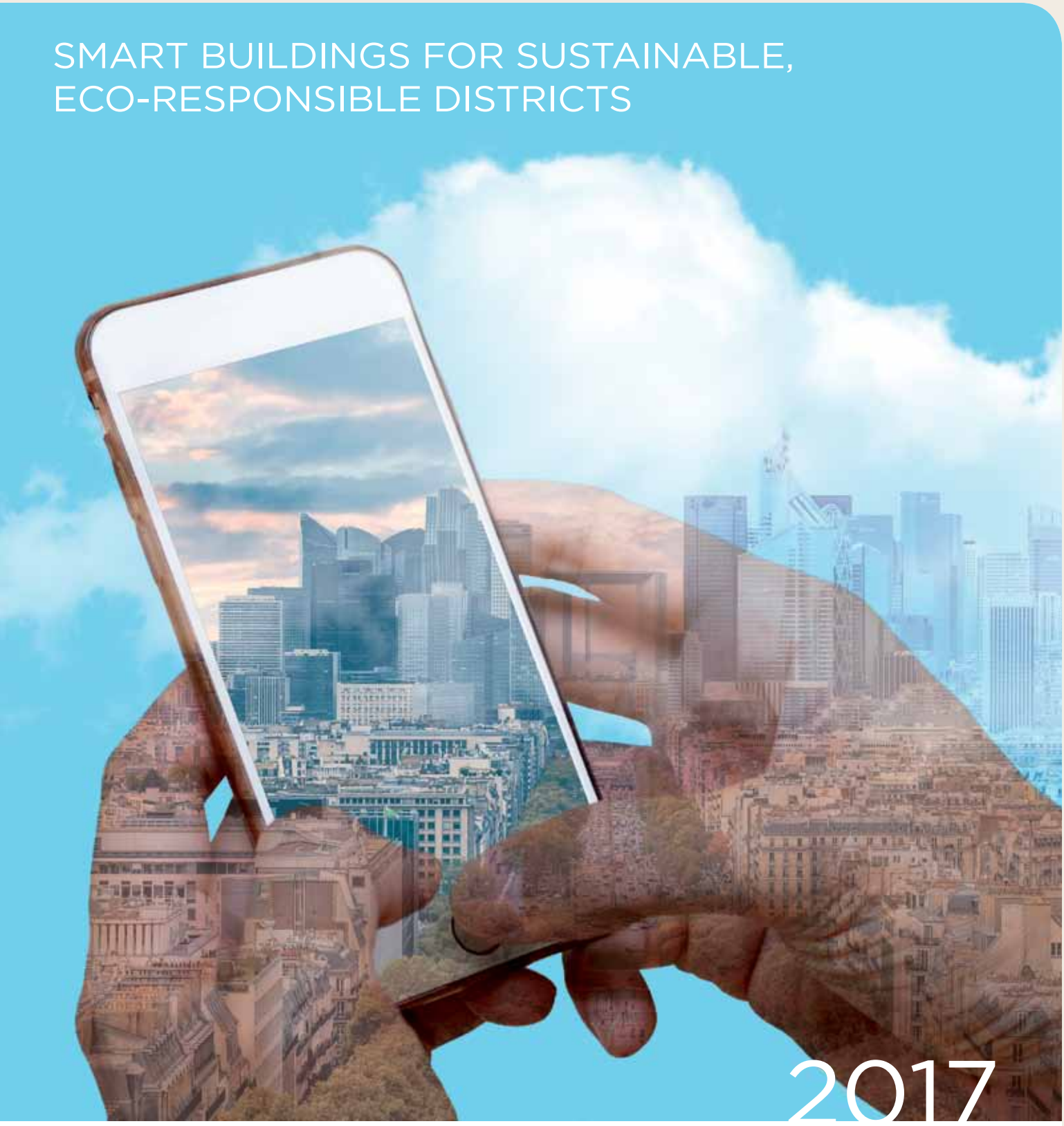
SMART BUILDINGS FOR SUSTAINABLE, ECO-RESPONSIBLE DISTRICTS



2017

MANIFESTO

SBA
SMART BUILDINGS ALLIANCE
for SMART CITIES

THANK YOU to all the members who have made a major contribution to producing this Manifesto:
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Cover and illustrations © **Les 5 sur 5 - Photos © Fotolia**
Production: **DoYouMeanBlue**

Printed in France by OTT Imprimeurs - Legal deposit: June 2017 - ISBN 978-2-95601-751-6 - © SBA - All rights reserved for all countries

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Introduction

Digital and connected objects are having a profound impact on established business models. In just a few years, the power of the Internet has revolutionised the life of individuals and businesses. Digital technology is continually developing, shaking up the traditional models and offering each sector the possibility of completely revising its organisation and its positioning. Digital technology is opening up new and promising horizons, holding promise in terms of potential developments and improvements, but is also brings a source of concern in terms of the inherent changes, the large volume of data available and how this data is being used. One thing is certain, this change will last, gain speed and drive the transformation of our society.

The Construction business which represented 124 billion euros in revenue in 2015 in France, according to the Fédération Française du Bâtiment (French construction federation), must adapt to digital transition. Economic, regulatory, environmental and social changes are pushing the sector to adapt to a new reality, and digital technology provides the required tools and solutions.

This change in direction is critical for the 1.4 million workers, employees and tradesmen in the sector, because fundamentally the transition requires a complete revamp of standard practices, **A NEW MEANS OF DESIGNING, CONSTRUCTING AND OPERATING BUILDINGS**. Trades must work closer together, we must work with new partners, acquire new skills in information technologies, open systems up for interoperability purposes, design new applications and the services of the future, etc.

This change may offer a challenge to the historical players in the sector who do not march to the digital beat and who are questioning the arrival of newcomers. Many questions are raised, which is normal – in relation to this move towards digital buildings such as cost, financing, feasibility, profitability and how to approach the change in real terms. In order to meet these unprecedented challenges, all players must be supported in the form of learning programs, and with the assimilation of new digital tools, as well as the understanding of new economic models. This is why the Smart Buildings Alliance was launched: **HELPING PROFESSIONALS WITH THIS MOVE TOWARDS MODERNISED BUILDINGS, DESIGNED, BUILT AND OPERATED TO MEET THE PRIORITIES OF TODAY'S SOCIETY**. SBA federates over 150 upstream and downstream players in the sector, and can offer unique expertise, as well as solutions, by focusing on the priorities of the economic model.

Emmanuel François
President of SBA

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OBSERVATIONS & **STEREOTYPES**

Fighting stereotypes

SMART BUILDINGS ARE GADGET BUILDINGS

To approach the digital transition with confidence and determination, we must first overcome some of the stereotypes that are blocking change and threatening a clearly vital evolution. Firstly, the smart building is considered as a 'gadget product' aimed at customers who love new technologies, a building that is too costly, only for an elite or showcase projects.

Certainly, the smart building – a connected building that communicates with its inside and outside environment – does require the deployment of technologies. But SBA, in its "Ready2Services" (R2S) frame of reference, defines a concept based on the smart use of technologies for new added-value or efficiency-generating services, never ignoring the smart building's cost. SBA recommends pooling infrastructures and equipment – sensors – and convergence via open, shared protocols, to avoid redundancies that lead to extra costs, environmental impacts and energy overconsumption. SBA promotes a design approach that protects the environment, considers the overall cost, includes CAPEX and OPEX from the initial development phase, and anticipates future needs.

Smart buildings are the buildings of tomorrow. Offering their users a wide range of services, their intelligence will enable them to meet energy, environmental and economic challenges

Smart systems play a role in optimising the management of buildings and the smart building, the natural development of the green building. Smart buildings are not just 'gadget buildings'. Truly the buildings of the future, their intelligence will enable them to meet energy, environmental and economic challenges and satisfy user requirements. Smart Buildings are the result of a change in usage, life-styles and consumption, to which they must adapt, and this adaptation can only be achieved through the implementation of digital tools.

THE SYSTEMS WOULD NOT BE SUFFICIENTLY INTEROPERABLE

Some will argue that the smart building is too complex, and the systems are not completely interoperable or compatible.

The complexity of the interconnections between systems or ecosystems is a fact, and must not be ignored. Yet, today, this is mainly because of their diversity and lack of openness. This choice is understandable in historical terms, with systems and technology dedicated to a single function (silo approach). For a manufacturer, offering a dedicated system was a way of guaranteeing its commitments to its customers. However, this often entailed a specific design and operation, generally limited to the initial function. This closed nature of the systems is currently a restriction. Buildings equipped with a closed automation system or BMS are unable to supply the data that allows building performance to be monitored or managed optimally, and the combined management of lighting, heating and blinds, which significantly improves energy performance, cannot always be achieved. Of course, everything is possible if you accept to pay a high price for it, but is such a premise acceptable? Consequently, construction is only developing in a piecemeal way and does not offer the future-proofing we are entitled to expect. Ultimately, these planned-obsolescence facilities will lose value in the pro-

The building becomes a service platform.

perty market because a large number of services for the residents or operators cannot be deployed. As for the installation of a multitude of gateways and automated systems for communication (frequently put forward as a solution to the interoperability problem), this not only adds to the cost, it also increases the complexity of the set-up. Yet these additional devices are not the only solution.

In twenty years, the systems have improved markedly, their robustness has been augmented, **THE STANDARDISATION OF COMMUNICATION PROTOCOLS MAKES A FIRST LEVEL OF INTERCONNECTION POSSIBLE FOR THE EQUIPMENT**, and IP (Internet Protocol) has become used in all sectors of the economy as the main exchange protocol for services.

It is highly unlikely that there will be a single application protocol one day. This is why, in its "Ready2Services" recommendations for building infrastructures, SBA identifies the openness of systems – whether standard or proprietary – to IP as an essential pre-requisite for the smart building. This openness will allow innovative systems and applications, sources of value creation, to be developed.

Interoperability between ecosystems is an essential condition for the emergence of smart buildings

Remember that the adoption of standardised communication protocols (TCP/ IP, Webservices, etc.) enables easier interconnections for systems, that Internet's success is based on the widespread adoption of standardised communication protocols, and that these languages are common to all connected systems, regardless of the brand, operating system or software used

Mechanically, opening up ecosystems will facilitate their implementation and, in addition, will enable easier, continuous upgrading of the building so that it satisfies the requirements of the market and the users at lower cost.

The smart building is not based on futuristic or emerging technologies. It is based on proven technology that can now be deployed by all stakeholders.

THE SPECIFICATIONS WOULD BE TOO COMPLEX TO DEFINE

Smart buildings are complex structures, and currently only a few professionals have a thorough understanding of them. For property developers and engineering firms used to siloing, the global approach is an innovation. Drawing up the specifications seems a complex exercise and any innovation, which offers a new opportunity, has to be included with all the constraints linked to the building's construction. So how should such a project be approached? How do you structure it, architect it, take its operation into account right from the design stage, coordinate all the players in the value chain?

While some professionals have successfully managed the technological change and are now able to handle smart buildings, the safe practice of copy/paste and the upstream/downstream split long rooted in usage have not encouraged the development of collaborative working practices, which could perhaps be helpful. There is also a lack of frames of reference to guide the professionals. SBA's experts therefore set about drafting the R2S frame of reference. This recommendations base will improve the approach to drafting specifications for smart buildings. The fundamentals are intended not to give a single technical recipe, but rather **TO GUIDE CONSTRUCTION PROFESSIONALS IN THEIR SMART BUILDING PROJECTS BY PROPOSING A STEP-BY-STEP METHODOLOGY**, that can be applied in all types of buildings, both new and existing.

Supporting change for managing the innovation processes.

Today, SBA offers an operational frame of reference for engineering firms requesting recommendations for organising digital services. These professionals are aware of the immediate need to anticipate and adapt the specifications to the new situation of the smart buildings to be built in the next two or three years. In this way, these buildings will not only be able to provide all services expected by users, but they will also not be obsolete when delivered and will meet the obligations validated at the planning stage.

Nonetheless, coordinating all construction trades remains complex because it requires an overall view, an understanding of all of the smart building's systems and an ability to learn about new building functions. From this point of view, and further to the R2S frame of reference, support by a Smart Building PMO is a solution to be considered so as to be able to undertake such projects with more confidence.

In the end, smart buildings and their specifications are not too complex to establish. They could even lead to a significant simplification. But, to achieve this, the various stakeholders must be supplied with useful frames of reference and the sector must be helped to embrace the issue.

SMART BUILDINGS ARE NOT PROFITABLE

Smart buildings suffer from two deep-rooted prejudices: they might be very difficult to produce and, above all, very costly, which would restrict them to exceptional new-build sites of several thousand square metres.

Thinking that only a good initial design can lead to return on investment means ignoring the equation whereby the building actually costs much more to operate (75% of the building's cost over its life cycle, compared to 25% for the construction, including design costs) and that controlling the OPEX does not address the issue of smart building profitability.

As well the overall view of the entire life-cycle (CAPEX + OPEX), this involves considering all fields together. The silo approach prevents the easy implementation of profitable economic models. Therefore, even today, the issue of return on investment is basically addressed from an energy and environmental performance viewpoint, by linking active and passive management. But the low price of electricity in France does not provide enough leverage to guarantee return on investment for smart buildings. Therefore, an overall view of the services (energy, fluids, comfort, asset management, safety, security, well-being, etc.) is necessary, by pooling infrastructures as far as possible, in particular the digital layers.

An overall view of the building's life-cycle and a cross-disciplinary approach to services are key factors to optimising ROI.

