

RADAR DES STARTUPS SMART BUILDING : BUILDINGS ENTER THE DIGITAL AGE

With 105 million euros raised, 70% of it over the last three years, French Smart Building start-ups are covering all key areas of the building industry. They play a leading role in the digital transformation of buildings, promising to bring numerous services and benefits to users, facilities managers and the entire sector. Wavestone mapped out these start-ups in order to understand all challenges faced by their ecosystem.

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The building sector was one of the few remaining sectors that had not been disrupted by digital technology. Less than ten years ago, it initiated a decisive turn towards its digital transformation. In a recent study conducted by CBRE¹, the world leader in real estate consulting, 46% of companies said they are prepared to spend at least 10% more on rent for a smarter building.

Companies are now becoming aware of the potential of Smart Buildings to offer new services. Monitoring energy consumption, understanding the actual use of space or improving the quality of life of employees are examples of benefits that are being realised.

Data is essential to enabling these services and it has become a central asset of the building. It is not only key to collect it, but also to establish its management and the interoperability of all building systems and services.

The sector must now become aware and take ownership of the issues linked to digitalisation in order to take advantage of the benefits provided by smart buildings and ensure that these sources of value are not only being captured by emerging competitors at the crossroads of digital and building.

¹Source: CBRE EMEA Occupier Survey 2019



GEOLOCATED SERVICES AND SPACE OPTIMISATION

Meeting the expectations of employees

For companies, the implementation of geolocation and space optimisation services primary purpose is the transformation of workspaces. It aims to improve the wellbeing of employees, build their loyalty and attract new talents. Indeed, the success of this transformation relies on a good understanding of the habits of users, the inclusion of their new expectations in terms of collaboration and creativity, whilst accommodating a growing need for mobility. As prices per square metre are continually increasing, space optimisation represents a major economic issue for companies.

Two main use cases: analysis of space utilisation and geolocate users

Our space monitoring category brings together start-ups that measure actual space occupancy, in particular by setting up sensors around the office and in common areas. The collected data allows them to optimise space allocations and to adapt the work environment to the expectations and actual use of space by the occupants. The companies specialised in indoor geolocation help employees better understand the environment in which they evolve. Other start-ups specialise in dynamic management of vehicle parking, which is recurring problem encountered in office buildings.

A mature market moving towards end-user services

In order to justify and facilitate the collection of data, which is frequently perceived as intrusive in the eyes of the end user, start-ups put the employee at the centre of their offering by providing them high value-added services such as: mobile applications with immersive 3D plans, automatic booking and cancellation of collaborative spaces, easy incident reporting, etc. Some market players even integrated a social networking component into their solution.

WHAT ARE THE CHALLENGES FOR TERTIARY SECTOR BUILDINGS?

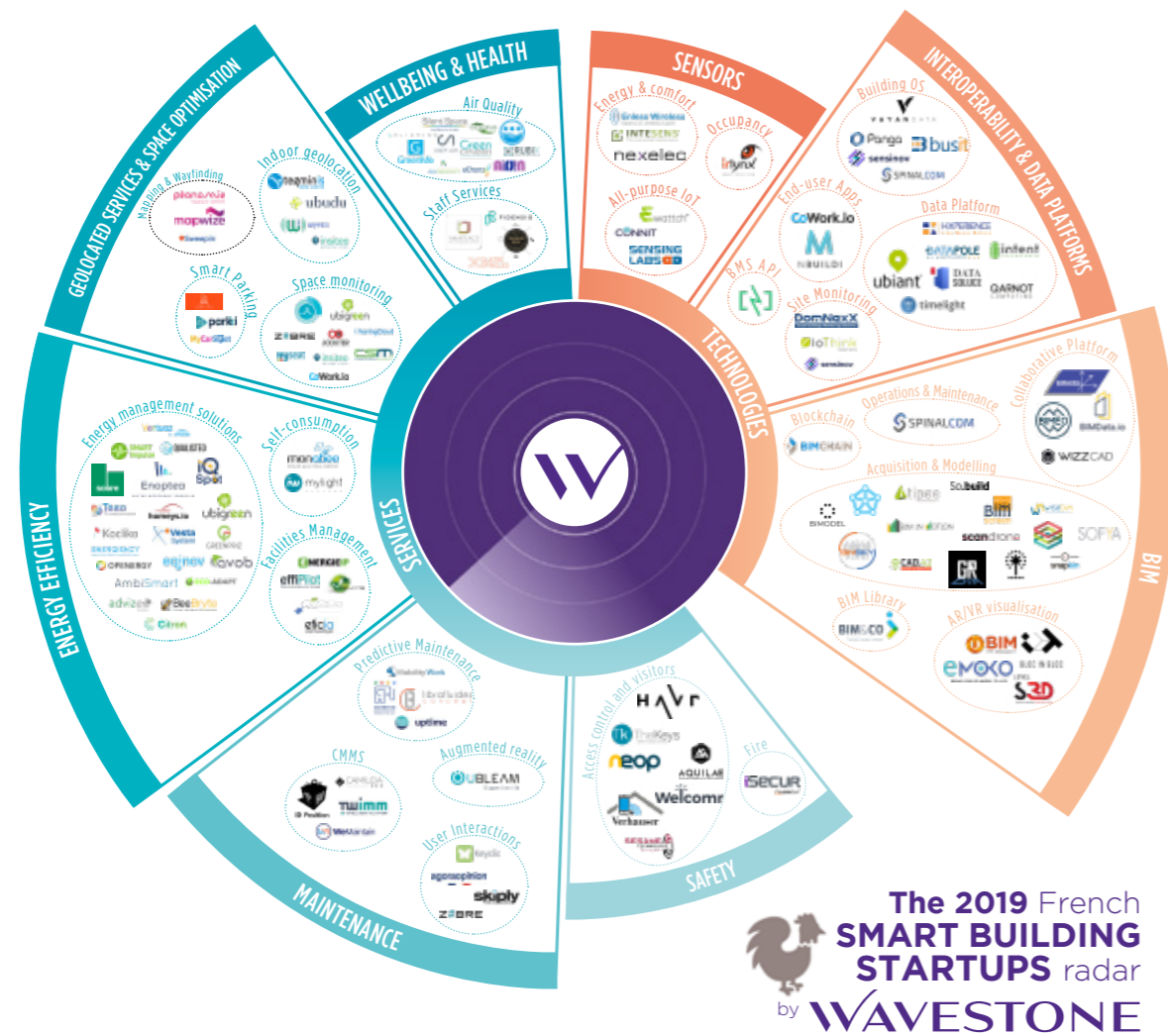
With several millions of square metres of office space created each year in Europe and an established stock of around half a billion square metres in the main European cities¹, the tertiary segment represents a high-potential market for Smart Building companies.

