUTIONS TO OPTIMIZE THE USAGE OF THE FACILITIES AND ASSETS

Crowd movement data and other digital solutions are on the rise and vitally important for the future of facility management. Here we look at some examples.

Real-time movement sensors make it possible to detect which meeting rooms are in use. This data can be fed back into a centralized booking system and rooms that have been booked but not used can be reallocated. This also generates data about how often rooms are used, and for what duration. This data can also be fed into lighting and temperature systems to optimize energy efficiency. For example, air conditioning could be turned on five minutes before a booking or triggered by movement if not booked.

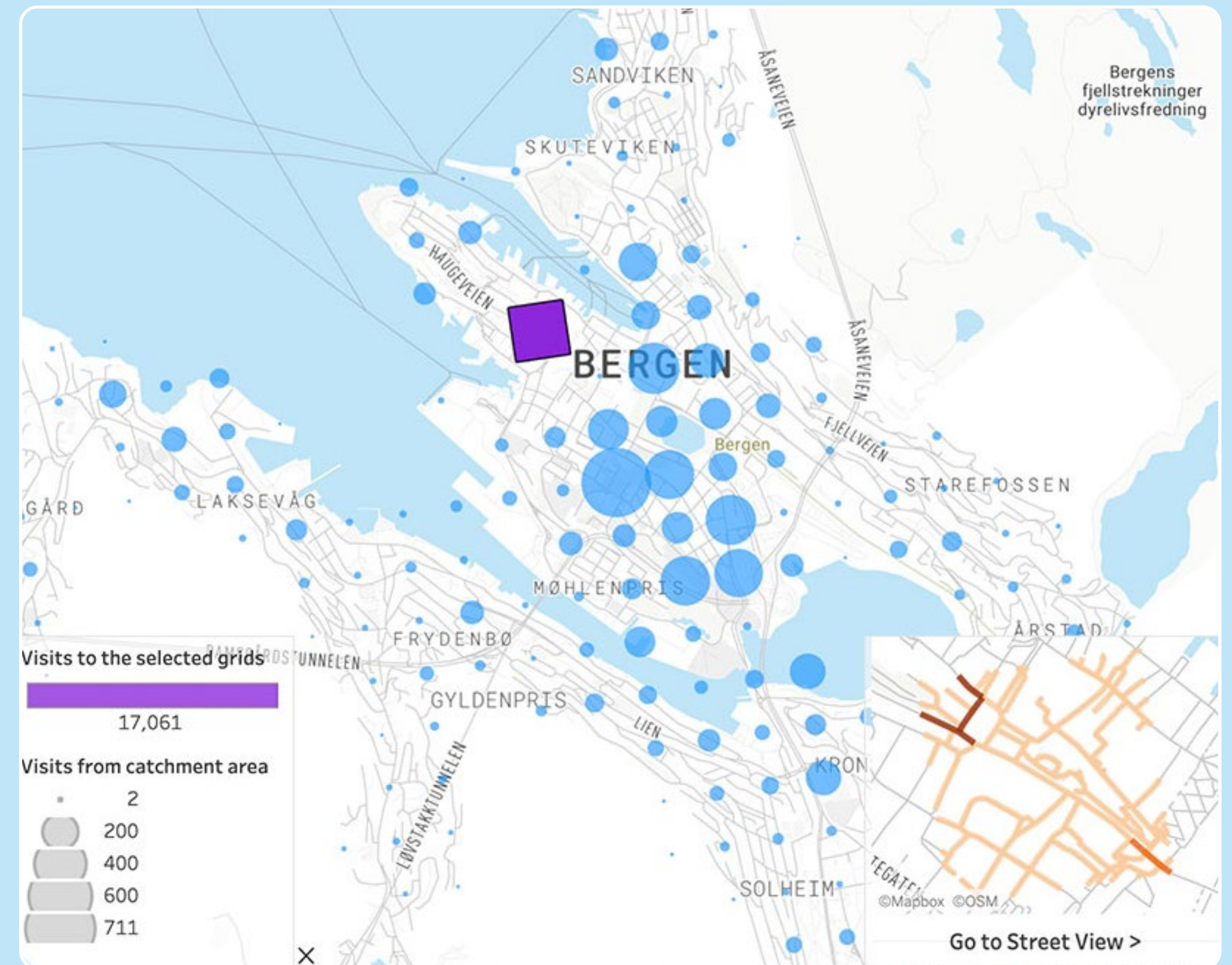
LOCATION INSIGHTS

Crowd movement data represents one of the most promising tools for the real estate industry. By analyzing anonymized data from mobile devices moving within cellular networks, it is possible to identify how many people are in different locations at different times. This provides insights about, for example, which locations have the most pedestrian traffic. Crowd movement data can also determine how and where people travel. These insights can be valuable to facility owners, development companies, municipalities, facility management companies and retailers.

Crowd movement analysis offers a lot of value for facility owners who are involved in urban design planning. It enables them to predict the effect on a neighborhood of different building types, parking lots, urban parks and so on.

Newsec, a full-service property firm, uses crowd movement data in Finland to gain better insight into crowd movements. Several **municipalities in the Nordics and Baltics** are also looking at the use of crowd movement data to monitor the impact of city development.

Another application area for crowd movement data is for store and restaurant owners, who might use data on the number of people passing their location, as well as the number of people entering, to optimize their business and measure the impact of changes. That data can be combined with data on the share of customers that end up buying something, to understand the impact of seasonal campaigns or how interior redesign influences the customers' willingness to buy. This helps brick and mortar stores get on par with their e-commerce equivalents, who have long had an information advantage with access to customer data derived from their web sites traffic.



Norway >

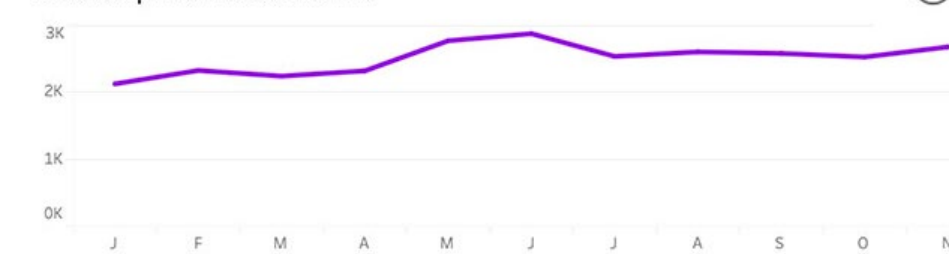
Klosteret

3 cafes, 5 restaurants, 2 stores,

2,501

Area visits per day

Development over time



Visitors





Crowd movement data can also be used by facility owners to determine the rent cost, by showing the potential number of customers passing by a store location.