SBA provides answers to this ROI issue through a different economic model, both profitable and replicable. These models underlay a global approach, facilitated by digital tools (the digital model, amongst others) that will allow systems to be pooled and optimised. With this model, operational issues are taken into account in the design phase (including maintenance costs). Collaborative working and better coordination of the site will ensure increased transparency, efficiency and speed of operation, and fewer additional costs due to evaluation and/or implementation errors. The structure will therefore be more qualitative, and this improvement will have positive impacts on the technical management of the building, conditions of use and working comfort, and also on the well-being of the occupants -now known to have an impact on productivity.

The services linked to the building's performance are the key to profitability, and will quickly offset the initial investment cost. The smart building will therefore prove to be less costly than a similar structure designed and implemented according to conventional silo-based practices. Optimised, it will become more attractive in the real-estate market.

The smart building will have positive impacts on the technical management of the building, conditions of use, working comfort, and on the well-being of the occupants

THE MARKET WOULD NOT BE READY

A study by the Moniteur Group[1], carried out during Simi 2015, revealed the barriers to the digital transition of buildings. The main ones include: resistance to change; the compartmentalisation of activities; the difficulty evaluating the ROI linked to investments in digital technology; the difficulty identifying experienced players; the knowledge deficit, making training necessary; concern about the security of companies' data, etc. **THIS SUGGESTS THAT THE SECTOR IS CHANGING TOO SLOWLY; ILL AT EASE WITH THE DIGITAL TOOLS AND AFRAID TO TAKE RISKS.**

Construction professionals must learn to trust each other – which entails setting new limits of responsibility. This requires discussions, support, partnerships, setting an example by visiting the construction sites, obtaining commitment by taking a cue, for example, from the communication networks industry. This sector very quickly understood that a powerful network allowed common values to be shared among the different service providers. Construction, with its compartmentalisation and lack of openness, is characterised by counter-references that should today encourage the transferability and cross-fertilisation of skills.

The industry's composition – mainly artisans, micro-, small- and medium-sized businesses – also raises the question of support for an entire sector. Having few means and little time, they risk being left behind by this change. Yet, while smart buildings are technically very sophisticated, this does not necessarily mean that specialised companies must be used. **SMART BUILDINGS ARE BASED ON STANDARDISED, PROVEN TECHNOLOGY, NOT DISRUPTIVE TECHNOLOGY.** While project management must pay close at-

1 - "Digital: enjeux et attentes des professionnels de l'immobilier d'entreprise" [Digital: challenges and requirements of commercial real-estate professionals], survey carried out 8–24 December 2015 among visitors to Simi in 2015 by the Moniteur Group.
Sample: 1.489 visitors to the 2015 Commercial Real Estate Show (SIMI) took part in the survey. They answered an annual global questionnaire emailed to them, containing 109 questions, 5 of which were about the impact of digital technology.

tention to the scheduling, design and monitoring of the site to anticipate and manage difficulties (which entails specific support), local businesses can still be involved in a smart building project.

The change of approach, in both construction and operation, requires a genuine change in current practices. These hurdles are a formidable challenge for the French construction sector, and new players could capture this market rich in opportunities. **SBA IS WORKING ON EDUCATIONAL MATERIALS, FRAMES OF REFERENCE, AN APPROACH TO BE IMPLEMENTED TO PROVIDE SUPPORT FOR THE SECTOR**. The Alliance's primary goal is to forge contacts between the various upstream and downstream stakeholders, to make progress on all issues by consensus, in a spirit of cooperation, understanding and simplification of the smart building.

Context and issues

DIGITAL TRANSFORMATION: TOWARDS A "USER-CENTRIC" WORLD

The dawn of the digital age marked a watershed in the development of society. It has revolutionised our way of life and led businesses to rethink their organisation, operation and positioning to meet the users' new needs and demands. The social phenomenon of the sharing economy (Airbnb, BlaBlaCar, WeWork, etc.), for example, establishes rules other than those commonly accepted.

The value chains have been extensively reappraised. Consequently, digital technology, through what is sometimes called "uberisation", enables access to resources that were previously not used or not shared. It calls the existing positions into question and opens the door to new players and new business models bringing services that are cheaper and more comprehensive. The user experience, simplicity of the concepts, convenience of use, accessibility to many people are advantages that have made these new economic models so successful.

*The "fixed" Internet of the 1990s had **1 billion** users connected. The Internet of Things could connect **28 billion** objects between 2014 and 2020*[1]

These models are not the result of disruptive technology, but are based on algorithms and control of the data produced by the building and its occupants. They are, however, disruptive in other regards: they are organised on the principle of peer-to-peer exchanges, collaboration and personalised service. They meet a need that conventional businesses are unable to anticipate.

These new entrants, not "core businesses", are competing with the traditional professionals, fragmenting the market, weakening the sectors unable to adapt, and could destabilise previous market balances.

With digital, the users are central to the system and decide the future of the solutions proposed to them. If an application isn't liked, another will quickly replace it, like the applications that can be downloaded onto a smartphone. The quality of the combination of product, platform and available services becomes decisive. The users have already adopted this principle, which favours use over ownership. Shared car-parks and bike sharing systems are examples of this; the emphasis is not on having a car, it's about being mobile. And **THE WEALTH OF POSSIBLE CHOICES IN TERMS OF SERVICES OPENS UP NEW HORIZONS, BOOSTS CREATIVITY, INCREASES THE PACE OF CHANGE**; "future" innovations are on the market in just a few months.

The digital revolution is also the result of networking, of "all-encompassing" communication between the various transmitters and receivers. It is also the Internet of Things (IoT), a booming sector and another form of the digital revolution. According to Idate, the number of devices, terminals and objects connected to the Internet was 4 billion in 2010, 42 billion in 2015. It could reach 80 billion in 2020[2]. The Internet of Things is growing exponentially.

1 - "The Internet of Things: Making sense of the next mega-trend" Goldman Sachs Group Inc., Equity Research, Sept. 2014.
2 - "Internet of Things: une base installée de 42 milliards d'objets en 2015 promise à une forte croissance" [Internet of Things: an installed base of 42 billion objects in 2015 indicates strong growth], ITRNews.com

Users now control use.

Everything - cars, clothes and accessories, electrical appliances, household goods, etc. - can be connected, everything is communicating and interoperable, which makes the development of smart services possible.

The use of sensors, interfaces and applications will skyrocket. Especially in buildings and cities, which will be fitted with smart connected ecosystems – a pre-requisite – so as to develop into smart buildings and smart cities. Linked to this geolocation, a limitless range of innovations will open up in all business segments.

With the IoT, we will progressively enter the Web 3.0 world, **AN ENVIRONMENT OF ARTIFICIAL INTELLIGENCE IN WHICH COMPUTERS AND NETWORKS ARE INTEGRATED EVERYWHERE TO PROVIDE MASSIVE INFORMATION, SERVICES AND APPLICATIONS IN ALL FIELDS, AT ALL TIMES**. With the Cloud and virtual media, contact at any time and in any place becomes possible. It even becomes strategic, since continuity of service is central to the economic model.

Computer programs capable of increasingly sophisticated actions (analysis, diagnostics, decision making or decision support) raise the prospect of systems able to learn, reason, perceive the environment, understand language, and therefore provide services of a level never reached before... This growth in computer potential is leading towards cognitive computers, which may be a third digital revolution[3].

This proliferation of connected objects will result in the exponential growth of available open data, which will have to be analysed, organised, stored and processed, the requirement for immediate access to information, services, people, etc., which will need trusted intermediation, and also big data, which raises the fear of inadequate protection for personal data and its use by third parties. As early as 2005, the first prospective study on IoT, involving users and conducted by Capgemini, showed that their greatest worry was that the personal data collected could be used without the person knowing by whom or why[4].

3 - “Éthique et numérique, quels enjeux pour l’entreprise ?” [Ethics and digital, what are the issues for companies?], by Flora Fisher, www.questionner-le-numérique.org
4 - “L’Internet des objets. Quels enjeux pour les Européens ?” [The Internet of Things. What are the issues for Europeans?], by Pierre-Jean Benghozi, Sylvain Bureau, Françoise Massit-Folea, October 2008, p. 44.

Because the user and the use of personal data is of paramount concern to SBA, it is working on these sensitive issues with the reference bodies. This complex issue is very important as users will only adopt services if they trust the systems.

URBANISATION: TOWARDS MORE ETHICAL DIGITAL CITIES

The acceleration of urbanisation is a major challenge for humanity. According to a July 2014 report by the UN, the urban population will have grown 66%, with an additional 2.5 billion residents, by 2050. Within the next twenty years, 80% of the world's population will live in urban areas[1]. This concentration of the population in cities already has consequences today – land and air pollution, traffic congestion, insecurity, urban spread, security risks, etc. – further exacerbated by such concentration being badly organised and poorly anticipated.

17 billion euros

Estimated cost of congestion in 2013

This has major economic, environmental and social impacts. One example is the cost of congestion, estimated at 17 billion euros in 2013 (lost productivity, wasted fuel, increased wear of vehicles), which could reach 22 billion euros in 2030 if nothing is done[2].

Strategies must be put in place to provide the entire population with a better quality of living in cities: facilitate transport and make it more fluid, ensure access to services (health-care, transport, schools, etc.), preserve biodiversity, develop areas of sociability, combat the unequal treatment of districts, ensure security, provide support for ageing with respect, etc.

For urban planners and elected officials, this involves **RETHINKING THE CITY AND CREATING A MORE "DESIRABLE" URBAN AREA, WHICH PUTS PEOPLE AND SUSTAINABLE DEVELOPMENT AT THE CENTRE OF PROJECTS**. The urban approach must now pass through a human-focused perspective, with the smart city enabling and encouraging the commitment of inhabitants by developing a social and solidarity-based economy.

Planning tools: Territorial coherence scheme [Schéma de cohérence territoriale: SCoT], Local Housing Plan [Plan local de l'habitat: PLH], Urban Transportation Plan [Plan de déplacement urbain: PDU] at citywide level, Local Development Plan [Plan local d'urbanisme: PLU) at local level - provide a management framework for the city with a view to sustainable development. The issue to be faced now is one of urban compaction, of rebuilding the city on top of existing areas, of literally reaching for the sky, and reducing the sprawl that is encroaching too far into rural areas, and costly in terms of transport and energy. That is the challenge for smart cities: to make a city pleasant to live in, respectful of both people and the environment, in this new urbanisation scenario.

Smart cities are essentially connected, communicative, adaptive, resilient. They can monitor and optimise operation and infrastructures through data used in real time. Smart cities are **POLYCENTRIC, MIXING RESIDENTIAL**

1 - "Habitat, bâti et développement durable" [Housing, construction and sustainable development], 9th RIODD (Réseau international de recherche sur les organisations et le développement durable) Conference, 2014.
2 - "Le coût exorbitant des embouteillages" [The enormous cost of congestion], study by Inrix, Le Monde, 14 October 2014

Smart cities, a response to the issues of growing urbanisation.

AREAS WITH COMMERCIAL AND BUSINESS CENTRES TO AVOID THE CONSTRUCTION OF DORMITORY ECODISTRICTS, OFFERING COWORKING SPACES THAT HELP AVOID UNNECESSARY TRAVEL, ENCOURAGE EXCHANGES AND DEVELOP A CERTAIN UBIQUITY, ETC. These new smart "neighbourhood circles", where everything is within a few minutes' walk, will bring improved urban efficiency, less congestion, better balance between neighbourhoods, greater social and functional diversity, etc.

In this way, digital features in the smart city renew the vision of the city and the region, bring this ability to link areas together, and individuals or groups of individuals with areas. This approach eliminates the boundary between public space and shared space. Their boundary-lines become less distinct: a company's garden could become public at certain times of the day; the fully-equipped workroom in the basement of an apartment building could be used by the residents, parking spaces could be shared, etc. Digital options have the power to link things that were not necessarily linked beforehand. This approach makes it possible to develop new uses based on sharing, eliminate isolation and boost "living together", address the needs of the silver economy by enabling home support and more autonomy for elderly or disabled people, etc.

The challenge for smart cities is to make a city pleasant to live in, respectful of both people and the environment, in a new urbanisation scenario

Digital features also offer simulation tools for seeing, in a forward-looking way, the consequences of the design phase. Cities and regions can therefore be managed much more rationally. When the local elected officials and developers see what can be achieved at the neighbourhood level, the impact on the population, transport or energy consumption and urban planning rhetoric will all be called into question.

SBA IS STUDYING ALL THESE ISSUES IN ORDER TO DEFINE THE TYPE OF APPLICATIONS AND SERVICES THAT NEED TO BE DEVELOPED AT THE NEIGHBOURHOOD LEVEL, AND THE CONSTRUCTION INDUSTRY'S CONTRIBUTION. IT'S WORK IS ORGANISED AROUND FIVE MAIN QUESTIONS:

- what applications/services does a connected neighbourhood want developed in its private property complexes and in its public spaces?
- what contribution can smart buildings make to the connected neighbourhood (energy, services, pooling)?
- what technical and contractual measures must be developed for the implementation of services?
- what economic models must be identified?
- what contribution must be made to the social and solidarity-based economy?

These analyses will make it possible to define the fundamentals for better understanding smart cities, and for supporting the change from a centralised organisation of the urban area to a decentralised, diverse mode, placing the inhabitants as key stakeholders at the centre of new use scenarios.