For the companies in this sector this is reflected in **four main challenges**:

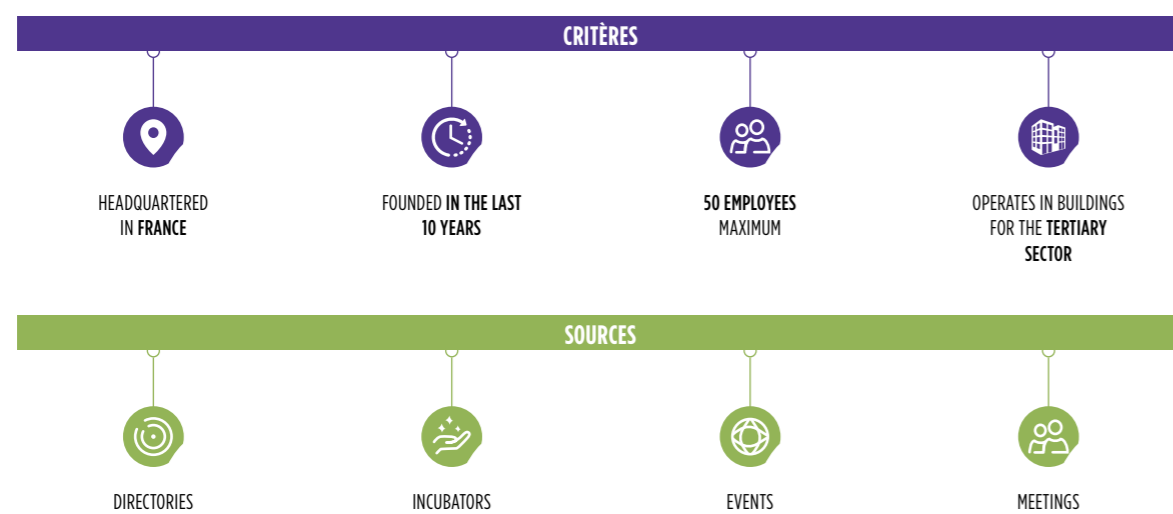
- ✓ The improvement of **energy performance**, driven by increasingly restrictive regulations in this respect and the consequent increase in the number of certifications and labels (BREEAM, HQE, ISO55000, LEED, E+C-, etc)
- ✓ The need to **understand the actual use of different spaces** (offices, collaborative and common areas, parking). A detailed knowledge of the use of these spaces allows us to imagine new ways of optimising or exploiting under-utilised areas
- ✓ The desire to **reduce maintenance and operating costs**, evaluated in France by ARSEG2 at around 35€/m² each year for a standard level of service
- ✓ The improvement of the quality of life at work, an essential lever for attracting new generations of employees and improving their productivity

¹Source: AEW, Savills, CBRE

²Source : ARSEG - BUZZY Ratio 2018



The 2019 French SMART BUILDING STARTUPS radar by WAVESTONE



This mapping is intended to be as exhaustive as possible in accordance with the above criteria. In the possible case that we have missed certain companies, please do not hesitate to contact us at the following address: radarsmartbuilding@wavestone.com



MAINTENANCE



Pressure on maintenance costs is reflected on operators and occupants

Maintenance and operations account for 75% of overall costs in the lifecycle of a building³. Over the past thirty years these areas have been progressively outsourced and subject to increasing budget restrictions.

In order to maintain their profits, Facility Managers have to improve the efficiency of their services and identify new value propositions to their customers. Building stronger relationships with the end users became an important aspect of this transformation.

The digitalisation of maintenance requires knowledge about the end user and the anticipation of faults

Start-ups in this market have understood the need to integrate the end user into the core of their offerings. **Agora Opinion** and **Skiplly** simplify incident reporting and automate the connection and follow-up between stakeholders. Therefore, they offer an improved experience for the end user and a more detailed knowledge of occupants for the Facility Manager.