Crowd movement data is indeed a growing area and its importance will only increase as the number of ways to extract insights increases.

Whereas crowd movement data gives insights of people's movement patterns, IoT insights combine large volumes of data from multiple sources to enable advanced analytics. IoT insights become even more meaningful when used in conjunction with predictive maintenance, which relies on large volumes of data to accurately predict failure. However, specific technical failures in a facility occur very few times leading to limited historical data unless it can draw learnings from other similar installations in other facilities. Most of all, IoT insights allow for the rapid scaling of many IoT-enabled solutions as they immediately get fueled by data from other sources to generate insights from the get-go.



Paired with our own, transactional data we could easily see what our sales conversion rate was. We were able to break this down into an hour-by-hour and day-by-day analysis which helped us build a better strategy around our future events; including location, timing and how many days we should be open. It allowed us to move away from assumptions and focus on the reality of it."

- Head of Ecommerce at Klättermusen

CASE STUDY

Scandic Hotels using Crowd Insights to understand customer potential



Scandic Hotels in Tampere, Finland, used Telia Crowd Insights to identify where potential customers came from and where to target their sales and marketing efforts in order to attract them.

Questions that the hotel chain needed the answer to were: How many guests arrive from out of town? How many stay overnight in Tampere? In what areas of the city do they stay? Where do the people come from and where do they spend their days when visiting Tampere?

To find answers, Scandic combined Telia's data with their own customer data. "We got a very clear picture of the unrealized customer potential when we combined our data to see how many people stayed outside our hotel but within the area" says Christian Borg, Commercial Director, Scandic Hotels Group, Finland.

WHY DATA PRIVACY IS BUSINESS-CRITICAL

If you work with people’s data, you have the responsibility for protecting it. That is the clear message coming not just from regulators, but also from consumers themselves. With increasing scrutiny of the way companies use, process and protect their customers’ data; privacy has become business-critical.

This responsibility also extends beyond the company itself and includes the suppliers and sub-contractors it uses. This entails a need to understand where the data come from and the processes by which is collected, analyzed and used. On top of this, it is also very important to be able to trust the quality of the data used to make business decisions. The data source needs to be: accountable, transparent and explainable. Telia Crowd Insights provides an example of how data can be provided in a way that enables both transparency and privacy at the same time.

Because they collect and protect the data of millions of subscribers every day, data privacy is very much part of Telia’s core business. Crowd Insights uses only a small and specific sub-set of the data generated by Telia’s mobile network. This data is extracted according to strict ‘purpose limitation’ principles. This means only the specific data required is extracted and this is done according to privacy-by-design practices that ensure that subscribers’ privacy is protected.

As 16 million mobile devices move between base stations in the network, they automatically generate location data. On average, this is between 200 and 400 signals per device per day – which adds up to billions of data points. These reveal how many people are in specific locations at a given time, and what general movement patterns people have. To ensure the privacy of subscribers, individual device data is not extracted. Instead, aggregated data sets are extracted when 5 or more devices have the same generalized movement pattern between location ‘grids’ in a city.

The data extracted is completely anonymized. It does not reveal any device-specific details about which websites people visit, who they talk to or anything else that could be used to identify an individual. Instead, only the relevant time stamps and radio cell IDs are extracted. This is enough to measure how many people were in a specific location at a given time – and how many people exhibit the same movement patterns between different location grids. All storage, anonymization and aggregation processes are done according to GDPR and ePrivacy requirements as well as Telia’s own ethical business standards. Getting data privacy right takes some effort, but the cost of getting it wrong makes it worthwhile.

GUIDING PRINCIPLES FOR TRUSTED AND ETHICAL AI



Artificial Intelligence (AI) and advanced analytics offer the opportunity for increased efficiency, shared value creation and the growth of societies. Customers can benefit from smarter services and improved experiences. Companies can optimize production, supply chains and sales. AI will lead to widespread changes in many areas, such as productivity rates and the transformation of job markets. These changes need to be addressed in proactive and respectful ways. Trust is a prerequisite for fully harvesting the benefits of AI, for all stakeholders. Anyone deploying AI should, again, be transparent, accountable and responsible in every aspect.

To promote the ability of AI to extend and complement human abilities rather than lessen or restrict them, Telia Company provides the following Guiding Principles for its operations and employees regarding proactive design, implementation, testing, use and follow-up of AI.

***TELIA COMPANY DEFINITIONS OF KEY TERMS**

Aggregated ('grouped') data
= Grouping of underlying data to significantly reduce the risk of reidentification of individuals when combined with other data sources.

Anonymized data
= Data where characteristics that can be used to identify individuals have been removed. Anonymized data contains no personal information.

Telia Crowd Insights
= Telia’s commercially available solution for anonymous and aggregated movement pattern insights. It is used by municipalities and city planners as well as commercial customers such as retailers and building managers to understand crowd movements.

PAIN POINT 5:

NEW DIGITAL NATIVE COMPETITORS

The digital age has seen many disruptions in the real-estate and facility management sector. New competing business models have emerged that use digital platforms to enable secondary markets. These range from WeWork and Air BnB in the short term to a multitude of platforms where second-hand leases can be easily offered.

As customers move to these platforms to manage their facility service needs, facility owners risk losing customer insights. Their internal capabilities to address their customers' needs may

thereby erode over time. In addition, many facility owners consider this a lost opportunity to develop similar digital services of their own.

PAIN POINT	DESCRIPTION	NON-DIGITAL APPROACH
LOSING GRIP OF CUSTOMERS	With customers choosing other channels (secondary markets) to make rental deals, facility owners are left out and lose out on customer intel and branding awareness	<ul style="list-style-type: none"> Customer surveys to keep up with expectations Dedicated key account managers for largest customers Newsletters and various external marketing efforts
LOST REVENUE OPPORTUNITIES	By not having access to the end customers, facility owners fail to see, learn and develop new revenue streams and pricing models	Strengthen attractiveness of the buildings through building upgrades, marketing, lobbying to promote public measures to increase attractiveness of location
NEW CAPABILITY REQUIREMENTS	Knowledge of new prominent business models based on modern technologies are not infused in the organization and thus risk outdate internal competences over time	<ul style="list-style-type: none"> Wait for next generation of workforce to enter the market Occasional internal training programs and recruitment measures





SATISFY
TENANTS' DIGITAL
EXPECTATIONS



IDENTIFY
NEW REVENUE
OPPORTUNITIES



REDUCE
OPERATIONAL
COSTS



REDUCE
ENVIRONMENTAL
IMPACT

ADDRESSING DIGITAL NATIVE COMPETITORS

As the industry moves towards digitalization, the ability to generate revenue from new digital – and particularly data – services is seen as an area of high potential by the interviewees.