SUSTAINABLE DEVELOPMENT: DO BETTER WITH LESS

Energy-plus buildings will have to generate more energy than they consume

To reduce global warming and tackle the depletion of fossil fuels, France is taking increasingly ambitious steps to reduce its greenhouse gas emissions and energy consumption: the Grenelle Environmental Law, the Energy-Climate Plan, the energy transition law, the Paris Agreements, etc. Cities – which produce over 60% of the greenhouse gases[1], mainly from transport and buildings – must implement their energy transition. For this purpose, they have made energy efficiency a key element of the fight against global warming, in particular through Agenda 21 and the Energy Collective Services Scheme, which sets targets for the use of renewables and for the rational use of energy[2].

One of the main levers available are buildings, which account for 40–45% of end energy consumption, depending on the sources (the French Environment and Energy Management Agency [Agence de l'Environnement et de la Maîtrise de l'Energie: ADEME]). Increasingly energy efficient since the 2005 and 2012 Thermal Regulations [Réglementations thermiques], their role will become pivotal with the implementation of the 2020 Responsible Building Regulation [Réglementation bâtiment responsable: RBR 2020], which will establish BEPOS [Bâtiment à Energie Positive: Energy-Plus Buildings] as the new construction model. **"ENERGY-PLUS BUILDINGS" WILL HAVE TO GENERATE MORE ENERGY THAN THEY CONSUME FOR FIVE TYPES OF USES: HEATING, VENTILATION, AIR-CONDITIONING, LIGHTING AND DOMESTIC HOT WATER**. Logically, this implicitly entails its connection to the smart grid, the pooling of energy and, ultimately, the development of energy-plus territories [territoires à énergie positive: Tepos]. This target of balance, at the scale of the block, neighbourhood and, more generally, city, cannot be achieved unless the buildings are interconnected and the systems are interoperable.

Today, energy is generated in large-scale, centralised ways (hydroelectric dams, nuclear and thermal power plants, etc.) with a relatively stable and controlled predictability. This electricity was delivered with ease to our homes, and no one challenged the system. But the growth of renewables, the 2012 Thermal Regulation and, in particular, RBR 2020 (which establishes buil-

1 – UN-Habitat, Annual report, 2014.
2 – French law no. 99-533 of 25 June 1999 on guidelines for planning and sustainable development for the territories.

dings as decentralised generation points), together with the increase in the atypical loads of electric vehicles and computers are changing this historical model. **THE TRANSFORMATION IS ALREADY UNDERWAY, WITH A RISE IN LOCAL PRODUCTION CHARACTERISED BY SMALL-SCALE POWER GENERATION UNITS (WIND TURBINES, BIOMASS, SOLAR CELLS, ETC.).**

The existing model is based on relatively inflexible consumption and production having to adapt to it immediately. Flexibility mainly comes from production, which provides most of the production/demand balance required for the electrical systems to operate properly. The transformation taking place is fundamentally altering this system. On the one hand, production increasingly contains a "fatal" inflexible component: wind turbines only generate power when wind is blowing and solar cells only when the sun is shining, not necessarily when needed for consumption. On the other hand, thanks to digital technology in particular, consumption is now more flexible: it is possible to make greater use of the thermal inertia of buildings, to change the time for some uses without affecting user comfort, etc. At the same time, storage technologies are improving and their cost, still high for wider use, is steadily coming down.

This new balance is therefore based on greater interaction between the various players in the electricity system - production, consumption, storage and load-shedding - with any player being able to carry out more than one of these functions.

These new interactions can only be developed based on sustainable business models. An approach restricted to just the energy silo may lead to considerable delays in the emergence of solutions for large-scale deployment. Here again, the pooling of digital infrastructures, advocated by SBA, is an essential measure.

The issue then arises of the interface between buildings and smart grids. **THESE INTERACTIONS NECESSARILY ENTAIL TECHNICAL CHANGES FOR A BUILDING. THEY ASSUME THAT IT WILL BE "READY2GRID", AS DEFINED BY SBA, AND THUS ENABLE REDUCTIONS IN ITS NETWORK INFRASTRUCTURE REQUIREMENTS, WHETHER FOR HEATING, COOLING OR ELECTRICITY**. The underlying issue of this Ready2Grid building's valuation also arises for all stakeholders and the local authority.

Smart buildings at the centre of sustainable development issues.

2

NEW
MODELS

Revolution through use

At the same time as our uses become digitised, forms of organisation are changing. With digital options, buildings are evolving towards a concept of a modular, flexible, multi-function platform. This type of approach can be used to provide new services, all offering simplification, accessibility and comfort tools for users. Thanks to the Cloud, which means you can be connected anywhere and at any time, mobility and mobiquity – meaning limitless internet access anywhere and everywhere – are increasing, the relationship with work is changing, energy and property management are being redefined, etc. Apart from fear and resistance to change, this possibility of doing things remotely, for residents and operators in particular, brings benefits that far outweigh the inconvenience of being connected. New requirements are appearing. This is revolution through use, boosted by digitalisation and continuous real-time interconnection.

FLEXIBLE, SHARED SPACES

33% of businesses in the Greater Paris area have available space. 1.5 million square metres are under-optimised and 4.4 million vacant - meaning almost 6 million square metres are available in the Greater Paris area[1].

Smart buildings lead us to consider uses beyond a building's physical envelope

In the tertiary sector, virtual work made possible by the Cloud (videoconferencing, sharing data, access to software systems, etc.), the explosion in mobile devices, and the time lost due to congestion in large cities, have led businesses to rethink their way of working. One result is the change to a more horizontal organisation of businesses. And there is a growing trend for employees to be "nomadic". More and more are organising their work-time between the office and teleworking, either at home or in public places (cybercafés, coworking spaces, etc.). A continually growing number of independent professionals and auto-entrepreneurs are the largest users of these new spaces, where they can meet customers or suppliers, and possibly benefit from synergies arising from contact with other professionals.

The shared spaces are diversifying, but they all share a similar concept: centres of human resources and pooled equipment, which encourage cross-fertilisation, conviviality and support. Sharing is the keyword in these places of collaborative experience.

La Cantine, the Paris site that pioneered coworking in France, opened in 2008. By the end of 2013 over 120 had opened in France, for about 100,000 coworkers[2]. In total, between coworking and teleworking, 20–25% of the Greater Paris working population could be teleworking by 2030, according to ORIE[3].

With office occupancy rates falling, more and more company managers are rethinking how their office spaces are managed (second expenditure item

1 – IPSOS study for Bureaux à Partager and La Poste, January 2014.
2 - "Transformation numérique et vie au travail" [Digital transformation and work life], report by Bruno Mettling, September 2015.
3 - ORIE: Observatoire régional de l'immobilier d'entreprise [regional commercial real estate observatory].

Create flexible spaces to adapt to changing lifestyles and working methods.

after salaries). For managers willing to rent part of their unused spaces to other companies, networking platforms act as real-estate managers. This market is promising: in Greater Paris, between 45 and 65% of office spaces are empty on a permanent basis. Furthermore, one million companies in France have less than ten employees and only draft three- or six-month forecasts at most4; committing to a 3/6/9-year lease can provide truly complex for these company directors. By sharing working spaces, each and every participant benefits: on the one hand, remuneration is received for empty spaces and real-estate assets are used; on the other hand, flexible rental, meeting ad hoc requirements, over varying periods, can be concluded with just a few mouse clicks, with reduced costs and less paperwork; guaranties, insurance, billing, etc. are all handled by the service platform. Sites can be totally "corporate" or 100% atypical for companies looking to unite their management in a more original and friendly environment which could help promote more exchange and creativity.

While real-estate managers are not interested in small surface areas (from a few square metres to approx. 150 m^2), they are now appearing as profit centres, and this vision is completely renewing the approach to managing tertiary sites.

Despite this, this trend towards flexible working methods has not affected service requirements: the idea that staff can be less productive due to a location change is not acceptable. The working environment must be recreated, regardless of the location. **THIS IS THE STRENGTH OF THE CLOUD, WHICH CAN BE USED TO CONNECT TO FILES, APPLICATIONS, DATA, ... FROM**

4 - Hub Grade. SBA round table, "Nouveaux usages des espaces de travail" [New uses of working spaces], 12 May 2016.

ANYWHERE, ANY TIME, AND USING ANY COMPUTER... This is the very principle of mobiquity, continuous service provision via mobility, where the line between private lives and work is increasingly vague. This switch towards home working and use of public spaces or cafés naturally affects the occupancy rate of buildings, changes the rules for managing working spaces and could potentially lead to optimised real-estate use.

In this context of mobility and sharing, tertiary real estate must be able to adapt, be reversible, be multi-purpose, an open space can, for example, become a coworking space, be used to show films or hold receptions, etc. The notion of diversity mentioned for urban planning again arises for tertiary spaces. Large tertiary buildings are currently home to offices, shops, dwellings, public spaces, etc. This functional diversity intrinsically requires flexible infrastructures.

78% of workers in generation Y wish to work while mobile[1]

This sharing-based approach is currently applied in the residential sector, particularly in blocks of flats, where new concepts are emerging: a fully-equipped workshop is delivered with each building, and at the disposal of tenants via a booking platform, a shared car park in the basement, etc. **THE BUILDING'S APPEAL, AND THEREFORE ITS VALUE, IS ALSO BASED ON THE SERVICES PROVIDED, TAKING REAL ESTATE BEYOND THE SCOPE OF CONSTRUCTION. THESE ARE IMPROVED OR HIGHER VALUE BUILDINGS, PROPOSING PLEASANT ACCOMMODATION, AS WELL AS SERVICES.**

MOBILITY AND CONTINUITY OF SERVICE

In the "nomad" era, the absence of network coverage, slow data transmission, etc. any hindrance to mobility, is unacceptable for users. Ad hoc tools, particularly converging networks, must be implemented to ensure that services can be accessed anywhere, whatever the circumstances.

Geolocation, combined with access to services making day-to-day life easier, has become a key system for mobility: geolocation does more than just provide route information; it can provide context and hypercustomised information. Looking beyond GPS, now used by just about everybody, a geolocation system combined with inertial sensors and/or voice synthesis can improve the independence of the blind in terms of mobility; a company will be better able to track fleet movements and, if vehicles are electric, will be able to plan for recharging time and sites, and charging requirements. This information could also be very worthwhile as part of a building connected to the smart grid.

THESE TECHNOLOGIES HELP TO ENSURE THE APPEAL OF LOCAL AUTHORITIES BY OFFERING INHABITANTS BETTER MEANS OF USING PUBLIC SERVICES, BETTER GUIDANCE IN ADMINISTRATIVE BUILDINGS, MUSEUMS, ETC. These technologies have an economic impact, e.g. by helping to increase the visibility of regional cultural sites by displaying context information to tourists at the right time... They also provide precious help with enabling home support – a considerable issue – for the remote assistance of the elderly or disabled

1 – "Retour vers l'espace de bureau du futur" [Back to the office space of the future], Michel Octernaud, 9 April 2009, www.lesechos.fr

Well-being at work: a strong and legitimate expectation.

WELL-BEING AND HEALTH AT WORK

Employees – particularly since generation Y – have become more demanding when it comes to the layout of their working space and this trend is on the up, driving company management to reconsider the comfort and well-being of their staff at their workplace. "Digital natives" are particularly sensitive to showing respect for others, using a friendly approach and collaborative working: 81% consider that the existence of collective working spaces is a selection criterion for a new job[3]. When these aspects are considered, they offer a means for companies to stand out, increasing their appeal and ability to recruit young and talented personnel. This concept of well-being at work is one of the characteristics of campus. These are tertiary buildings, located in city suburbs to save costs, which often satisfy the most demanding standards and offer multiple services to employees: sports facilities, crèche, multi-service caretaker (dry cleaners, car washing, errands, etc.)... These services help to simplify daily lives, and ensure a healthy balance between work and private lives; the remote location therefore becomes more acceptable.

The other strong trend indicating a cultural change in direction at work is the fact that companies consider the well-being and health of staff as a concern. In France it is considered that an average of 10% increase or decrease in productivity is possible based on well-being at work[4].

According to 86% of staff, the working space has a significant impact on well-being, according to 80% on their work performance and according to 72% on their motivation[2].

2 – "L'espace de travail, un élément déterminant dans le quotidien des salariés" [The working space, a decisive feature in the daily lives of employees], Actinéo/TNS Sofres summary report, 9 May 2011.
3 - "Les espaces de travail: un outil de stratégie et de management" [Working spaces: a contributor to strategy and management], Utopies, position report, March 2015.
4 - ARP Astrance. SBA round table, "Nouveaux usages des espaces de travail" [New uses of working spaces], 12 May 2016.

The quality of light, fitness, food, etc. are all part of these new well-being values of modern companies. They call for new management methods and a new state of mind: less hierarchy, more transversality, better listening skills, cooperation and not just execution... all of which are revolutionising management methods and boosting project-type approaches.

Service platforms, for which tools were prepared in coordination with doctors, sociologists and psychologists, provide managers with means of monitoring the level of satisfaction of their teams in order to maintain staff morale at the highest possible levels, enabling them to give their best. For example, an anonymous questionnaire could be launched on views on working conditions, allowing the manager to optimise some aspects of these conditions; a dialogue window could be created when moving offices, to address the concerns of some employees... These practices, which have been used for around fifteen years in the United States, are starting to appear in France. Experience has shown that the digital world brings people together, particularly during periods of conflict; it improves teamwork thanks to participation-based management. Humans are brought to centre stage.