Digital innovation is still fairly low in this domain and mainly focus on improving CMMS (Computerised Maintenance Management Systems). Predictive maintenance also tends to be distinct offering in the tertiary sector. **Uptime** raised 2 million euros in 2018 on this very topic. With a collaborative maintenance platform, **Mobility Work** believes that aggregating data from all players of the ecosystem will enable predictive maintenance of devices.

Operational maintenance is undergoing its digital transformation

Leveraging preventive and predictive maintenance is a real source of efficiency for the Facility Manager and it's becoming accessible with the acceleration of IoT, Big Data and AI. However, it is still constrained by the availability of historical data and its quality. Companies must therefore accentuate their efforts in collecting, storing and sharing data.

³Source : ADEME

TOMORROW'S BUILDINGS WILL BE INTEROPERABLE AND SERVICE-ORIENTED

Making the building intelligent means first of all **becoming aware of the importance of data** and the multiplicity of use cases that can be resolved by integrating different sources of information, both internal and external.

Data from sensors and building services systems must be **easily and securely accessible**. This will enable solutions to be interlinked in order to exploit the data and offer new services to users and operators.

The technical infrastructure of tomorrow's buildings will not be able to remain siloed as it is the case today. The interconnection of systems is essential to making data accessible. However, there are fundamental prerequisites such as the **improvement of interoperability** between different systems, the **reinforcement of the level of digital security** and the consideration of **governance and data quality control issues**.

With this in mind, the Smart Buildings Alliance (SBA), an organisation of more than 300 companies related to building and the Smart City, published the **Ready-to-Services (R2S) framework** last year. A reference for the Smart Building industry, it defines the technical and organisational foundations necessary for the integration of new services in buildings.

In order to supervise these new services and ensure the operation of new IT infrastructures, the R2S label introduces a **new role of building services operator**. Facility Managers see it as a new potential growth opportunity that would make it possible to compensate the slimming of margins in multi-technical and multi-service offerings. For example, Vinci Facilities and Bouygues Energies & Services have recently changed their value propositions to take into account the IT and services dimension in their operating services.



HEALTH AND WELLBEING: A BETTER QUALITY OF LIFE AT WORK

Quality of life at work is the new must in office buildings

The Smart Building service offering is increasingly taking into account the needs of end users by adopting a user-centric approach to define the workplace experience. Employee satisfaction is a key metric when measuring the success of redesigning workspaces.

The objectives of this approach are threefold:

- ✓ To track the experience of employees in order to improve their wellbeing in their work environment
- ✓ To prevent and minimise the impact of building infrastructure on the health and performance of employees
- ✓ To promote a global, high quality employer brand

Air quality concerns have led to substantial investments

In 2019, among the start-ups operating in the Comfort domain, the most dynamic were companies specialising in air quality forecasting and control, as well as the control of noise levels in shared workspaces.

According to our study, among the fundraising activities carried out over the last 10 years in the field of Smart Building in France, this segment has attracted the most investors with some start-ups raising up to 10 million euros. This market, mostly composed of specialist companies, is likely to be disrupted particularly due to concerns raised by occupants and the evolution of legal frameworks.

Corporate concierge services, meanwhile, are developing and we can witness the emergence of connected lockers and applications aimed at modernising the office management experience and optimising space.

SMART BUILDING: A VERY ATTRACTIVE MARKET FOR START-UPS

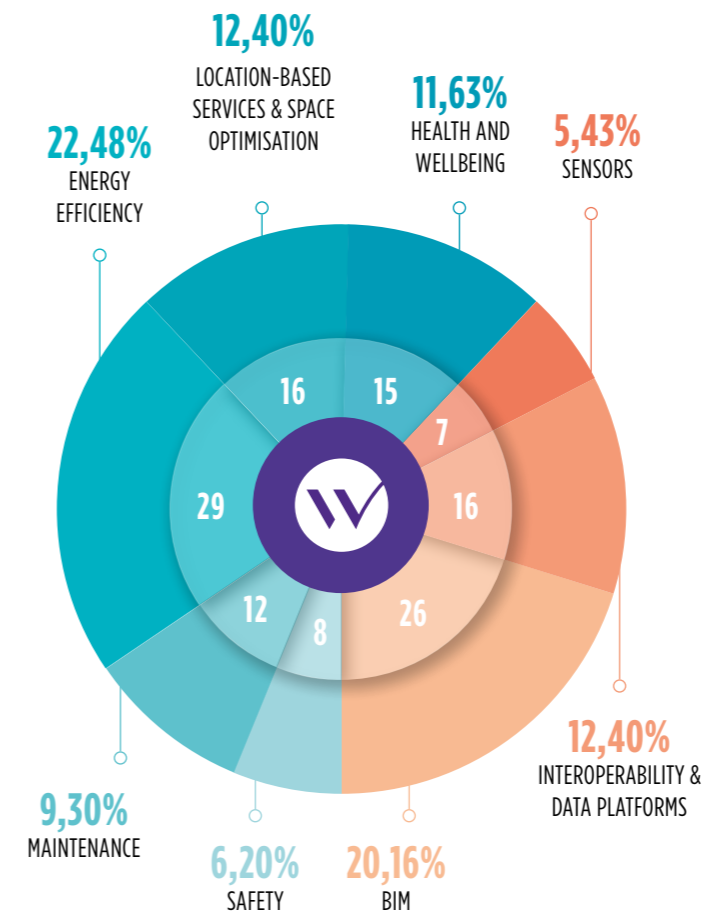
Over the past decade, the sector has seen the **emergence of a dynamic start-up ecosystem**. Attracted by the market's potential, regulatory changes around energy and the diffusion of digital technologies, these companies have made the **introduction of digital innovation** possible in a sector that had been historically lagging behind on technological adoption.