However, new business models continue to emerge from new digital native companies that target value-added services with a value proposition of reducing the barriers of renting, leasing and providing flexible facility-related services.

Facility owners risk getting left behind and losing access to the data and the relationships needed to evolve their services.

DIGITAL LOGIC FOR THE PHYSICAL SPACE

To choose the right location, negotiate rent levels, focus marketing and benchmark against competitors is challenging for anyone renting space as well as for facility owners. But there are easy ways to gain real and relevant insights, as data is transforming all areas in society.

Having the facts when it comes to seasonal visitor trends for different locations makes your location more relevant. The insights from crowd data can help you target customers and make decisions, as well as running more feasible negotiations about rents and conditions.

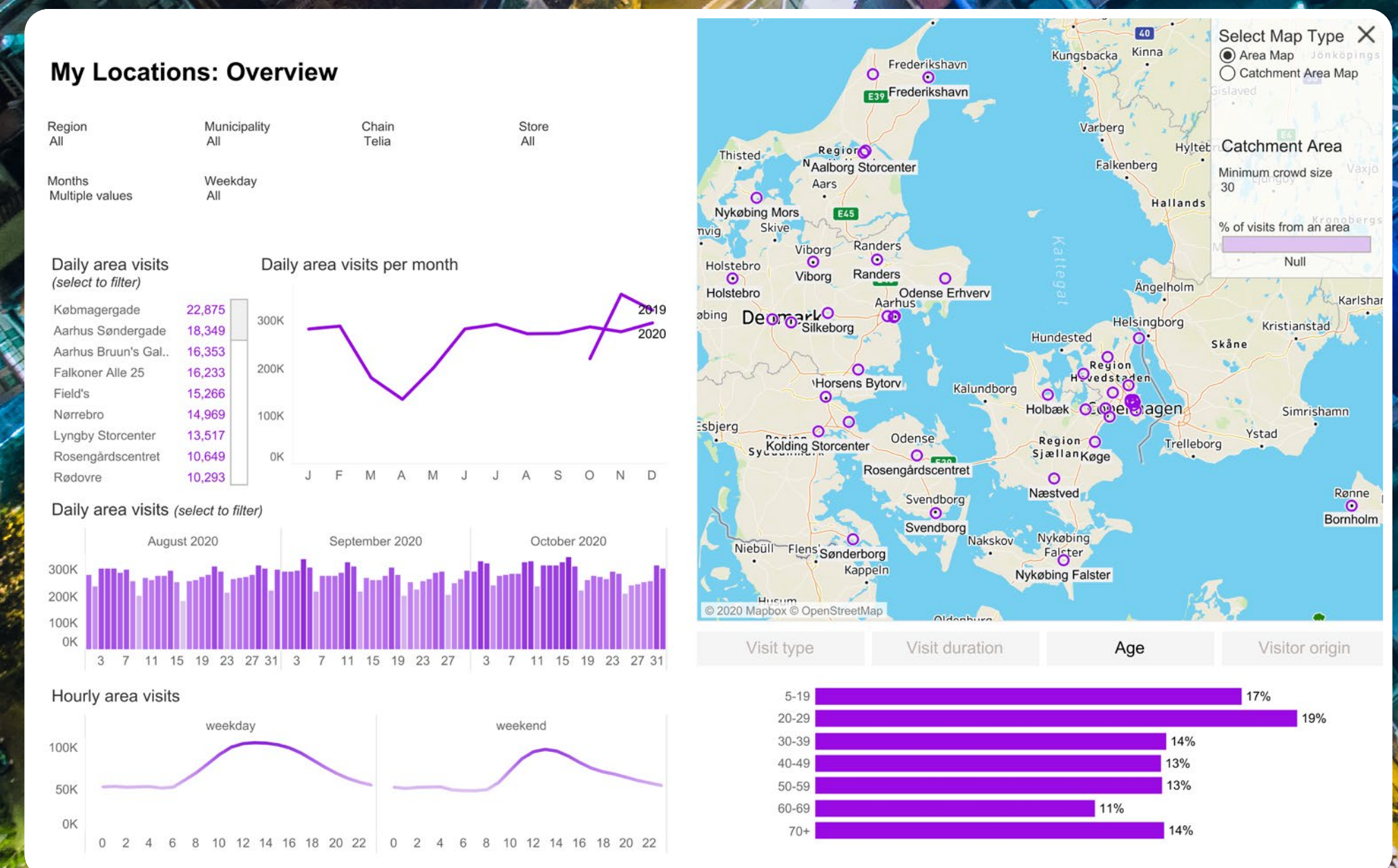
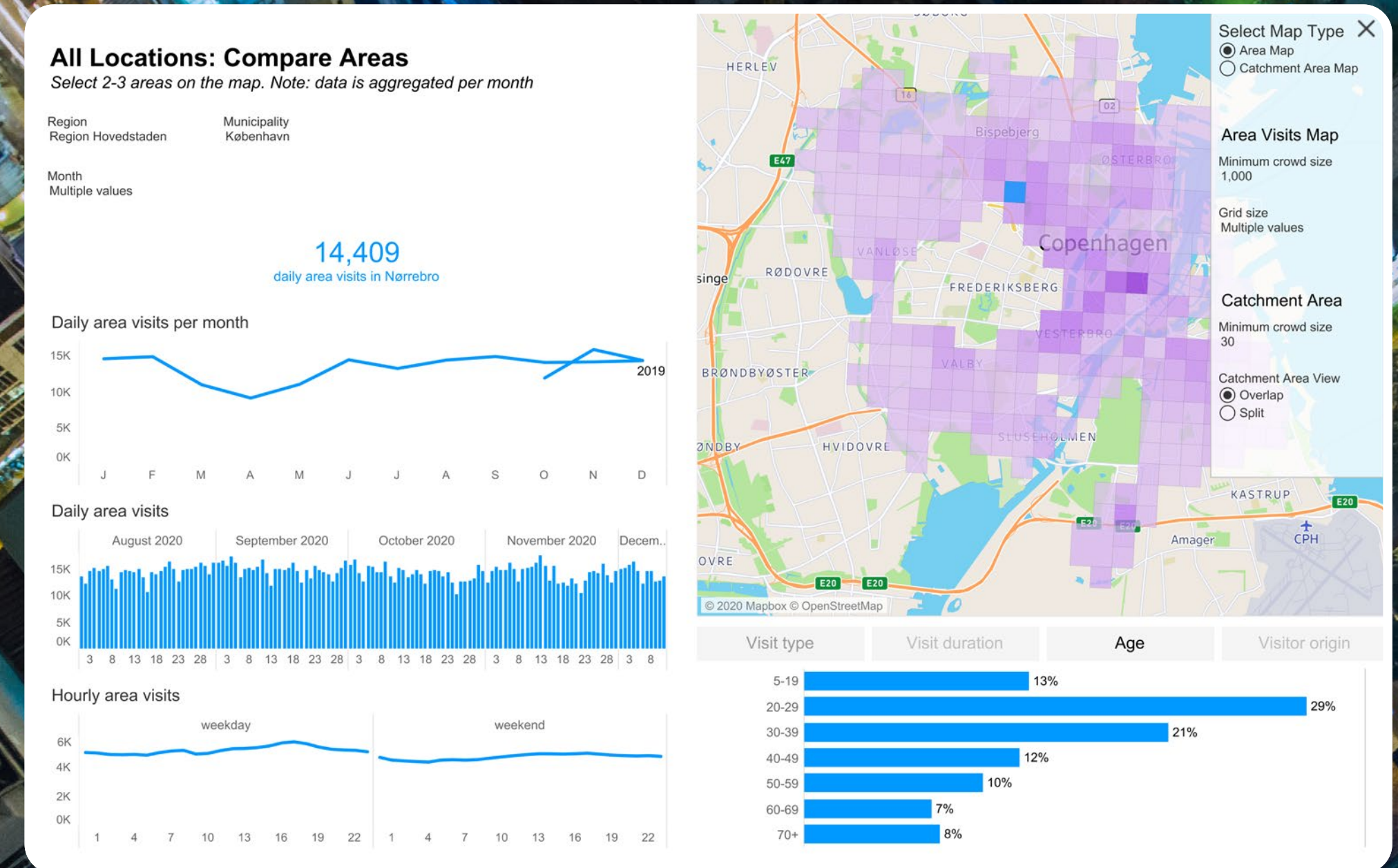
Insights into where people come from and where they are going after a visit to one of your locations