Companies having invested in a policy on the quality of working conditions have recorded a return on investment three to six times higher[1]

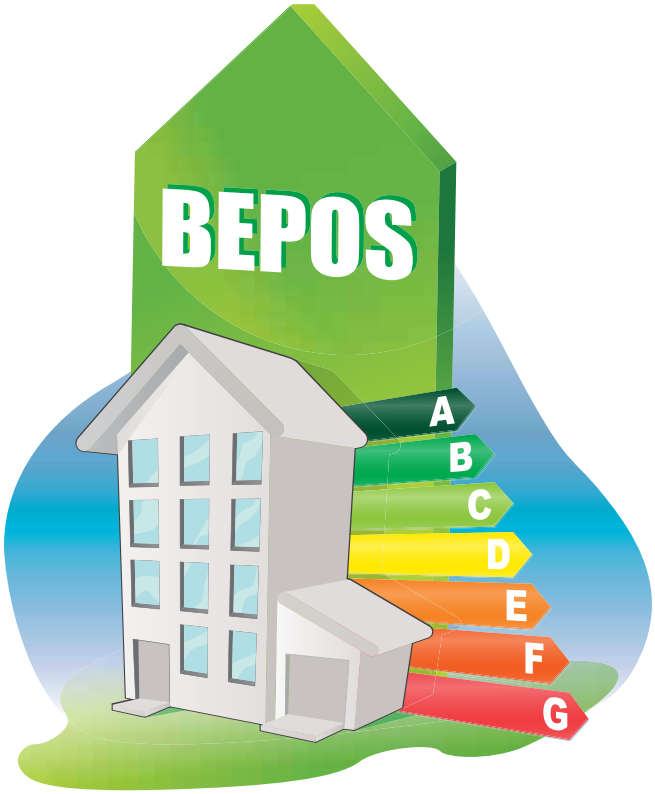
Other aspects must be considered, over and beyond these management support services: smart offices, avoiding sedentary lifestyles and encouraging mobility, taking full advantages of the benefits of luminotherapy, etc.: 38% of staff consider that a good working environment helps improve satisfaction levels, and feedback has confirmed the correlation between satisfaction and fitness[1]. **THE IDEA IS THEREFORE TO ENSURE THAT EMPLOYEE HEALTH AND WELL-BEING AT WORK ARE BOOSTED BY THEIR SURROUNDINGS**. Buildings, until recently considered as having no effect on the results of companies, are increasingly considered as contributors to productivity. All companies having invested in a policy on the quality of working conditions have recorded a return on investment three to six times higher[1]. Studies in the UK and in the USA have assessed the increase in productivity generated by better listening to the expectations and needs of the occupants of office blocks at between 6% and 26%[3].

ENERGY AND ENVIRONMENT

In the fight against global warming, the Grenelle I and II laws launched a construction policy aiming to reduce energy use and improve the protection of the environment. On this basis, RT 2012 (RT: thermal regulations) established binding targets for results for new buildings and a commitment to improve existing buildings. Council housing is strongly affected (particularly in the fight against the scarcity of energy supplies) and ambitious targets also apply here: to reduce energy use by 38% or more by 2020.

This policy has driven the sector towards unprecedented change, implementing the necessary technical and technological resources to meet these targets.

1 – Wittyfit. SBA round table, "Nouveaux usages des espaces de travail" [New uses of working spaces], 12 May 2016.
2 - "Vers une approche globale des enjeux spatiaux, fonctionnels et humains" (Targeting an overall policy for spatial, functional and human issues) Cerema, Sheet no. 1, L'Essentiel collection, June 2015.
3 - "Bâtiment à énergie positive", known as Bepos, Energy-plus buildings, Enerplan sheet, Syndicat des professionnels de l'énergie solaire (Union of solar energy professionals), April 2013.



Buildings must totally offset the energy used for the 5 types of use listed in RT 2012 by producing renewable energy locally.

RT 2012 buildings are currently optimised during the construction phase to meet the Bbiomax coefficient, the first part of the regulations, which requires the intrinsic performance of the building in order to limit the use of heating, lighting and cooling systems. These buildings have lower energy use, complying with a mean Cepmax (max. primary energy use) of 50 kWh/m^2·year, the second part of RT 2012, covering 5 types of use: heating, cooling, lighting, domestic hot water and auxiliary systems. These buildings use less air conditioning, the third part of RT 2012, which is also strictly governed.

THIS SPECTACULAR IMPROVEMENT IN NEW BUILDINGS WILL REACH NEW LEVELS WITH ENERGY-PLUS BUILDINGS (BEPOS) as part of the RBR 2020, the national transposition of European directive 2010/31/EU on the energy performance of buildings: buildings must fully offset their energy use for the aforementioned five types of use via locally produced renewable energy, this energy balance for the building must be positive over the year[3]. Energy requirements can be covered using local production resources, with the energy either used directly or injected into the grid as extra energy. Energy-plus (BEPOS) houses require the imbrication of buildings and energy networks, an underlying principle for smart grids.

In this context, buildings contribute to grid operations and balancing, and the grid must integrate the ever-increasing use of energy produced locally – renewable energy –, self-consumption or resale to the grid, while ensuring a guaranteed supply. This strategic guideline requires indispensable multi-source energy flexibility as an intrinsic feature of buildings, the ability to better manage the local energy mix (power, heat, gas). Without this approach, the risk exists the grid will not be able to absorb the extra renewable energy occasionally injected into it, and it may even be grounded in an absurd scenario.

However, buildings must also prove effective outside of the five types of use listed in RT 2012, based on new high-energy uses with variable consumption periods, starting with IT and recharging electrical vehicles. From this point of view, reducing energy performance to these five types of use would mean

ignoring the energy impact of the massive deployment of digital hardware (including in homes) and the potential development of rapid charging stations for electric vehicles.

Concluding with a key point, complementing energy flexibility, buildings must be able to meet energy performance commitments in terms of regulatory and specific uses, the only means of guaranteeing the necessary reduction in infrastructural costs for grids.

REAL-ESTATE MARKET

The approach to the real-estate market is being totally rewritten based on digital options and the sharing economy. New models for housing, offices and shops are appearing, and even if these examples are still in the minority, the revolution is already underway.

The idea is no longer to propose surface area, the areas must now be connected, and come with services, while incorporating energy efficiency and the environment

If we consider the residential market, for example, participative housing combines privacy with collective actions, creating a more community-based lifestyle. The laundry, games room for the kids, DIY workshop, spare room, etc. are all shared. A shared kitchen and dining room allow occupants to organise meals together. All equipment, games, sports gear, etc. is purchased jointly. Human facets, shared expertise, passing knowledge on, as well as respecting the freedom of each person to participate in collective activities, are all drivers for this new housing model. In this context, the social ties encourage mutual assistance and social skills, inter-generational mixing ensures that the elderly are not isolated or stuck in a rut, promoting better ageing.

This model is still very rare in France, but represents 5% of housing in Denmark[1]. In New York, roof patios are shared to offset property costs[1]. **PARTICIPATIVE HOUSING REDUCES THE COST OF ACCOMMODATION AND ENERGY BILLS, WHILE GIVING REAL MEANING TO "LIVING TOGETHER".**

In collective housing, the digital revolution has also led to new resident requirements. According to the Alur law, property managers must install an intranet network to ensure that residents can access all building management data. This obligation has given some property managers ideas, and they have starting offering other on-line services via a service platform: residents can track energy use, manage their heating, be informed of events in their building or district, etc.

E-trading sites are competing with physical outlets when it comes to commercial real estate, and players on the real-estate market are starting to consider the use of data on behaviour, transactions or geolocations as a business opening for shopping centres[2].

When faced with these new models, the real-estate market must change direction and focus on the habits and expectations of users. The idea is no

1 - "Regards croisés sur les nouveaux rapports à l'espace, au travail et à la ville, cahier de la chaire Immobilier et Développement durable" [Views on the new relations with space, work and cities", volume by the Real Estate and Sustainable Development faculty], Essec Business School, volume no. 2.
2 - "La transformation au coeur du marché immobilier: bilan et perspectives 2016" [Transforming the heart of the real-estate market: report and prospects 2016], EY panorama of the real estate investment market

Buildings must integrate architecture, technical facilities and social aspects.

longer to propose surface area, the areas must now be connected, and come with services, while incorporating energy efficiency and the environment. The value of the asset is ultimately dictated by the users, who define to what extent the building on offer must be finalised. Technological developments and the growth in the sharing economy are expected to speed up, boosting the obsolescence of property which cannot meet these new standards. Vast upgrading works await the renovation sector. **RENOVATIONS AND PROPERTY DESIGN PROJECTS MUST INCORPORATE TECHNIQUES AND STANDARDS BASED ON THE NEEDS OF USERS**; buildings must optimise the integration of architecture, technical facilities and social aspects. The ability to assess and respond to the required level of user quality is a new challenge facing the real-estate sector[3].

NEW TECHNOLOGIES, NEW PLAYERS, NEW APPROACHES

The digital revolution is starting to impregnate all trades relating to buildings, urban services and regions in terms of design, execution and management, mainly via digital models and web services.

This digitalisation process requires the quantification of environments based on data collected by sensors, opens up the road to new IT and telecommunications players. IoT and service platforms are in full boom and can be used to

3 - “La quality d’usage des bâtiments - Vers une approche globale des enjeux spatiaux, fonctionnels et humains” (The user quality of buildings - Targeting an overall policy for spatial, functional and human issues) Cerema, June 2015.

inject intelligence into structures. These platforms open up a new realm for innovation by start-ups and third party developers, which could create a wide range of new services designed for all types of uses, comfort, energy performance, etc. These players know exactly how to structure and analyse data to achieve its full potential. Thanks to their expertise, these players can convert buildings into service platforms, just like smartphones, which can be used to download applications, optimising building functionalities, improving user comfort and making life easier: consider, for example, an application which can optimise the comfort-to-energy-cost ratio for housing based on the actual uses or feelings of the occupant and can self-teach.

Start-ups and innovative firms contribute intelligence, while industrial players and operators manage the actual service provided; a type of partnership where each party has a role to play, knows their trade and needs the others to deploy the "smart" part of smart buildings

In view of this growing range of services, traditional building operators are working in partnership with digital service providers to match market developments and stay in the smart building race: a lift manufacturer and IT firm are developing a system able to monitor thousands of connected lifts; a smart toilet system can be fitted in tertiary spaces to manage hygiene and consumables; help can be provided with regulation management to ensure that buildings stay conform, etc.

In general, start-ups and innovative firms are the driving forces behind innovation, however these players cannot penetrate the real-estate market alone. They contribute intelligence, while industrial players and operators manage the actual service provided; a type of partnership (other models also exist) where each party has a role to play, knows their trade and needs the others to deploy the "smart" part of smart buildings. **ENERGY EFFICIENCY, HOME SUPPORT AND THE MONITORING OF OPERATING CONTRACTS ARE THE PRIMARY THREE APPLICATIONS OF THESE NEW PARTNERSHIPS**[1]. Players which previously never interacted with the building sector, are now working with historical operators:
- IT software publishers;
- software engineering and IT service providers;
- telecommunications operators;
- energy operators, notably for smart grids;
- and more generally, data scientists or specialists in new technologies (cloud, big data, M2M, etc.).

This digital revolution will necessarily lead to major changes for buildings and related trades. Variants exist for traditional facility management operations, with new management services:
- the dynamic management of spaces and resources for new working methods, simplified by new technologies;
- environmental building management, overseeing environmental certifications (HQE, Breeam, Leed) with a life cycle policy and used to promote real-estate assets;
- health, comfort and well-being management, as part of a wider context including safety at work and personal services, as well as the quality of the working environment;
- sustainable development management for technical assets, using and improving the knowledge and monitoring of assets, notably thanks to Building Information Modeling.