This first publication of the **Radar of French B2B Smart Building Start-Ups** is the result of almost a year long work of research, selections and meetings and is intended to reflect a complex ecosystem.

Le choix d'une segmentation selon **deux macro-catégories** est représentatif de la manière dont les acteurs adressent le marché :

- ✓ **Services** - the start-ups offering an end-to-end solution centred on and responding to one or more of the sector's pain points and challenges
- ✓ **Technologies** - the start-ups offering technology agnostic solutions for uses such as capturing, storing, processing or visualising data

DISTRIBUTION OF SMART BUILDING START-UPS IN 8 USES AND TECHNOLOGY CATEGORIES:



ENERGY EFFICIENCY



Optimise energy consumption to spend less

According to ADEME, energy-efficient buildings tackle four main issues: reducing energy bills, complying with increasingly demanding regulations⁴, building renovation⁵ and sustainability. In the past, the reluctance of companies to implement energy efficiency solutions was due to a restrictive, low-priority and complex vision of energy efficiency. Furthermore, the combination of significant initial investment required in such solutions and a time to value perceived too high have long been strong financial obstacles. Today, despite the growing importance of regulatory and environmental issues, it is the certainty of economic savings that promotes adoption of energy-efficient solutions.

A market dominated by data visualisation platforms

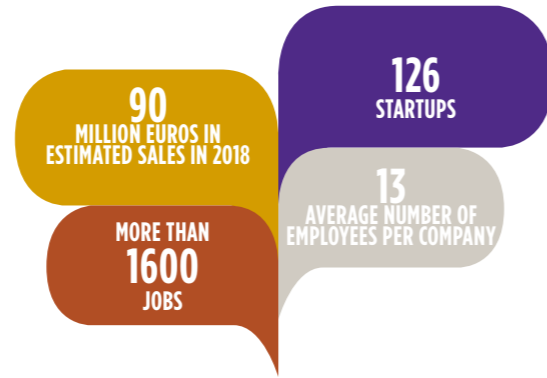
The Energy Management Solutions category is the one with the highest number of start-ups. Their solutions focus on the aggregation of different data sources, the processing of internal and external building data and visualisation of the entire real estate at scale. Being able to cross-reference very heterogeneous data points further increases the ability to plan and control energy efficiency. The Building Management subcategory references companies developing information systems that can centralise the control of technical equipment (heating, lighting, air conditioning, power supply, security systems). Several start-ups offer Cloud-hosted services that include smart automated control of devices as well as real-time visualisation of their energy consumption (**effiPilot**, **eficia**). The interoperability of BMS with other systems and the ability to interconnect the control of devices with energy management solutions are today's main areas of development for energy efficiency in buildings. Finally, two players address the topic of Self-consumption (**Monabee**, **Mylight Systems**) and have devised their offering around the concept of buildings that are not only energy consumers but also energy producers.

More efficient optimisation solutions, positive energy buildings and interoperability: what is the future of the sector?

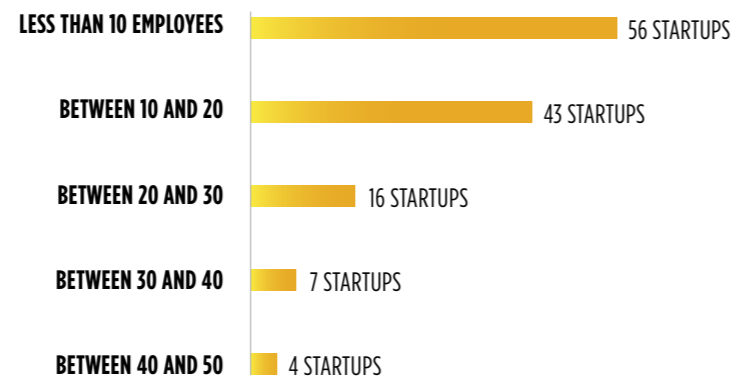
The opening of building systems connectivity, the popularisation of API use and the development of Building OS will simplify access to data and make it possible to control the performance of buildings in real time with multiple data sources. In addition, on the regulatory side, the European Energy Performance of Buildings Directive requires all new buildings to be nearly zero-energy by the end of 2020.