enables you to define trends and identify areas to optimize when it comes to marketing efforts and campaigns. By adding demographics to the mix, a business can, for example, learn which locations have the largest share of high-income visitors or what the other demographics look like.

Combining external data sources with internal data, such as store-specific offers, you can make more informed decisions and optimize the location's performance.

NEXT STEP

In the following section we describe the steps that facility owners and managers can take to come out on the right side of digitalization.

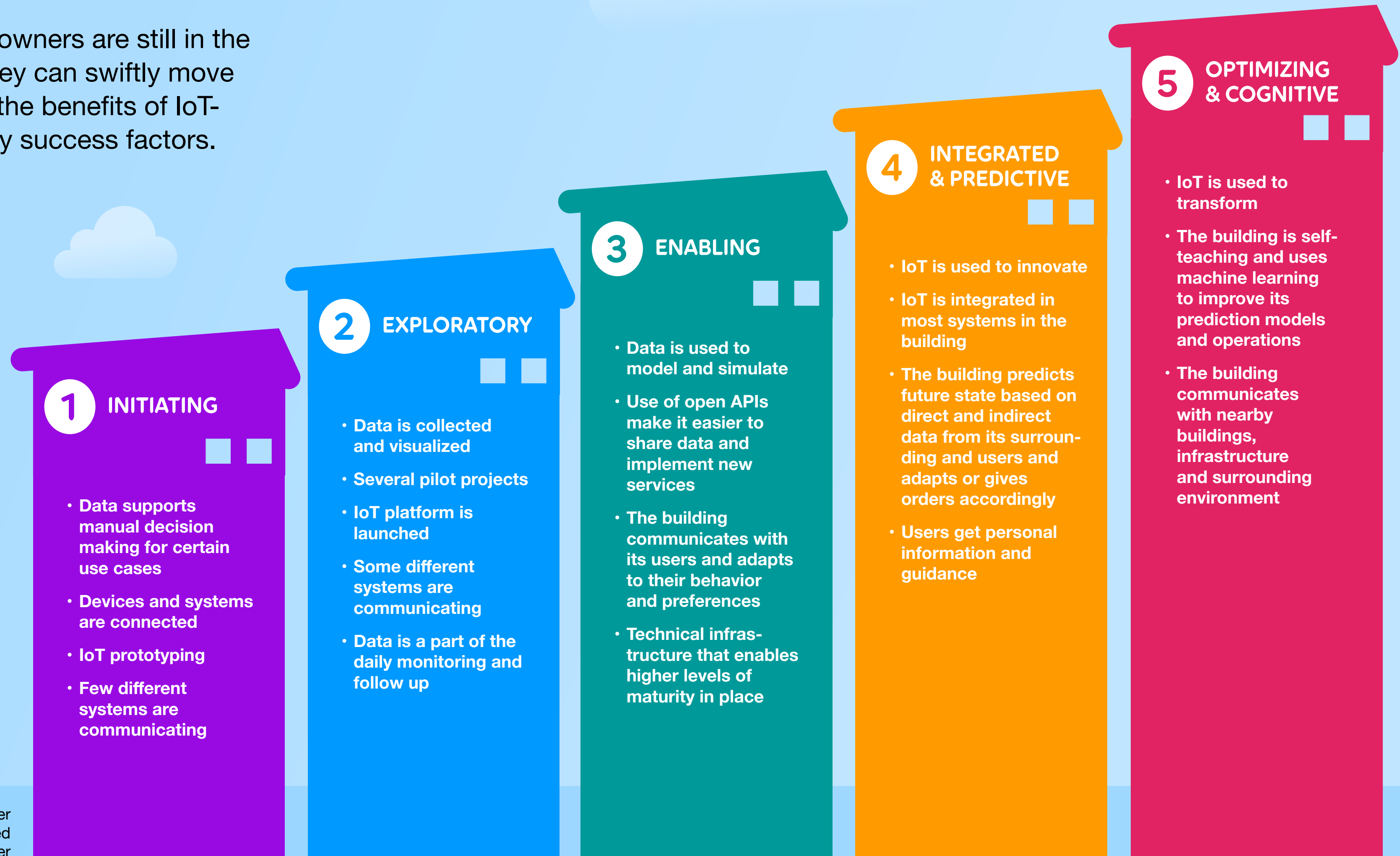


MOVING UP THE IOT MATURITY LADDER

Over 70 percent of Nordic and Baltic facility owners are still in the early stages of their IoT journey. However, they can swiftly move up the IoT maturity ladder, gradually seizing the benefits of IoT-enabled solutions, by adapting to a set of key success factors.

By increasing their recruitment efforts, initiating internal training programs and developing an innovative mindset in line with the digital era, they can access the right competence and overcome conservative traits. Collaboration with peers enables broad data usage by setting common requirements for suppliers and sharing lessons learned. Meanwhile, sticking to focused use case deployments enables learning in small, manageable steps, allowing any facility owner to gain traction with moderate efforts.