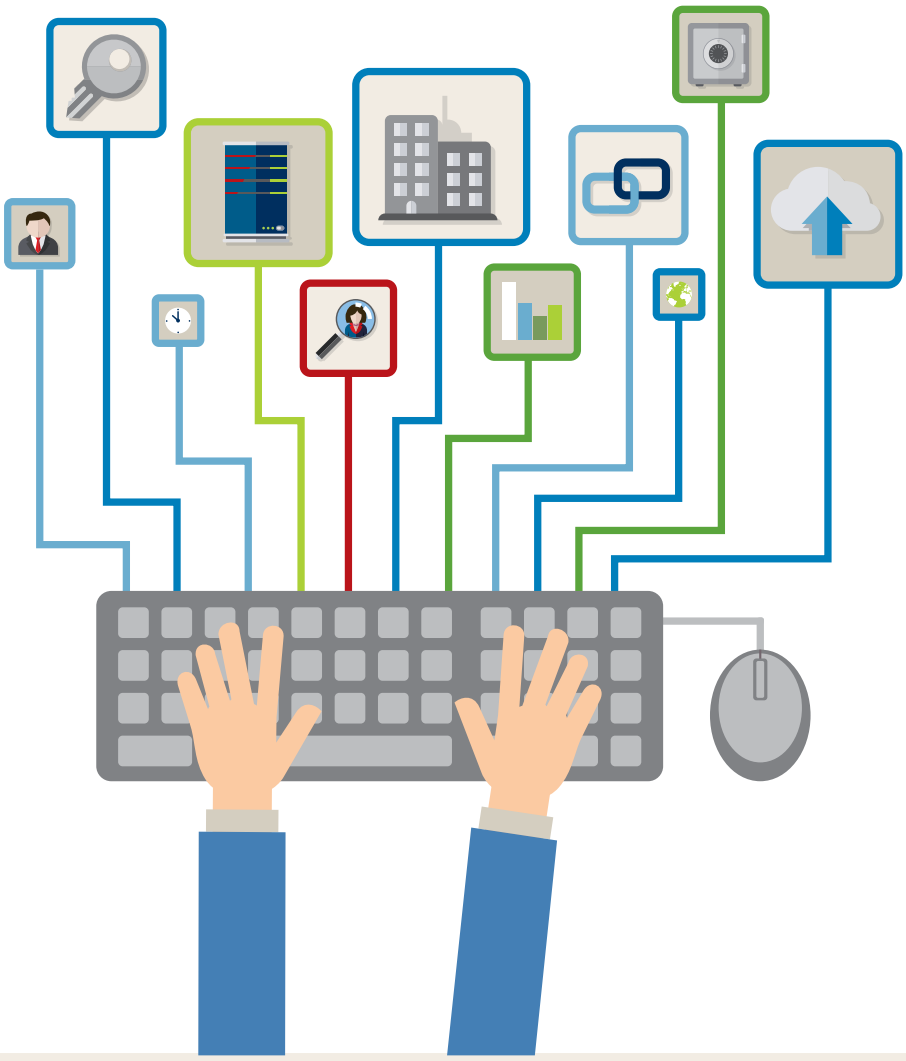
1 - "Bâtiments intelligents: quand l'innovation vient des start-up IoT" [Smart buildings: when IoT start-ups drive innovation], bye Arthur L., www.objetconnecte.com, March 2016

As BIM is developed, an integrated design approach is becoming part of a mandatory systematic vision, able to cover all technical, regulatory and environmental requirements, while keeping costs under control. The BIM Manager is becoming a key player in this new approach.

The Energy Manager is in charge of energy management in a world of free energy markets – requiring the dynamic management of energy supply contracts based on fluctuating production capacities – and can also guarantee performance for all of the services proposed (energy, water, waste, shared car parks, etc.) and not for the building mesh, but for the entire district.

The need for consultancy services, project management assistance, studies and territorial planning is also growing, driven by uses and services, which create economic, social and environmental value. Commitments underlie this new focus on services, and mediation skills are required for relations with building users and occupants.

SBA BRINGS TOGETHER ALL PARTIES IN THE SECTOR, WHETHER UPSTREAM OR DOWNSTREAM, AND REFLECTS THE MANY DIFFERENT TYPES OF TRADES REQUIRED TO CONSTRUCT SMART BUILDINGS. THANKS TO THIS FEDERATING APPROACH, AND THE WORK OF ITS COMMISSIONS, SBA CAN NOW PROPOSE A ROADMAP, ABLE TO ASSIST ALL PLAYERS IN THE SECTOR TO UNDERSTAND THE CHANGES NECESSARY TO ENSURE THE SUCCESSFUL BUILDINGS AND TOWNS OF THE FUTURE.



Jointly supporting upstream/ downstream sectors towards a successful digital transformation.

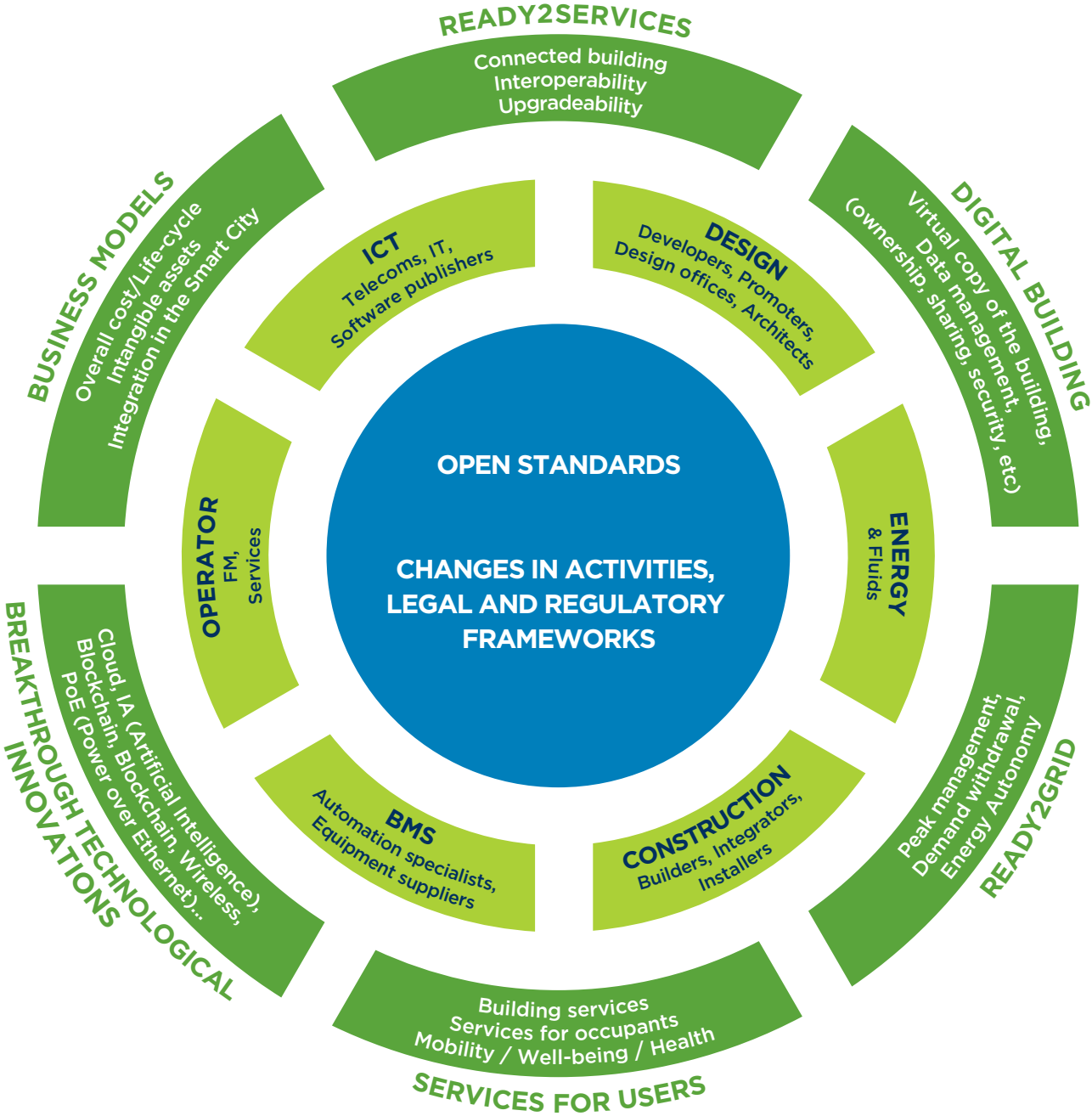
SOLUTIONS

The approach of the Smart Buildings Alliance

By federating all players in the construction sector, from design and execution to maintenance, not forgetting engineering firms, energy specialists, ICT players, real estate agencies, and territorial planners, etc. SBA is globally considering the development of an open and connected urban network, with smart buildings playing a central role in this network. Considering the impacts of the digital revolution at all levels of the value chain in the sector, from design to uses, is at the heart of SBA's works.

IN THIS CONTEXT, SBA'S GENERAL INTENTION IS TO CONSTRUCT A POSITIVE FRAMEWORK FOR ALL ACTIVITIES, TECHNOLOGIES AND SERVICES RELATING TO SMART BUILDINGS IN SMART CITIES, PROVIDING FRAMES OF REFERENCE AND GUIDES TO INFORM AND SUPPORT PLAYERS IN THE SECTOR, NOTABLY PROJECT MANAGERS AND PRIME CONTRACTORS, ON THIS NEW APPROACH TO BUILDINGS, PROVIDING THE INFORMATION THEY NEED TO MANGE THIS CHANGE WITH CONFIDENCE.

This approach is fed by the brainstorming sessions of the various SBA commissions, which include upstream/downstream experts from the sector. Working together, sharing a joint vision, based on an open-minded approach and communication, are the conditions for the development of smart ecosystems for a wide range of adaptable, long-lasting solutions. For SBA, only a cross-disciplinary approach can provide the key to this transition from buildings to smart buildings, as part of the development of a smart city.


READY2SERVICES
Connected building
Interoperability
Upgradeability
DIGITAL BUILDING
Virtual copy of the building,
Data management,
(ownership, sharing, security, etc)
READY2GRID
Peak management,
Demand withdrawal,
Energy Autonomy
SERVICES FOR USERS
Building services
Services for occupants
Mobility / Well-being / Health
BREAKTHROUGH TECHNOLOGICAL INNOVATIONS
Cloud, IA (Artificial Intelligence),
Blockchain, Blockchain, Wireless,
PoE (Power over Ethernet)...
BUSINESS MODELS
Overall cost/Life-cycle
Intangible assets
Integration in the Smart City
ICT
Telecoms, IT,
Software publishers
DESIGN
Developers, Promoters,
Design offices, Architects
ENERGY
& Fluids
CONSTRUCTION
Builders, Integrators,
Installers
BMS
Automation specialists,
Equipment suppliers
OPERATOR
FM,
Services
OPEN STANDARDS
CHANGES IN ACTIVITIES,
LEGAL AND REGULATORY
FRAMEWORKS

A BASIC TECHNICAL FRAME OF REFERENCE

The "Ready2Services" framework (R2S)

SBA is offering a new concept for buildings, based on a new frame of reference, a digital and ethical building, easy to adapt and pleasant to live in, compatible with a wide range of services, and which can interact with its environment and is part of the sustainable and smart city of the future, a profitable building, whose value on the real estate market will be guaranteed thanks to its value-in-use.

Buildings must be able to communicate with various environments and a wide range of equipment in order to deploy user services, address the issues of shared energies, home support, mobility, etc. The quality of design and execution of a structure – even with many labels – and the performance of its ecosystems, taken individually, is not enough. The ability to communicate without limits and without technological barriers is indispensable. Naturally, the information transmitted may or may not be sensitive, so communications need to come with protection for the data exchanged.

On this basis, SBA developed the concept of Ready- 2Services (R2S) buildings, buildings ready to provide any and all services, the plural is not there at random!

This IP infrastructure has the advantage of using a universal data transmission protocol, which is already available and interoperable for all communications, at international level

THE R2S CONCEPT IS BASED ON A SHARED ARCHITECTURE FOR ALL TYPES OF STRUCTURES: residential, collective housing, tertiary, industry, etc. This concept covers all connectivity and security requirements and can be used to move towards smart, adaptable buildings, and contribute to a complex environment with which it can interact, and which today's society needs.

THE R2S ARTICULATES AT THREE LEVELS

1 – THE CLOUD AND WEB SERVICES: the software layer used to transmit building data. Data must be available to allow services to emerge for building users, whether inside or outside;

2 – THE IP (INTERNET PROTOCOL) INFRASTRUCTURE: the network layer where all equipment can converge and communicate. This infrastructure is separate from the IT network, and must transfer data in a clear and secure manner. It can be used to interconnect hardware and services;

3 – EQUIPMENT or ecosystems: the hardware layer, including the sensors, actuators, controllers or systems such as heating, air conditioning, lighting, etc. It is essential for this equipment to be able to communicate with the IP network layer of the building.

Technologies are available to develop secure exchanges from the building, when outside of its walls; users can connect to services using a login, password and two-factor authentication, etc.

To implement these technologies, the intra-building infrastructure must be robust, secure and scalable: these IP networks have proven their effec-

tiveness for information systems, and it is logical to use these mature technologies when creating the building's information system.