⁴Source: European Energy Efficiency Directive (EED - 2012/27/EU) and Energy Performance of Buildings Directive (EPBD - 2010/31/EU)

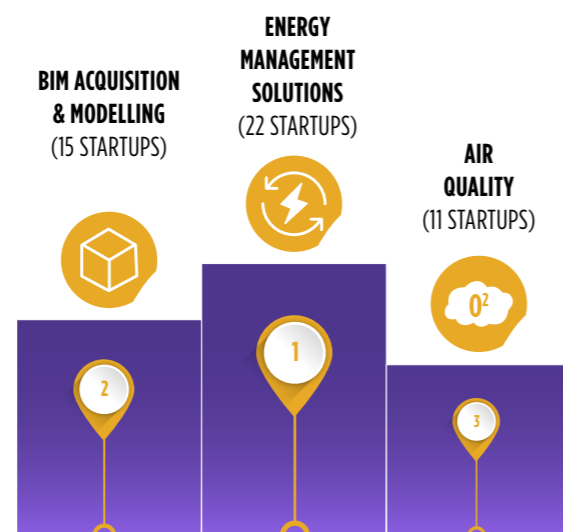
⁵Source: Labels and certifications (e.g. HQE, BREEAM, LEED, ISO 50001)



A JOB-CREATING SECTOR



We noticed that start-ups tend to focus on specific use cases. **Energy performance** companies amount up to the **largest number of start-ups**. On the one hand, demonstrating the growing importance of occupants' comfort, the companies specialising in **indoor air quality** are the ones that performed the most impressive **fundraisings** in recent years. On the other hand, the safety segment is still less attractive to investors.



TOP 3 TOPICS WITH THE MOST START-UPS IN 2019



SAFETY

Safety and security are key selection criteria

Safety and security are key issues in the design of a building and its surroundings. On the one hand, safety aims to prevent accidental events that could harm people and property, such as fires. On the other hand, security is intended to prevent malicious activity such as intrusion, theft or assault.

In addition to security, the digitalisation of visitor reception is also becoming an issue for companies. Reception being the first physical contact that a visitor has with the company, it must be a fluid and exceptional experience for the user without threatening or reducing the site's security level.

These activities prove to be a major challenge for safety and security managers, both because of the wide business scope on which their implementation has an impact and because of the amount of technical and human resources involved on a daily basis. In order to succeed in building a coherent and effective security system, they must maintain balance in the distribution of human and technological resources and keep the use of the building simple and fluid, while enhancing its safety and security altogether.

A market siloed by use cases

A smart security system must be leveraging new technologies such as dematerialised access controls or intelligent image recognition. It should be capable of covering the various use cases faced by an operator on a daily basis: access control, visitor management, identification and prevention of risk situations.

The market for specialised companies remains quite siloed by use case. Each player focuses on a product (**Havr** with their connected lock) or a solution (**Aquillae** and their Video Analytics solution). Few have taken the step of covering several use cases because they require highly-critical systems and significant investment on equipment that is often very complex and expensive with an obsolescence that is not under control.

A sector in development

With 8 companies identified, the security component covers only 6% of the start-up landscape in Smart Building. Few companies specialise in this segment.

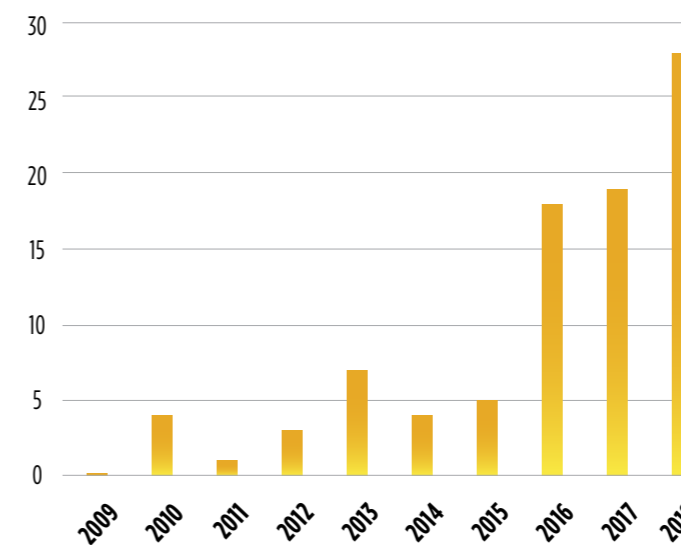
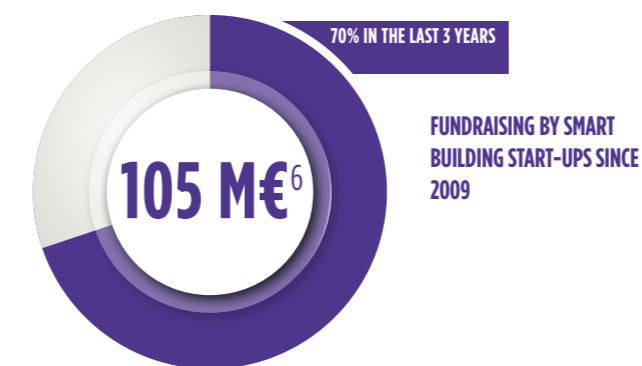
The prerequisites needed for the integration of these solutions within a Smart Building are yet to be defined as we are still waiting for major flagship projects that can be referenced and capitalised upon. Historically siloed solutions for building safety issues will have to be decompartmentalised in order to get value from their data for other uses and services (e.g. aggregation with other occupancy data sources, building maintenance, etc.). Furthermore there is a gap between the maturity of technologies and a regulatory framework that limits their deployment, as in the case of biometrics.

KEY TAKEAWAYS

Energy efficiency, the driving force behind Smart Building

Not only energy efficiency is the category with the most start-ups, it has also been the one with the most fundraising events each year for the past eight years. This corroborates that **energy efficiency is still the main driver behind Smart Building adoption**.