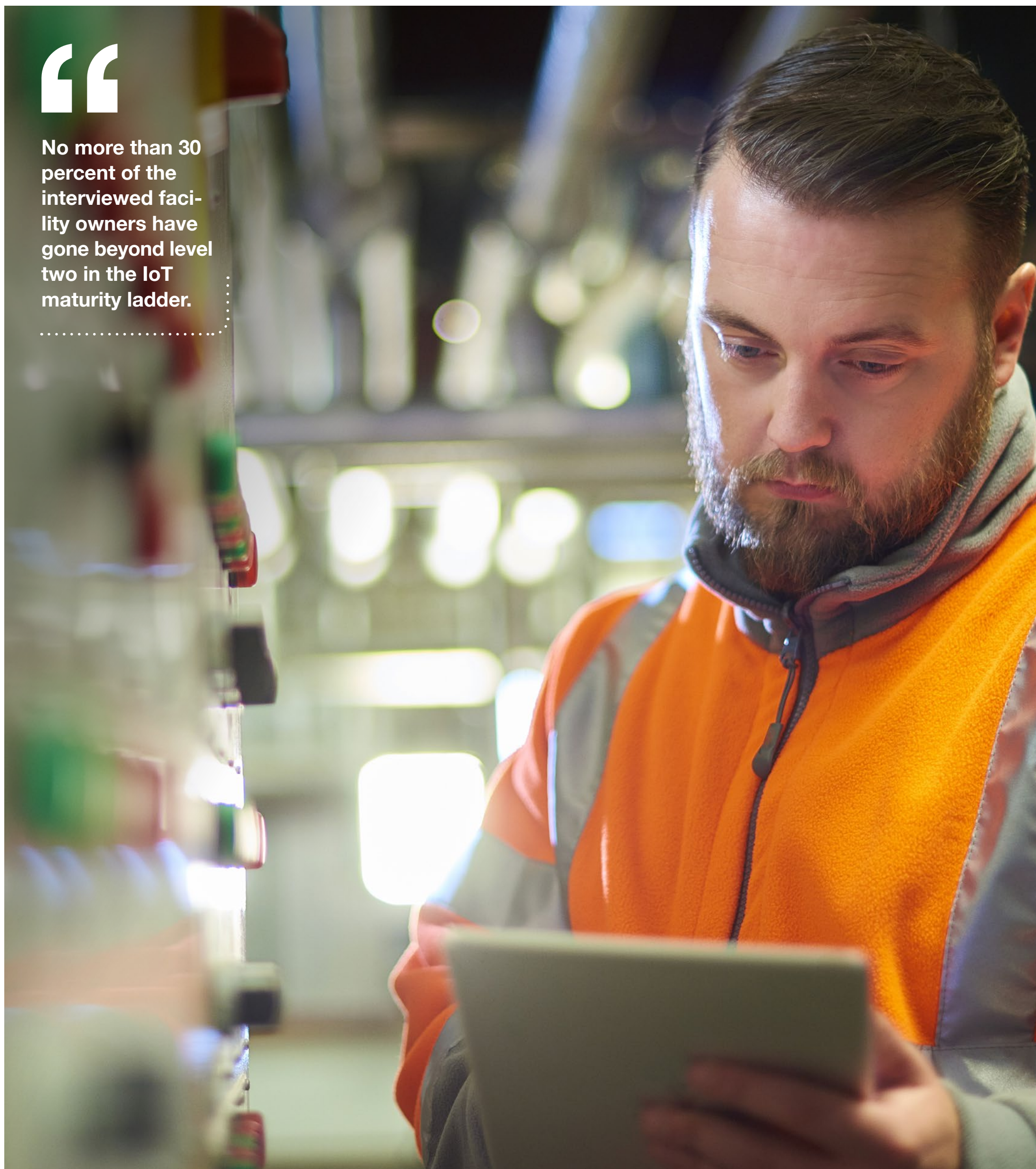
Capturing the value of IoT-enabled solutions is done gradually by moving up the five levels of the IoT maturity ladder for buildings as illustrated on the previous page. To manage this climb, an initial set of basic prerequisites should be considered, and appropriate actions taken. Subsequent growth is enabled by adhering to a set of key success factors.



Illustrative IoT maturity ladder
– capabilities are accumulated going up the ladder



No more than 30 percent of the interviewed facility owners have gone beyond level two in the IoT maturity ladder.



PREREQUISITES FOR SUCCESS

There are three prerequisites to consider before commencing the IoT journey:

1. UNDERSTANDING BASIC TECHNICAL PRECONDITIONS
2. ACCESSING THE RIGHT COMPETENCE
3. DEVELOPING AN INNOVATIVE MINDSET

The term “basic technical preconditions” refers to the building’s technical infrastructure and systems, and to the extent to which they can easily be connected and used with IoT-enabled solutions. While all buildings can be modernized, older buildings may face a costlier journey. An understanding of these preconditions is key to charting a feasible IoT direction.

Facility owners require the right competence for, and understanding of, both the technology and the operational aspects of the real estate industry. This combination is scarce today, as recruiting is mainly done from within the industry – best exemplified by the Swedish real estate industry having only 13 percent of its recruitments from other industries in 2018. Therefore, skills related to digitalization, technology, and data analysis are not acquired and spread internally. To access the right competence,

companies can both broaden the search for candidates and offer development initiatives and training for current staff.

A mindset for innovation is highly useful to counter the industry’s generally conservative ways. The 100-year time span of investment plans is a stark contrast to the fast-changing digital landscape. In addition, facility owners’ service offering has barely changed at all during the last century. Those who are willing to adapt to new ways of thinking and working stand to benefit from new opportunities provided by IoT-enabled solutions.



It is hard to find staff with the right technical competence. Working operationally with digital facility management requires a different profile and it is also challenging to get employees to change their current ways of working”

– CXO, Swedish facility owner

Tillväxtverket, 2018


FOUR KEY FACTORS TO SUCCEED WITH DIGITALIZATION

With the prerequisites appropriately considered, facility owners can start moving up the IoT maturity ladder in accordance with their ambition. For most, reaching level three would be a major change, while level four and five could serve as a longer-term ambition for now.

Based on lessons learned within the industry, the following key success factors were identified. These are covered in more detail in the section that follows.



COLLABORATIVE
Work together with industry peers to accelerate progress



OPEN
Standardize and share for mutual benefit



FOCUSED
Prioritize, start small and be ready to scale



ALIGNED
Develop your organization as well as your technology



COLLABORATIVE

Collaboration will help facility owners increase their IoT maturity by integrating lessons learned from peers. In addition, common requirements and standards can be agreed upon that promote scalability and integration of solutions.