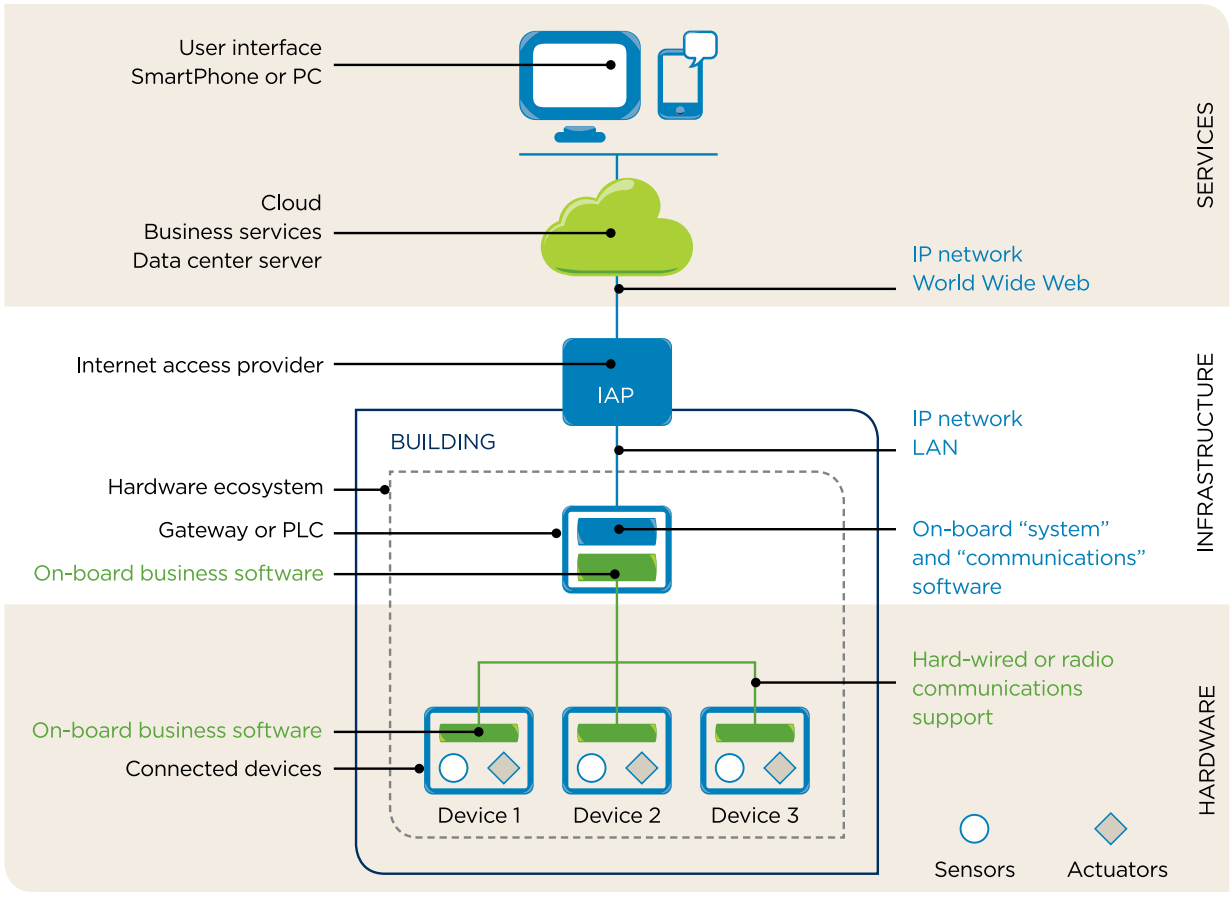
This IP infrastructure has the advantage of using a universal data transmission protocol, which is already available and interoperable for all communications, at international level.

Historically, in buildings, each part of communicating hardware and the ecosystem has developed their own data transmission and software protocol. These protocols are not always interoperable, and sometimes require gateways, which are incompatible with sustainable development as they require materials to produce and energy to use, as well as the necessary extra investment. Cloud-based smart building management therefore requires the use of a base IP infrastructure for the building, able to support communications flows just like the power, gas and water networks.

Despite this, SBA does not make native IP ecosystems a pre-requisite. SBA will accept any technical approach and respects existing ecosystems by principle. SBA considers the wide range of uses within a building, uses which are supported by different hardware and technologies, from the instrumentation and control systems, to multimedia, security, comfort, etc.

Only performance, level of service and the ability to interact with other ecosystems are truly necessary. The number of different protocols is not an issue, and the ecosystems can operate independently. The key point is that they must at least be equipped with an interface allowing access to web services, so that functions or information available for users inside the building are also avai-

Technical set-up for an R2S architecture



lable outside of the building, via the Internet. On this basis, equipment connected to the IP backbone of a smart building can exchange data locally or in the cloud, based on the same operating principle as smartphone applications.

The virtualisation of systems – i.e. the capability to create a second copy in the cloud and use remote applications – will ensure that other applications and information systems, not linked to the building, can access their functions and data. **SERVICE PLATFORMS WILL BE ABLE TO USE THESE FUNCTIONS AND DATA TO PROPOSE NEW SERVICES**. To give just one example, users with a heating control system at home will be able to control their heating when away from home too.

This architecture comprises three totally separate levels, providing a solution to the problem of interoperability and ensuring extensive flexibility for the building

Access to some types of data and equipment functionalities clearly raises the question of open systems; industrial players must explicitly describe this level of openness in order to establish the degree of interoperability of their products. It would not be appropriate to install a native IP infrastructure which could not be used or exploited during operations.

This architecture comprises three totally separate levels, which has the benefit of providing a solution to the problem of interoperability as well as ensuring extensive flexibility for the building. By separating the software layer (services), the communications layer (infrastructures) and the hardware layer (equipment), the R2S model establishes the rule that no specific equipment or dedicated infrastructure is necessary for a service, and vice versa, for all three layers. If an existing building is already equipped with a BMS, for example, if the operating contract is allocated to a new service provider, the new provider could use its own software and application to provide the same service, or an improved service, as communications will be intrinsically available either locally or via the cloud for all the data produced by the building's technical systems and its occupants.

The existence of these three independent layers is therefore essential and decisive when qualifying a Ready2Services (R2S) building. The structure guarantees that services can be deployed in the long-term and the sustainable efficiency of the building. **BUILDINGS DESIGNED USING THE R2S CONCEPT ARE CURRENTLY COMPATIBLE WITH THE EQUIPMENT AND SERVICES OF THE UPCOMING THIRTY YEARS, WITH NO SIGNIFICANT STRUCTURAL MODIFICATIONS REQUIRED.**

Despite this, this virtualisation will not change the need for product autonomy, in other words, the basic functionalities of the equipment stay the same, with or without a network. With lighting, a switch must be able to turn the light on or off, regardless of whether or not the Internet is operational. If the communications network is cut, data transmission will cease, but the lighting will continue to work. Switches will therefore still be available to activate the lighting, blinds or heating, etc. This local resilience is an indispensable condition for the acceptance of these new systems.

SBA has designed a frame of reference describing this 3-tier architecture, establishing the methodology for such a project, and all of the criteria to be taken into consideration for the hardware, infrastructure and IT security. **THIS R2S FRAME OF REFERENCE IS DESIGNED TO SUPPORT PROJECT MANAGERS AND PRIME CONTRACTORS WHEN DRAFTING THE PROGRAMME AND SPECIFICATIONS FOR A SMART BUILDING READY2SERVICES.**

Smart Data: providing a framework for digital confidence

Smart building services can only develop if they are acceptable to users, which implies data security, accessibility and governance. If users reject building services on the grounds that these factors are ignored, this would seriously hamper the development of smart buildings and comprise the inherent prospects for improvements. Data use must be monitored by all players involved in the data life cycle, whether public or private, however users also play a role, as they will provide their personal data when accessing services and, on this basis, may feel "vulnerable" in relation to the ever-growing power of digital tools.

The customised services provided for building occupants comprise the concept of use tracking, geolocation and therefore data on private lives. If this data is crossed with other data as part of ecosystem management, this knowledge of our preferences and behaviour becomes even more precise, strengthening the need for a digital code of ethics. In the tertiary sector, meeting room management, for example, can provide information on the presence of staff, their movements, etc. This information will rapidly be considered as sensitive for those who feel "watched".

When operating a building, systems can be used to determine the precise duration of an operation on equipment. While this brings clear benefits in terms of streamlining and rates, the technician carrying out the operation may be far less appreciative.

Data reliability and availability are fundamental for smart grids and all players involved must accept to provide their data to a smart platform, therefore confidentiality and network security must be closely monitored, and must be considered from the design phase for buildings, in view of integration in a smart grid.

The smart market can only develop if digital confidence follows suit. On this basis, a positive frame of reference must be created for data use for all related activities.

Smart data requires data collection, access, use and checks.

THREE TARGETS TO ESTABLISH DIGITAL CONFIDENCE

PROVIDE A FRAMEWORK FOR "DIGITAL TRANQUILLITY", and therefore ensure user confidence in order to deploy service solutions to the benefit of all. This digital confidence is primarily based on the protection of the privacy of users and the sensitive data of public and private firms. This confidence will be founded on a legal framework, governing relations between consumers and data providers involving smart buildings.

According to a study by Microsoft, only 23% of French inhabitants are prepared to share their data[1]

LAY DOWN THE TECHNICAL CONDITIONS APPLICABLE TO DATA PERFORMANCE AND QUALITY. The idea is to consider the interoperability of the different service platforms (BIM, BMS, CAMM, smart grids, etc.) and new data generators (connected objects, connected hardware, connected vehicles, etc.) and smart buildings in depth. The question of data – location and ownership, analytical processing and aggregation, fluid use and security – contributes to the performance of smart buildings; it is important to define assessment criteria for a digital infrastructure and use performance in the building from all perspectives.

PROVIDE INFORMATION ON TRADE-BASED ASPECTS RELATING TO NEW ECONOMIC MODELS AND SYSTEMS. The interaction between smart buildings and their environment, converging ecosystems (smart cities, smart grids, etc.), the boom in connected objects, etc. all call for new skills and new trades. This new scope must lead us to consider good practices, methodologies, and new business models, which could provide the basis for the deployment of the smart building environment (R2S, BIM, etc.) and propose a real service performance able to satisfy users.

FROM RAW DATA TO SMART SERVICES

Many types of data are transferred to the cloud:
– PLC data;
– sensor data;
– connected hardware data;
– connected object data;
– data long saved in software such as, for example, operating data, ... collected throughout the building's life cycle.

A considerable volume of raw data is transferred (big data) and raises two major issues: on the one hand, the ability of the network to cover the required volumes, computing speeds, and different data formats while guaranteeing smooth data flows. On the other hand, data mining, i.e. sorting and processing data until it is useful and usable, as data only really gains value when qualified. This requires access to data from industrial ecosystems and products to develop services, which create value.

Not being able to install an application on your computer or smartphone because the system is not compatible reduces the value of the product far more than the application. This creates a vicious circuit, the value of the service ensures the value of the product and ultimately that of the buildings.

1 - "Value Me" study, Microsoft Advertising, 2015

The digital model, for improved building operations

The digital model is the digital twin of smart buildings 3D models created using Building Information Modeling (BIM) open up great prospects for buildings. This digital tool provides a process helping to collect, summarise and share data between the different players involved in a real-estate project. Digital models are increasingly used by engineering firms and architectural agencies during the design and execution phases, and are no longer an option; they will soon be mandatory. We must be ready.

By focusing on BIM, SBA is not aiming to repeat the projects already completed by other groups or bodies, but to demonstrate the benefits of digital modeling when it comes to operating smart buildings, managing assets and services. To give just one example, new smart city services will emerge thanks to the digital models of buildings and regions.

THE GUIDE WHICH SBA IS WORKING ON, AND WHICH CAN BE USED TO SUPPORT PROJECT MANAGEMENT, AIMS TO EXPLAIN THE POTENTIAL OF BIM, AND THE OPPORTUNITIES OFFERED BY THIS TOOL DURING THE OPERATIONS PHASE, IDENTIFY DIFFICULTIES AND PROPOSE SOLUTIONS.

Contrary to expectations, operations BIM can be launched without the digital model for the design/execution phases. SBA's approach therefore aims to encourage project managers to adopt this tool right now, and apply it in their existing buildings.

A UNIQUE BUILDING MANAGEMENT SYSTEM

Technical building management, maintenance, risks, flows, personnel, equipment, costs, information, etc. the operations BIM covers all of the internal actions of a building throughout its entire lifecycle.

On the basis of these services, a digital model reflecting the actual building is created – the virtual thumbnail –, enriched with static data (physical infrastructures and equipment) and dynamic data (data from sensors, meters and connected objects). This digital model can be shared between several players (project manager, Facility Manager, manager, etc.). This across-the-board use brings inherent interoperability criteria and a need for open systems. The aim is to interconnect all this data, and converge input into one single operating system, avoiding all silo-type management.

New services could be developed, which would have been difficult to imagine in the past, using geolocation and georeferencing options

SERVICE SUPPORT

The technical management of buildings (asset management, energy optimisation based on usage scenarios, functional analyses of ecosystems, predictive maintenance, etc.) can be optimised and made far more effective thanks to digital models designed for the operations phase, with highly precise statistics and analysis. New services could also be developed, which would have been difficult to imagine in the past, using geolocation and georeferencing options.

Using the digital model initially created to design the building is clearly the ideal starting point, however, this input is not indispensable. The operations BIM can be deployed using a digital model based on a survey – which is currently easy to achieve using systems connected to a 3D camera. The data necessary for operations will then be integrated using information from the BMS, CAMM, diagrams, the technical datasheets of the industrial players having delivered the facilities, etc. This process can take time, but will lead to significant subsequent improvements and allow for access to the highly worthwhile functionalities of this digital tool:

OBJECT GEOREFERENCING with data allocated to the same site (office, room, meeting room, etc.), the same system (lighting, telephony, coating, etc.). Georeferencing will be useful for services relating to spaces (e.g. cleaning hotel rooms);

THE GEOLOCATION OF INDIVIDUALS AND BUILDING COMPONENTS, this data can be crossed. The geolocation of medical equipment in a hospital, guiding a person to a meeting room, a technician or an emergency team to the site of an incident/accident, visitors in a shopping centre, etc.;

SIMULATING SCENARIOS to study their feasibility, cost and impact. This could involve moving offices, replacing technical equipment, modifying a set-up for home support, etc. These modeling processes can be costed prior to implementation, converting this predictive approach into a highly effective decision-making help tool. Operators can use these simulations to commit to target results.

Council landlords, managing a series of dwellings with a wide range of buildings, equipment and backgrounds, have also understood the benefits of operations BIM and use for existing assets is constantly on the up.