Wellbeing and Maintenance players have become increasingly prominent over the last two years and this is reflected by an increase in the amounts raised. They rank correspondingly 2nd and 3rd in cumulative amounts raised.



A CLEAR ACCELERATION IN FUNDRAISING SINCE 2016

Growing concerns on indoor air quality

Air quality is addressed by no less than 11 companies and includes the start-up with the largest fundraising in the radar. This segment has been growing in importance in recent years, highlighting the market's strong interest about these issues. The majority of companies in this field come from the research and chemical industries and are usually providing niche solutions.

⁶Source : Wavestone analysis based on the start-up radar scope



Led by its three co-founders, Spinalcom revolutionises data management in buildings by offering a **global solution** including a **BOS**, a **Digital Twin** and advanced analysis and control tools.

A complete solution that contextualises and structures building data to understand it.



Insiteo puts the employee at the core of their offering by providing **high-class geolocation services** such as wayfinding, space availability and real-time reservations. The collected data also enables the company to better **manage and optimise the workplace.**



Mobile application with innovative features and equipped with a very advanced graphics engine (immersive maps, advance bookings, incident reporting).



Qarnot Computing offers decentralised, environmentally-friendly and reliable **Edge Computing** solutions. They are particularly famous for their computer radiator which generates heat from embedded microprocessors that are connected to the Internet and perform remote distributed computing paid by third-party companies.

Their dual expertise in hardware and software makes them a key player in Edge Computing in France.



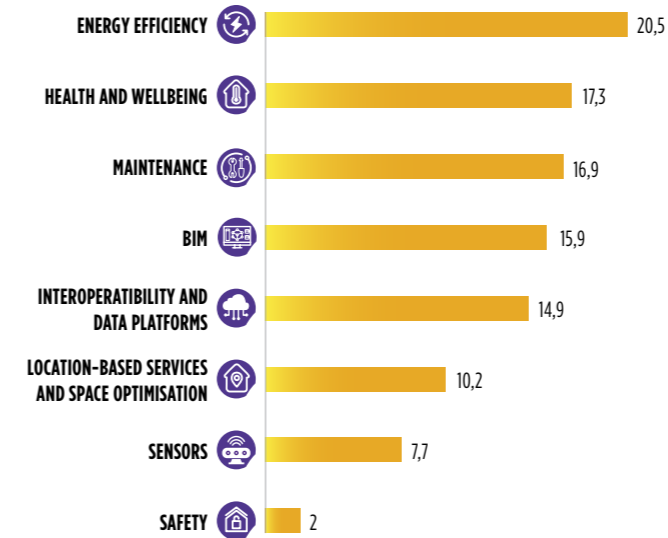
Welcomr **virtualises access management and visitor reception** by offering a web platform, a mobile application and a control unit that interconnects with security systems. The apps are fully customisable and interoperable with all solutions on the market.

The solution is adaptable to all types of access control: lifts, lockers, doors, gates...

SPOTLIGHT ON 4 INNOVATIVE START-UPS

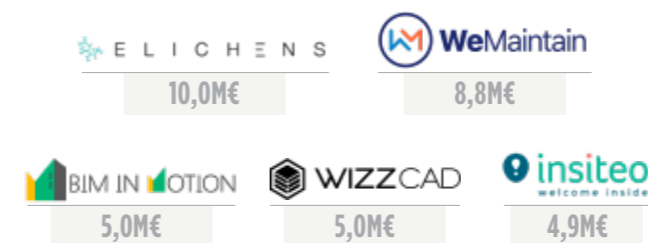
A growing maturity and interest in Smart Building

There has been an increase in the number of new start-ups and a real surge in fundraising in recent years, with a 360% growth between 2015 and 2018. 70% of fundraising has been achieved since 2016, with a peak in 2018 at almost €30M. This demonstrates a growing awareness among investors of the potential of this market.

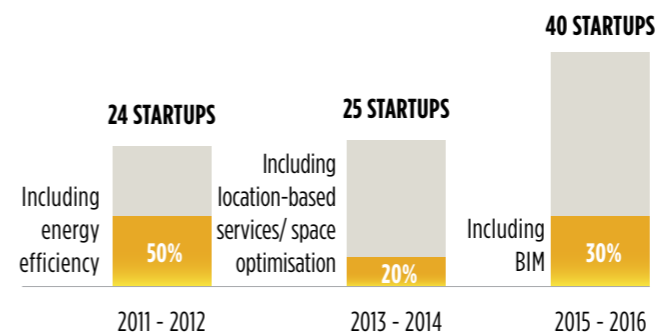


FUNDS RAISED IN MILLION EUROS

A BREAKDOWN OF FUNDRAISING ACTIVITY SINCE 2009 INDICATIVE OF INVESTOR INTEREST



TOP 5 FUNDRAISERS



3 EVOLVING TOP TRENDS THAT HAVE STIMULATED THE CREATION OF START-UPS OVER THE YEARS



SENSORS

Data collection is at the heart of buildings' digital transformation

It is estimated that there will be 80 billion connected objects in the world by 2025. The building sector is no exception to this trend since data collection is central to the Smart Building ecosystem.

The sensor segment is divided into two main categories of companies:

- ✓ Start-ups that focus exclusively on the development and supply of sensors
- ✓ Those who offer a service of collection, transmission and provision of raw data with their own sensor

Some of them offer a service that uses the data collected by their sensors. Since their value proposition lies in the service offered and not in the provision of the sensor, they have been integrated into the service side of the radar (e.g. **Ubudu** and **Elichens**).