By collaborating closely with suppliers, facility owners can more easily access the sought-after combination of industry savvy and technological know-how. Solutions that cater to tenants' needs, while educating the organization in the process, increase the chances of succeeding with the technical deployment.

Furthermore, the willingness to collaborate among facility owners is high compared to that of other industries. For example, several industry stakeholders in Norway have committed to a set of common principles for their digitalization efforts. This collaborative spirit can be leveraged to share experience as well as agree on technical specifications, data standards and other functional supplier requirements. Moreover, work efforts can be shared, and the strong bargaining power of collaborating facility owners compels suppliers to adhere to the demands.



OPEN

To capture and scale IoT-enabled solutions, data needs to be standardized, self-owned, accessible and readily shared to reduce time and effort. This remains a key challenge for the industry, as data is often siloed – locked within suppliers' proprietary systems. As data is considered a valuable asset, suppliers may not allow access unless required, so facility owners must set the requirements during procurements.

90 percent of interviewees ranked openness as the most important purchasing criteria, both in terms of access to the data and in working with suppliers. Still, many facility owners need to close the gap by enabling:

- Ownership of the raw data to allow use and reuse as required
- Standardized data, across definitions, data formats, models, and structure to enable easy comparison and combination
- Open data that permits data to be easily shared between personnel and integrated between systems

The value and status of data in the real estate industry are presented in the illustration on page 36. By fulfilling these criteria, facility owners can automate or radically reduce the time-consuming and tedious data processing prework. More importantly, facility owners have a better chance of combining data from various sources to use more advanced predictive models. This grows in importance moving further up the IoT maturity ladder, as the complexity and number of systems increase.



FOCUSED

In pilot projects, facility owners test IoT-enabled solutions for specific areas, in smaller scale and scope to limit complexity and generate quick results. Implementing solutions stepwise and one at a time enables continuous evaluation of benefits and avoids strain on the organization. IoT enthusiasts face less resistance and can eventually get the rest of the organization onboard more easily. Furthermore, focused pilots enable facility owners to learn and adjust their business, in small manageable steps, to the new type of procurement and ways of working.