Elected officials have also realised the clear benefits: when combined with CityGML, the 3D modeling standard for urban spaces and its components, the operations BIM (which includes more building data than the urban part

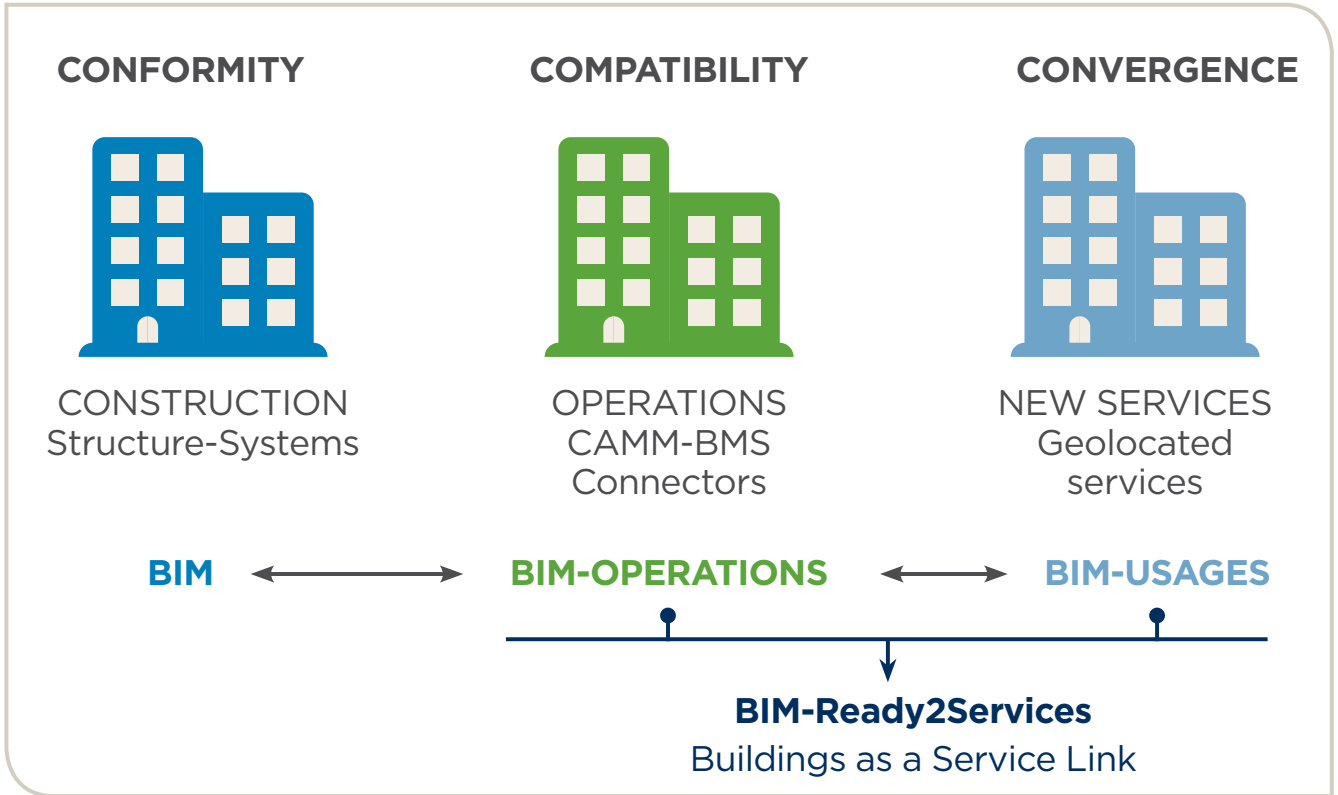
modeled in CityGML format) enriches asset data. This complementarity can be applied in the planning and management of urban areas, with simulations for transport, building operations, energy and environmental effects, etc.

PREPARING READY2SERVICES BIM

OPERATIONS BIM OFFERS AN EXCEPTIONAL TOOL FOR MANAGEMENT, INFORMATION AND STREAMLINING, REPRESENTING A KEY FACTOR IN ENSURING THE PROFITABILITY OF REAL ESTATE. The data base is continually enriched, throughout the life of the structures, and ensures extremely detailed and reliable knowledge of assets. This data base can be transferred in the same way as a deed, and represents a key feature in the value of the asset. The deployment process should be speeded up by regulations, which will require digital modeling from 2017 for government contracts.

While the operations BIM comes with endless potential, a large number of issues must also be solved and the tool still raises many questions: how, particularly in existing buildings, can the operations BIM, which is open source, scalable and dynamic by definition, be articulated with ecosystems, which have existed for years and are mostly closed? Must all of the necessary BMS points be recovered? How can the use of the operations BIM and continuous updates be guaranteed? Who owns the data? The matters of trades, roles and liabilities must also be considered, as well as access control. How can the professionals handling the BMS be incorporated in the process of the operations BIM? How will operators approach this tool? SBA has attempted to work on all of these points, aiming to create a formal working base for "Ready2Services" BIM and buildings

Ready2Services BIM as a frame of reference.



The service platform building (BaaS)

The purpose of the R2S building – the technical reference base for the smart building – is the "Building as a Service" (BaaS) concept; an advantageous, comfortable, flexible and scalable building, able to meet the expectations of users (managers, occupants, operators, etc.), the requirements of regulations and standards, and major energy, environmental and social priorities. These structures are much more than buildings, they are multi-functional, multi-service platforms for the various users, whether inside or outside the building. The value-in-use is multiplied by the value of the services, just like a smartphone enriched with its many applications.

SBA also aims to identify services with added value and related economic models. Describing the available options and synergies when deploying these services, as part of an overall cost approach, will prove the prospects for the building sector if they emerge.

Six major groups of services were identified using this inventory:
1 - MAINTENANCE / OPERATION, SUSTAINABLE EQUIPMENT MANAGEMENT
For example: deploy predictive maintenance, which is little used at the current time. Handling of major maintenance and the replacement of equipment, for which CAMM is inadequate. Facility management to ensure compliance with the details defined during the design phase...

BAAS SERVICE GROUP

MAINTENANCE / EXPLOITATION **GESTION DURABLE DES ÉQUIPEMENTS** **(ASSET AND FACILITIY MANAGEMENT)**	• Multi-technical maintenance • Facility management and operation • Managing facility life cycles
ENERGIE **(ENERGY MANAGEMENT)**	• Energy management • Smart grid: reacting to demand
AMÉNAGEMENT DES ESPACES **(SPACE MANAGEMENT)**	• Space planning • Transforming the use (type) of a building • Real estate management
SERVICES AU BÂTIMENT **(BUILDING SERVICES)**	• Waste management, Cleanliness management • Safety (risks / injury) • Security (risks of aggression and theft)
SERVICES AUX OCCUPANTS **(OCCUPANCY SERVICES)**	• General services, Caretaker • Inter-company restaurant • Sharing assets
BIEN ÊTRE / SANTÉ **(INDOOR ENVIRONMENT QUALITY)**	• Comfort • Health • Home support

2 - ENERGY
For example: inform and record energy consumption, integrate rate management, optimise collective facilities based on their state of use (plan for heating downtime over several floors), track deviation to minimise energy costs, manage local storage (cold, hot water, electricity), etc. Launch the management of alternative energy resources, a load shedding policy, and the management of recharging facilities for electric vehicles, etc. in the smart grid field.

3 - FITTING OUT SPACES
For example: adapt technical systems when re-fitting offices, manage the spaces allocated to personnel (meeting rooms, coworking areas, storage rooms, etc.) in a dynamic manner, reconfigure an apartment to suit a disabled individual, geolocate and manage equipment, such as connected objects, etc.

Indicate the decision to share equipment in the specifications to enable project managers to target more responsible savings

4 - SERVICES FOR BUILDINGS
For example: organise automatic waste collection systems based on volume, the occupancy rate of premises or a warning level. In terms of security, current regulations are strict, but we could innovate new approaches: shared movement sensors, which do not generally provide information to the security desk, for overall communications to avoid night patrols.

5 - SERVICES FOR OCCUPANTS
For example: analyse material flows, manage queues, reserve a coworking space, a car parking slot or a service vehicle, take a suit to the dry cleaners, manage car sharing, a spare room in a shared building, lend DIY equipment, etc.

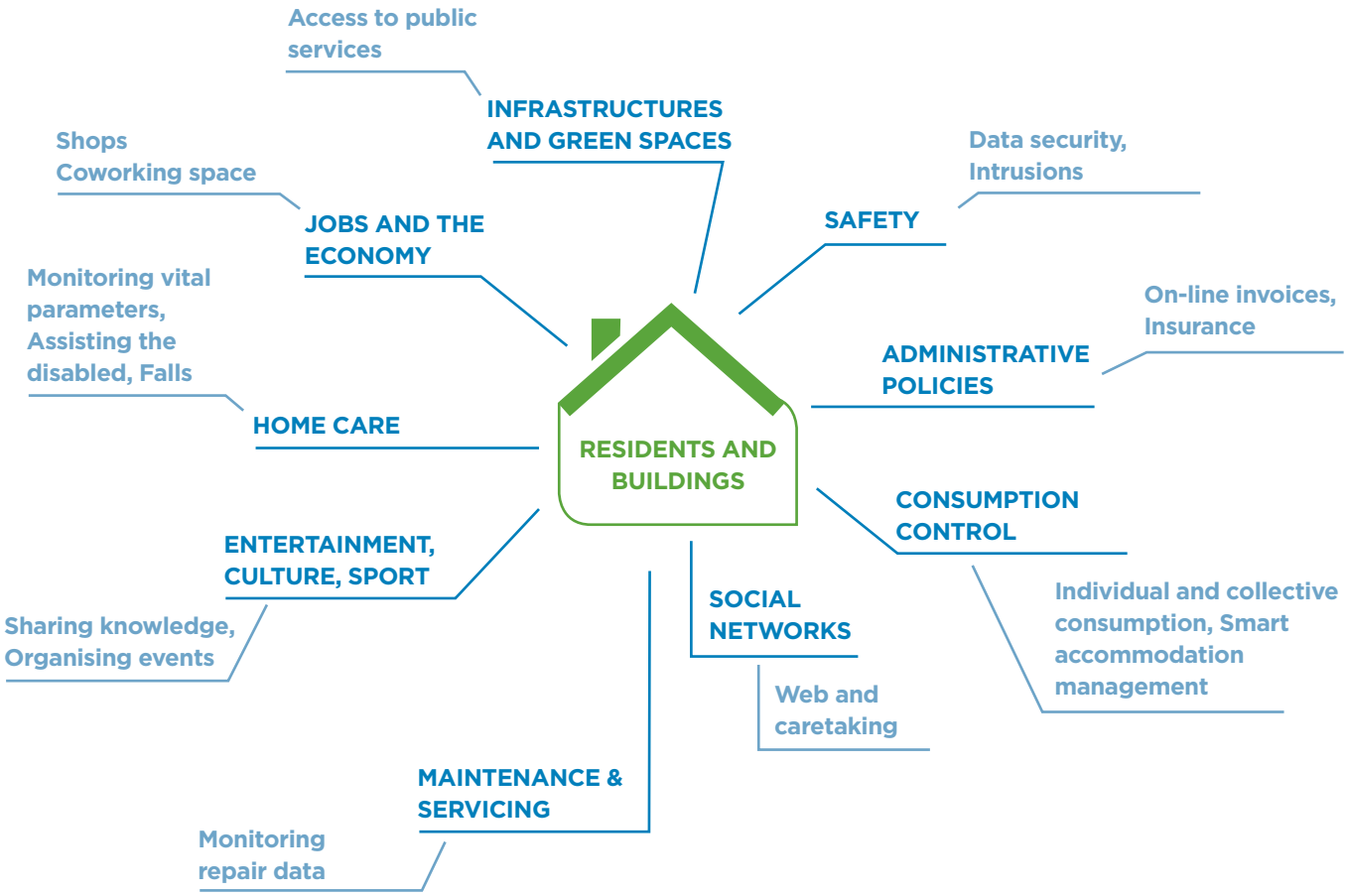
6 - HEALTH AND WELL-BEING
For example: simplify comfort applications by limiting the number of remote controls, adapting space to match the pathology of a member of staff, adapting air treatment based on sanitary risks (100% fresh air, for example, in case of a flu epidemic), launching remote assistance and coordinating social ties for the elderly, etc.

This inventory and coordination with **THE FUNCTIONS IMPLEMENTED DEMONSTRATE THAT THE SITUATION CAN BE OPTIMISED BY SHARING EQUIPMENT, PARTICULARLY SENSORS**. With lighting, the aim, for example, is to check if a sensor used for another purpose (such as heating) can be used to detect movement, to avoid any redundant equipment.

Indicate the decision to share equipment in the specifications, to ensure that companies submitting tenders are informed of this operating procedure, and to enable project managers to target more responsible savings.

SBA does not aim to reveal each and every service with added value which could be implemented in the building, this would not be feasible; services will emerge and be developed via the market. On the other hand, SBA's aim is to ensure awareness, provide advice and encourage the value chain (project manager, prime contractor teams for design and execution, operational manager) to consider users as the main beneficiaries of smart buildings, and launch a new deployment method.

Buildings are too often sold as finished objects, when they should be considered as configurable platforms, which can be adapted to meet requirements, and continually enhanced with functionalities and new services. Above all, we must stop constructing based on a business model targeting the lowest possible cost, and risk; this approach penalises innovation and is more expensive on a long-term basis, when the building must be adapted to new usages, just like home support and the smart grid, fields which infrastructures must be highly flexible.



BaaS, a service-based approach to buildings

A WIDE RANGE OF SERVICES TO BE INNOVATED OR DEVELOPED...