The different types of sensors

The majority of start-ups in this category design sensors that measure parameters such as air quality, temperature, humidity, energy consumption and noise levels.

Irlynx specialises in anonymous tracking of people's movements using infrared technology. **Ewatch** offers a differentiating concept with a modular sensor that has customisable inputs so that it can be repurposed for many different use cases, it has built-in inputs for electrical, temperature and optical readings.

Sensing technologies are constantly evolving

In recent years, thanks to the development of IoT, the autonomy of sensors has increased. These technological advances make it possible to consider larger deployments of sensors.

Aside from the obvious cybersecurity issues arising from sensors, one of the major challenges will be to successfully rationalise their presence within the building through the use of multipurpose sensors and interoperability between existing systems.

BIM (BUILDING INFORMATION MODELLING)



BIM is becoming more common in the phases of building design and construction

Building Information Modelling is a collaborative working process between all building stakeholders, from design to operation: architects, property owners, project managers, engineers, designers, facility managers, service providers, consultants, etc. BIM is based on a 3D digital model of the building that integrates all of its components, from the structure of the work to its technical equipment and installations. The digital file is therefore a virtual support, which provides a technical projection of the building throughout its life cycle. It's the core of building data.

Since 2015, there has been a 30% increase in the number of real estate projects conducted using BIM. The increasing adoption of BIM in design and construction phases is an opportunity to refresh best practices for building management, operation and maintenance, with a focus on collaborative and innovative approaches enabled by new technologies.

Start-ups and BIM, a sustained growth since 2014

The interest of industrial and real estate groups for BIM in building operations is reflected by the significant acceleration of fundraisings made by start-ups developing solutions around BIM. Between 2014 and 2018, the cumulative amount of funds raised by those start-ups has increased nine-fold, from 725,000 euros to more than 6 million euros.

The start-ups specialising in BIM acquisition and modelling are the most attractive to investors but the ones offering collaborative platforms also play a major role in the BIM market considering that **Wizzcad** ranks among the top five fundraisers on the radar.

Meanwhile, start-ups that enable visualisation of the BIM model with augmented or virtual reality are still developing.

The popularisation of BIM and the interoperability of models are key to developing this market.

Two main issues currently hamper adoption of BIM technology:

- ✓ The lack of BIM utilisation in some areas of sector and across the building lifecycle, which would otherwise allow the models to be maintained up to date in the long term
- ✓ The insufficiency of standard tools and protocols especially for the exchange of information between software applications!

As a consequence, open source initiatives promoting the interoperability of BIM models are multiplying and bringing together more and more players across the industry.

This will help dealing with the increase in the number of buildings built and delivered using BIM in the years to come.

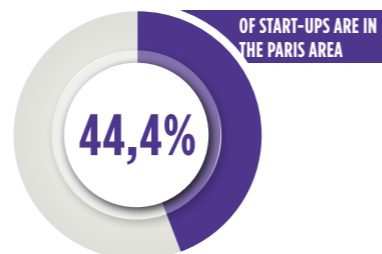
¹Source: Building Information Modelling (BIM) standardization report from the European Commission's Joint Research Centre

Paris and Lyon areas lead French Smart Building innovation

Although Smart Building start-ups have a footprint across the country, two major clusters emerge: the Paris region concentrates 45% of the players (56 start-ups) and the Lyon region, is home to 14% of the players (17 start-ups). Lille and Toulouse are also well represented, with respectively 8 and 9 start-ups choosing them for their headquarters.



THE MAJORITY OF START-UPS ARE BASED IN 6 URBAN AREAS



WHAT TO EXPECT NEXT?

A necessary confluence with the energy efficiency market

The proximity of value propositions with players in the energy sector suggests that **smart building and energy management platforms are likely to converge** in the coming years. The future positioning of companies and the differentiation of their service offering will be key for them to stay in the market. The **major players in energy and facility management sectors have already started to acquire the most promising start-ups** and will undoubtedly continue doing so.

Interoperability and data management will be essential

The expanding connectivity of technical systems associated with a growing awareness of the value of data from the building sector means that **data management platforms will be crucial** to a successful smart building strategy. **Building OS** solutions will become indispensable to any new midsize smart building. The interoperability layer, which ensures simplified acquisition, processing and provisioning of data, will facilitate the comprehension of the complex engineering systems that operate the building such as HVAC, energy supply and electrical systems. It will also be key to building new data-driven services.

The emergence of Digital Twin for the building industry

Digital Twin solutions are, with a few exceptions, offered exclusively by the leading players in the market, mostly Facility Managers. They provide **real-time and historical visualisation of the state of the building**, which is very useful not only for the operator but also for the asset manager.

Growing concerns for quality of life at work

The number of start-ups offering to assess the level of employee comfort (air quality, noise levels, luminosity, temperature, humidity, etc.) should continue to rise, driven by employers' **ambitions to improve the quality of life at work and productivity**. We can also expect, in the coming years, stronger legislation around the topic of indoor air quality, attracting new players to this developing market.