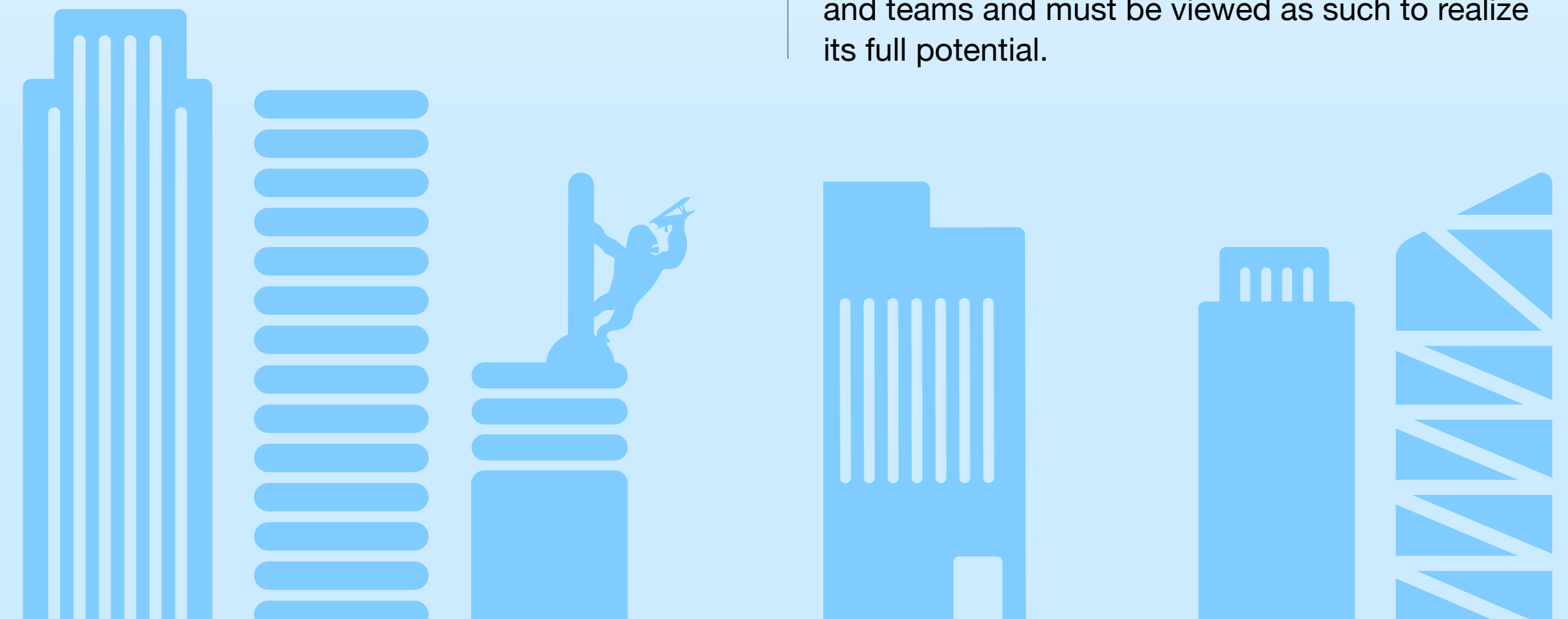


ALIGNED

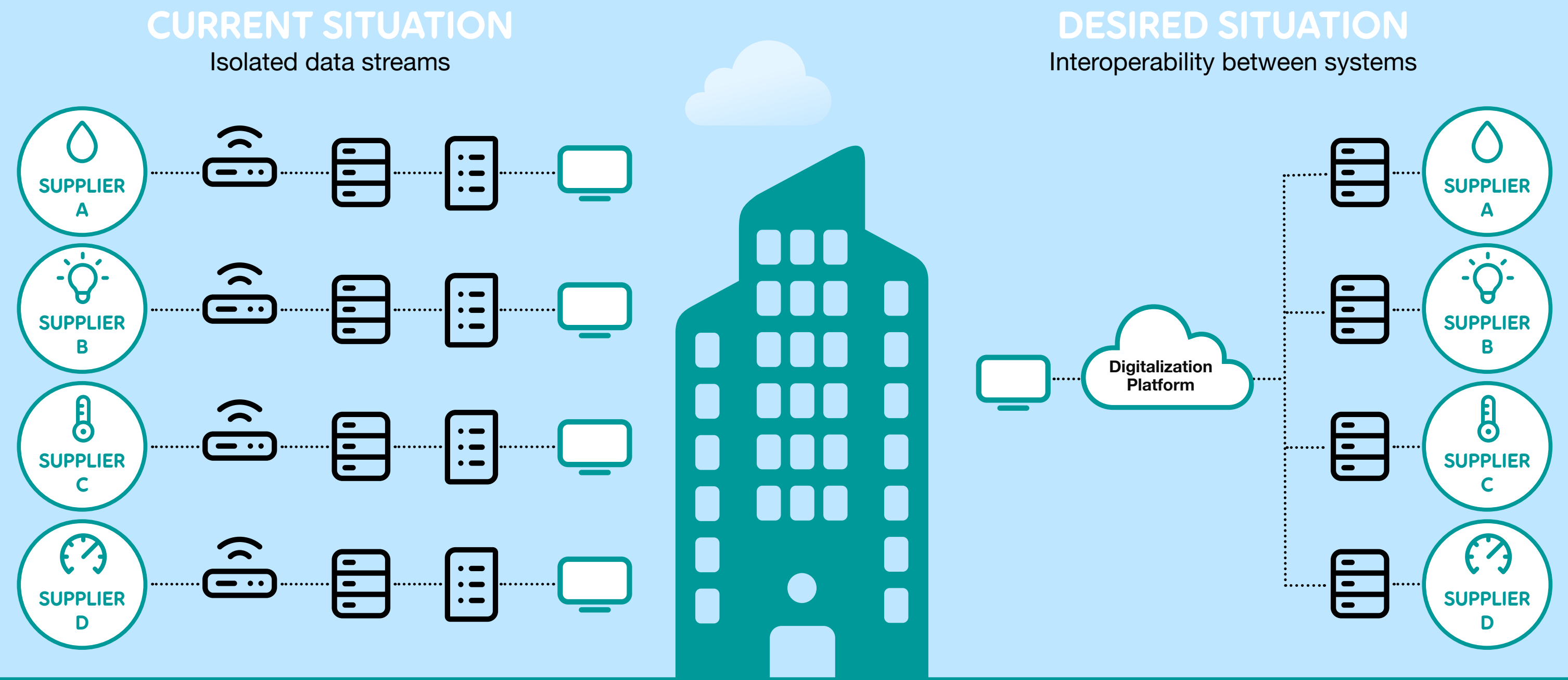
Regardless of their technical potential, the value of IoT-enabled solutions is unlocked only when used in the right way. Hence, to enable solution scaling beyond a pilot, the organization needs to change. The transition towards a more digital and data-driven approach begins with an innovative mindset and continues with active engagement and change management.

To this end, facility owners may have to recruit but, more importantly, they have to develop and train the workforce. Change does not come easily, and systematic work is required over long periods of time.

Unless managed properly, the benefits of IoT-enabled solutions will remain limited, as the solutions and newfound data will not be used outside the few business units directly involved in the deployments. As for digitalization in general, the potential of IoT intersects all functions, units and teams and must be viewed as such to realize its full potential.



DATA VALUE IS LOST IN ISOLATION



As we have realized by now, facilities have a wide array of infrastructures and electronics that can be combined and connected to transmit real-time data. Collectively the systems used to manage the security, life systems, facility management, and energy performance of buildings account for over 50-70 bnEURO globally. In addition, tenants, staff, residents, visitors and other facility users leave traces through their connected handheld devices. The amount of data that could be amassed is immense. What data then, and why would a facility owner, facility manager, or resident make the effort?

Data has the quality of increasing in value at the rate it is compared and contrasted to other data. An observation, a time, and a place make more sense together than either of the data points analyzed individually. More practically speaking, the

temperature in a facility is relevant once compared over time, across different rooms, and in respect of when it is used. Such a context permits optimization of heating and ventilation in order to spare the environment while saving costs. Data from complementary systems such as lighting and outlets could further supplement energy consumption awareness and insights. Moreover, the usage of these systems can indirectly provide insights in behavioral patterns used for future planning, system control, or changes to the property layout, etc.

Yet, to date we have not seen many successful cases of integrated data streams, fact-based decision making, and applied analytical tools in the real estate industry. Being a truly data driven organization remains fiction for many players in the industry. Not only is it difficult to recognize applica-

tions for all possible data streams, but even when application areas can be conceived, facility owners across all categories point to the same underlying issue – a lack of openness.

The figure above portrays a typical facility with multiple non-integrated modules, typically procured separately. Such modules, when connected, can typically only deliver isolated data streams related to their operating data and related metrics. The data is usually delivered in a visual format with charts, aggregated and readable only by using a proprietary system. After all, suppliers are incentivised to create lock-in effects through development of such systems.

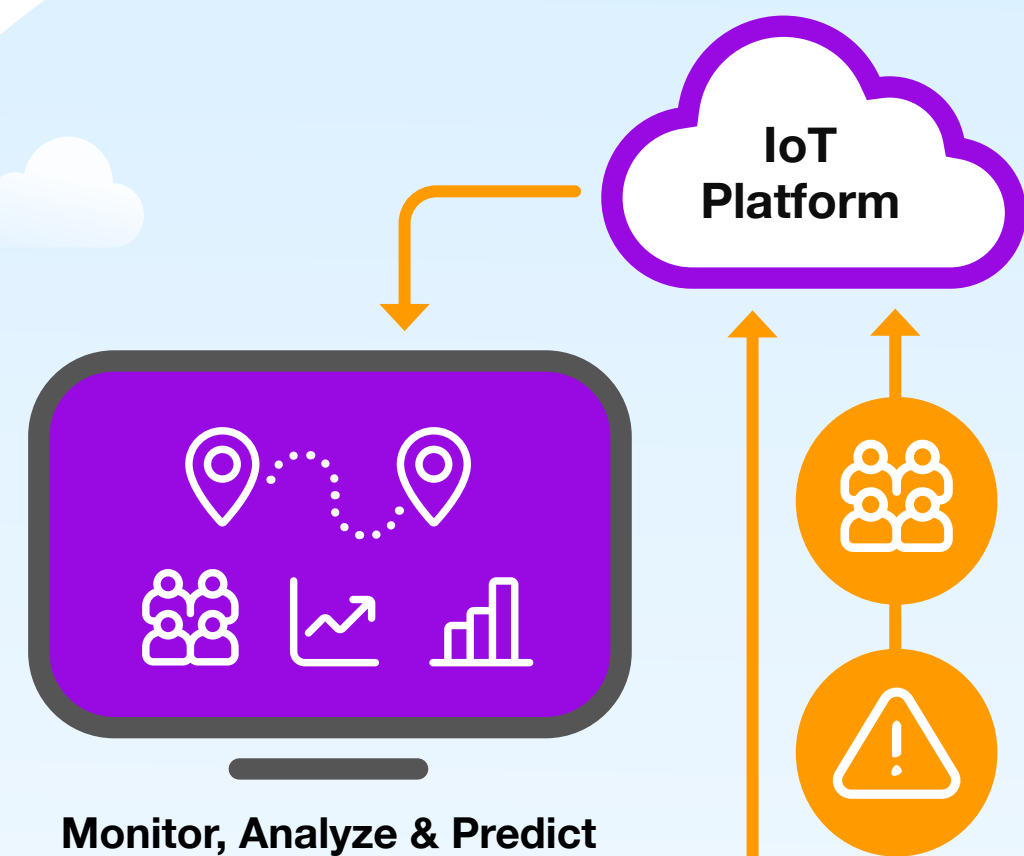
This lack of interoperability between systems means there are no easy ways of extracting, processing,

and combining data for analytical work. To put it in perspective, data scientists are reportedly spending 80% of their time working with collection, cleaning, and organisation of data – i.e. the necessary pre-work to set up a foundation for analysis. The potential benefits of data are therefore not always seen as worth the time and effort.

The industry has thus looked to renew their IT structures starting with reclaiming ownership of their own data, adhering to data standards and open APIs to improve system interoperability and using digital platforms to collect and analyze their data as intended. Through these efforts, data synergies are enabled and opportunities to identify new use areas are enhanced.

DIGITALIZATION IN ACTION

Telia Smart Building enables a broad suite of tools for property owners to gain insight into how their building is used and operating. By connecting the building, data is collected and visualized in Telia's IoT platform. This is complemented by Telia Crowd Insight movement data and location insights to unlock new opportunities and enable data driven decision making.



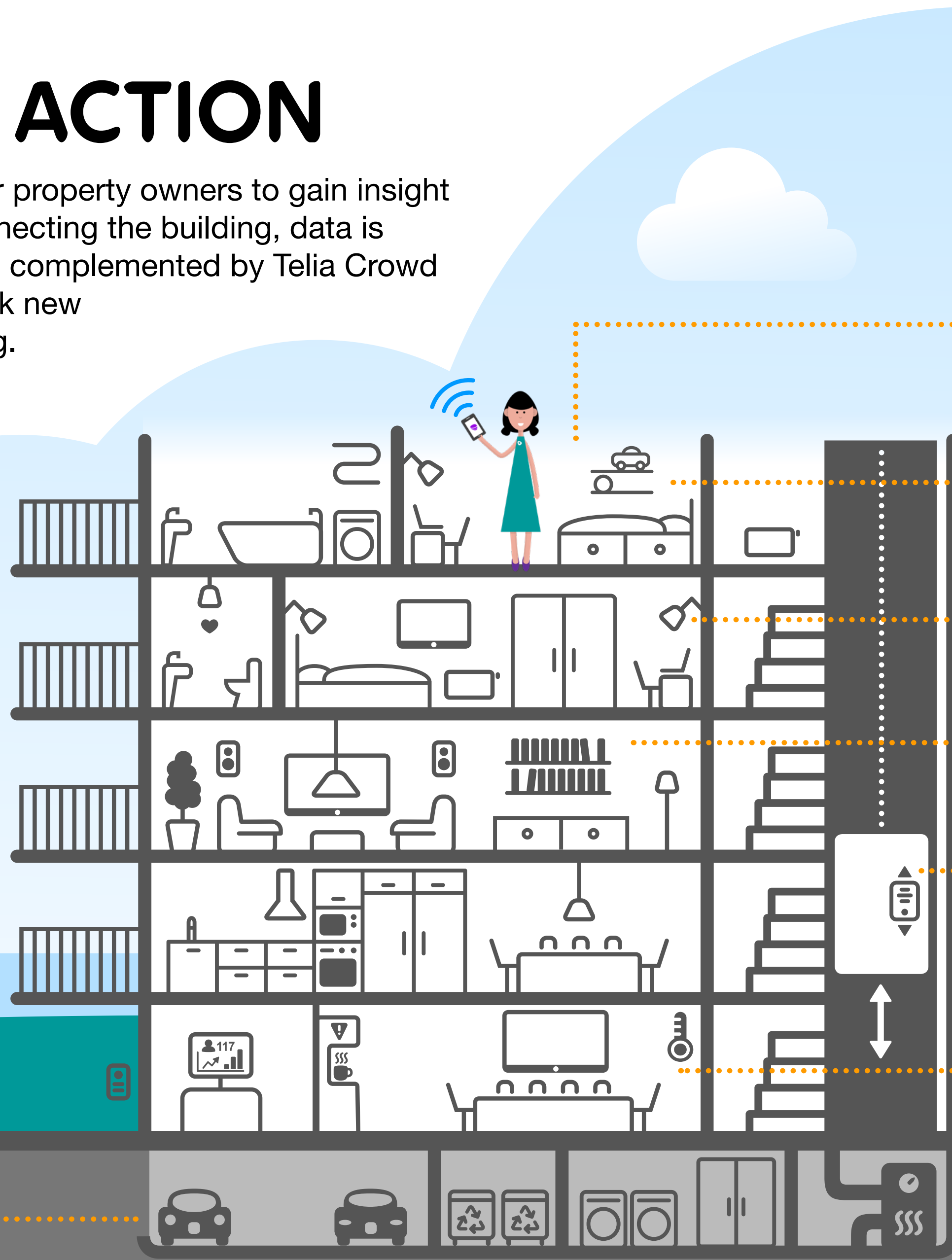
Crowd Insights
Macro perspective on movement of groups of people



Crowd Alerts
Real time alerts when overcrowded



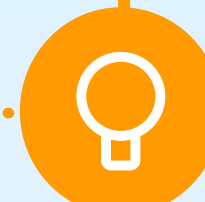
Asset tracking
Availability and location of shared resources



Temperature monitoring
Maximize tenant comfort and minimize energy wastage. Detect potential problems without needing to wait for complaints. Great for customer satisfaction, cost reduction and our environment



Air quality monitoring
Monitor humidity and CO2 levels to prevent 'stuffiness', discomfort and concentration problems. Detect harmful substances in the air to protect the health of your tenants and your building



Ambient noise and light
Identify harmful noise levels and keep track of your lighting to be able to optimize energy consumption



Air pressure
Secure the right air pressure in your facility and its rooms to prevent a contaminated atmosphere



Elevator communication
Connected emergency communication to maximize passenger safety and comply with safety regulations



Occupancy optimization
See which meeting rooms or work stations are being used and identify underused spaces

Learn more about IoT and Data Insights at business.teliacompany.com