INTEROPERABILITY AND DATA PLATFORMS

Moving beyond interoperability into the era of "building as a service"

Building data is a source of immense value that is still underexploited. The main reason being that without interoperability, the management and enhancement of data sources remains complex and difficult to sustain over time. For market players, the major challenge today is to succeed in implementing this interoperability layer in order to enter the era of «building as a service».

Locally or in the cloud, tools are emerging to rethink the management of dynamic building data

The BOS (Building Operating System) is a new intermediate software layer. Acting as a true data hub, it enables the collection and structuring of dynamic data from all sources:

- ✓ Building equipment (IoT, BMS, CMMS, etc.)
- ✓ Business applications (ERP, IWMS, etc.)
- ✓ Sources external to the building (Smart City, weather services, third-party providers, etc.)

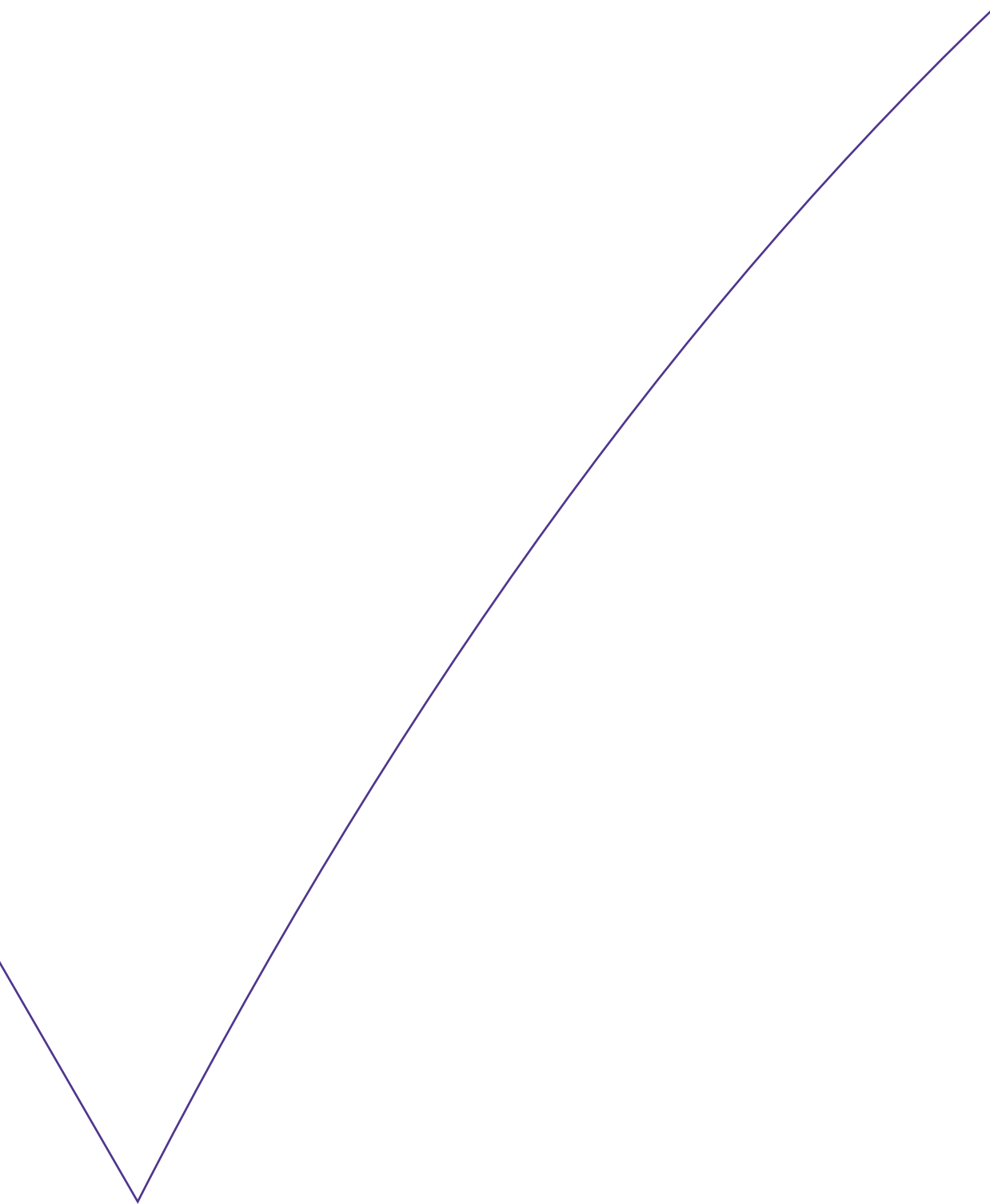
They ensure the interoperability of data sources associated with the building by making them available for third-party applications through secured interfaces. This allows for new services to be developed, such as predictive management of incidents or remote control of workspaces (lighting, heating, etc.).

In the cloud, data platforms are capable of processing and analysing data dynamically for an entire portfolio of buildings.

Building data management is now an essential project to address. Local or cloud-based solutions are fully complementary and will allow companies to manage both static data (from BIM) and dynamic data (from BOS and data platforms).

An emerging market where know-how is combined with credibility

Interoperability and data management start-ups offer innovative solutions compared to historical players in the sector. Given the enthusiasm of the players and the size of the potential market covered by data management, the start-ups of this category will face a lot of competition in this complex environment. They will also have to convince buyers of the scalability of their solutions and their ability to support major projects.



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