HOME SUPPORT

The ageing population and greater life expectancy represent a real challenge for society: by 2050, over 30% of the population will be over 60. In 2010, the costs incurred due to the loss of autonomy of the elderly were estimated at 26 - 34 billion euros[1]. These figures are constantly rising: support for the el-

1 - Le Monde.fr, 11 March 2013, "Vieillissement, au-delà du défi financier, l'enjeu de société" [Ageing as more than a financial challenge, a social issue], by B. Bissuel and G. Dupont

derly, estimated at 92 billion euros in 2013, could reach 130 billion euros in 2020, in France, according to a study by Senior Strategic[2].

While improvements which enable us to live better and for longer are good news, we need to find solutions to the issues inherent to the ageing population, particularly home support. Not enough homes (elderly care homes, medical care homes) currently exist to meet requirements, and the cost of accommodation (2 500 euros per month on average) is a major obstacle for many.

If accommodation satisfies BaaS requirements, this system can play a key role in managing the problem of autonomy and home support. BaaS is flexible and adaptable by definition, and can be used to implement digital services able to simplify the daily lives of occupants and prevent the risks that come with age and disabilities.

Automation offers a basic level of digitalisation for "adaptable homes"; control systems – the automatic extinction of lights when leaving home, automatic opening of the blinds, the garage door, etc. – will limit the movements and physical efforts of the independent and active elderly. Accommodation can easily be upgraded and enhanced with connected and communicating equipment, to help overcome more challenging obstacles to independence: a light instead of a bell for the hard of hearing, a mattress equipped with pressure sensors to warn family or the medical service if the person fails to get up at the usual time, an illuminated path for moving about at night, automatic remote opening of the entrance door if the person suffers from mobility problems and cannot get up to open the door to a visitor, etc. Thanks to NICT (new information and communications technologies), a remote assistance and/or medical service can now be contacted to support people with severe physical problems.

According to a study by Credoc/Promotelec, 94% of accommodation for the elderly is not suitable for home support[3]

New information and communications technologies can also be used to ensure the safety and security of the elderly, another key aspect of home support. The elderly are more vulnerable and also more exposed to the risks of domestic accidents, fainting, falling, aggression, etc. Objects connected to emergency services, family or friends or a regional health agency (Agence Régionale de Santé - ARS), can help to protect and reassure the elderly, as well as their loved ones.

This BaaS approach is critical for council landlords, as it allows tenants to stay in their apartments, even if they face health or mobility problems. The initial investment can be high, however **BAAS OFFERS AN INTEROPERABLE AND OPEN INFRASTRUCTURE AND EQUIPMENT, ALLOWING THE MOST AFFORDABLE STANDARDISED PRODUCTS AVAILABLE TO BE USED. THIS OPEN APPROACH PROVIDES THIRD-PARTY PLAYERS (MEDICAL SERVICES, PERSONAL SERVICES, ETC.) WITH THE OPTION TO EASILY BENEFIT FROM ASSISTANCE AND SUPPORT**. In terms of the benefits gained, this investment must not be considered as a cost, but rather as investment in better living and happy ageing

2 - "Marchés et Leviers: cartographie des tendances" [Markets and Leverage: mapping trends], edition 2016, Cap Digital
3 - www.maison-et-domotique.com, "Quel intérêt de la domotique pour les seniors ?" [The benefits of automation for the elderly], Marie-Lou Guérin, February 2015

The "Ready2Grids" (R2G) building

The Ready2Grids concept: open buildings...

Current energy and environmental issues require new approaches to energy management and consumption. The Brottes law of 2013, which mainly focuses on load shedding to improve power consumption and the need for dynamic network management based on programming models, requires systems able to transfer management data in real time. Smart grids provide a solution to this problem, however they can only be implemented in structures which are technically able to incorporate this smart network logic. Buildings can only contribute to smart grids if they can interact with the power grid in a flexible manner, and must therefore be designed on this basis. SBA's response to this idea is its "Ready2Grids" (R2G) concept, creating buildings able to open up to external contacts and communicate via the Internet and ad hoc systems, and to exchange with energy distribution systems. On this basis, these buildings can adapt their energy management to the different variables. On this basis, SBA also intends to contribute to defining this model and the operating procedure for these exchanges.

The R2G buildings recommended by SBA are primarily communicating buildings, both inside and outside of their walls. This is a mandatory starting point for exchanging with the various smart grid players. This approach requires a network of sensors and a management system able to precisely determine energy consumption at time T (with which energy source), and forecast loads for all types of usages, as well as the load to be shed, stored and generated. It must be possible to route these exchanges via a secure, open protocol, able to manage transactions. Open systems and interoperability are another prerequisite for R2G buildings.

THIS TECHNICAL BASE IS ALREADY A REVOLUTION IN THE SECTOR IN ITS OWN RIGHT, AND YET, THIS IS JUST A FIRST STEP IN TERMS OF REQUIREMENTS.

R2G buildings will be able to commit to forecast charging curves for all energies, and meet their commitments, without overshooting. On this basis, these buildings will be able to better optimise energy costs: determining potential load shedding, its duration, response time, etc. In terms of electricity, this knowledge is critical, as it will define the building's ability to interact with the power system or optimise supply. From a technical viewpoint, this means that the computing systems and forecasts are reliable, that the control of the BMS or any other management system are totally effective.

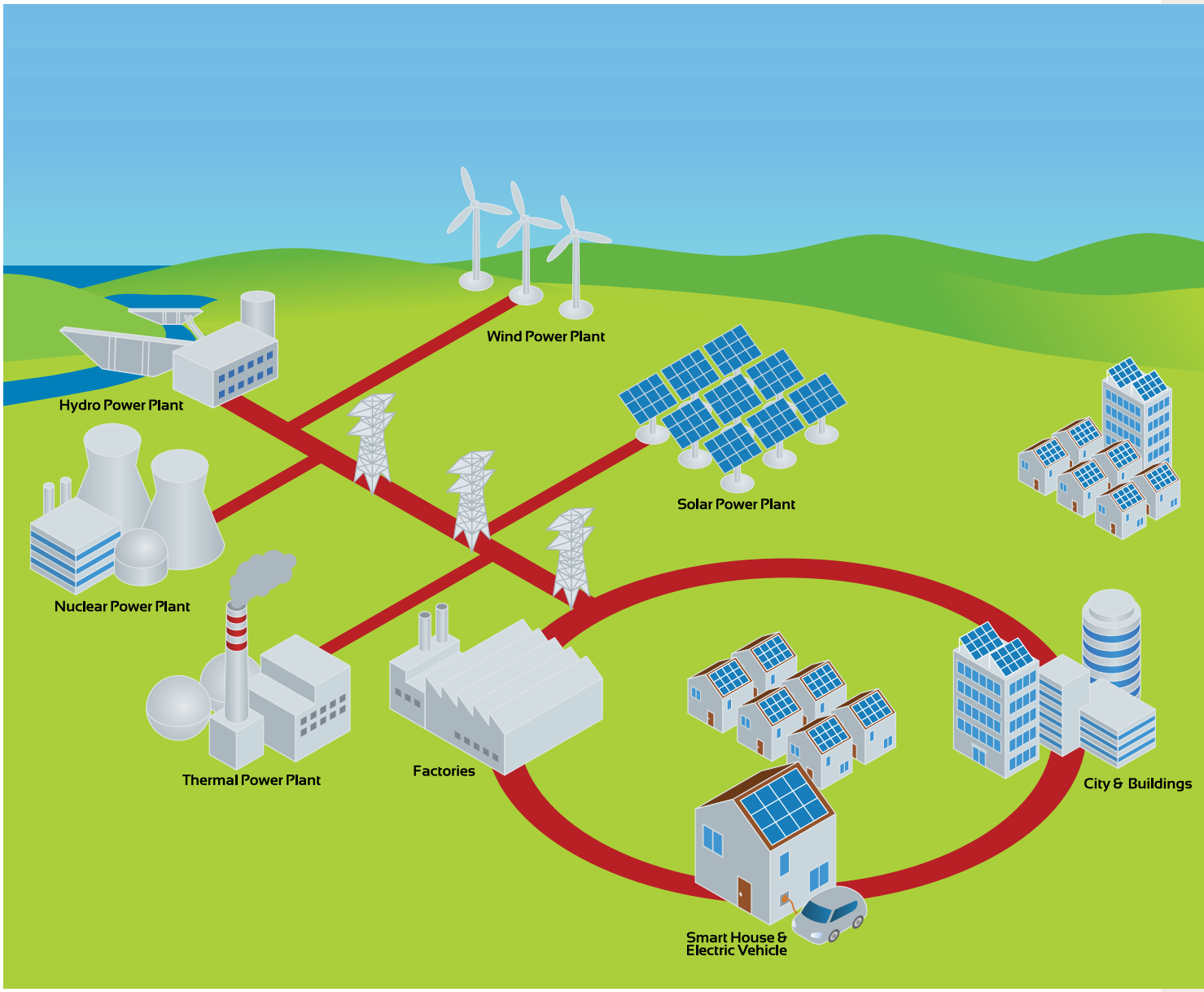
R2G buildings can be flexible thanks to deferred production, temporarily suspending the heating system if the thermal inertia of the building is high enough (without reducing user comfort), or using storage batteries or a secondary energy source (using gas instead of electricity). All this leads to the excellence of the "smart" in smart buildings.

Aggregators specialised in selling load-shedding mechanisms will manage this deployment phase, whether energy suppliers, specific aggregators, representatives of local players or, depending on regulations, energy network operators, and in the future, microgrid operators (e.g. ecodistricts).

The operator must define the target quality of service for users and energy service operators, with whom commitments have been concluded. For example, the operator may accept to suspend the supply of energy in a building for 30 minutes at a specific pre-determined time, but not in some circumstances, which will also be pre-defined. This agreement concluded between the stakeholders requires detailed forecasts.

Finally, and equally significantly, **SBA IS WORKING ON THE "EVANGELISM" OF THE SECTOR, TO HIGHLIGHT THE BENEFITS OF THIS R2G MODEL, REMOVE ANY OBSTACLES IDENTIFIED BASED ON FEEDBACK (REGULATORY, FINANCIAL, ETC.) AND LAUNCH AN ENERGY STRATEGY WHICH WOULD BE BENEFICIAL FOR EVERYONE.**

Ready2Grids buildings: active links in the smart grid.



4

PROSPECTS

Economic model and profitability

The value of real-estate assets has been established based on binding international frames of reference for decades (see insert). In France, a benchmark charter on real estate expertise also applies. These traditional assessment methods have not changed under the influence of innovations; “green values” for example, have not modified the value of an asset, or rendered it obsolete, even if proposing accommodation or offices without double glazing or cabling options is no longer currently viable. The location remains the main factor in the value of an asset.

Current interest rates – highly representative of the value of real estate – are extremely low in France. As risks are low and profitability has improved, innovation would not appear necessary, the asset is profitable by default. This obstacle to innovation is combined with high tax levels (notably taxes at resale) and a moderate lease duration (9 years), which establish real estate as a demanding, stable, long-term asset,.. unlike innovation, which is a short-term project and rapidly obsolete. In these conditions, how can the value of a building be improved when construction takes approximately three years, if all goes to plan? Can innovation be used to improve the value and profitability of smart buildings?

Building quality has improved thanks to pressure from standards (BBC - Low-energy building - in particular) and regulations (RT 2005, RT 2012). Buildings are more effective, more pleasant to live in, but also more costly and profitability is not guaranteed. These positive, forced, developments, have not been reflected in the value of real-estate assets, and are therefore not well received by professionals, even if the final efficiency leads to substantial energy savings.

SBA CONSIDERS THAT THE APPROACH NEEDS TO BE CHANGED, REPLACING MANDATORY INNOVATION DEFINED IN LEGAL TEXTS WITH INNOVATION BASED ON USER PREFERENCES. SUSTAINABLE BUILDINGS NEED TO BE DESIRABLE, WITH PROFITABILITY BASED ON SERVICES WITH ADDED VALUE.

PRE-FORMATTED RULES APPLY TO VALUATION

The same asset valuation methods are used at national and international level. These methods can particularly be used to assess the value of large real-estate firms, insurers and banks. The impact on the balance sheet is significant.

Pre-formatted rules apply to valuation:
- the mortgage lending value, or long-term value, which can be used to refinance credit institutions, on modest valuation bases;
- value in comparison with identical assets in a similar environment. A method particularly used for residential assets, simplified by notary transaction data bases and the Internet;
- rent capitalisation value (rent less charges, to which a capitalisation or discount rate is applied for potential future rent).

The final value will be based on a mean value.
9-year leases are generally considered, or 12-year leases for shops. Forecast rents over these periods apply to rents less charges. Only potential rent is considered.

In terms of corporate real estate, the rules are less transparent, as leases can be negotiated indirectly (cover of the cost of works, rent-free period, etc. for an identical nominal rent).

Place users at the heart of innovation and the construction process.

Place users at the heart of innovation and the construction process in order to highlight the "smart" aspects of assets. If users fail to realise the green value of the building, they will, on the contrary, assess the quality of the services proposed. With prime real estate, e.g. on the Champs-Élysées, users target one specific address, and this value will prevail over any other aspect. However, in less high-appeal zones, improving usages can represent an advantage over the competition. On this basis, if a building is out of town, services making daily life easier, such as a caretaker, shared car park, or dry cleaners, a co-working space for commissions, to drop a child off at the crèche and avoid the need to waste two hours per day in traffic jams, offering flexibility and adaptability, avoiding the need to move, will be appreciated. Assuming that new usages could extensively modify the valuation of real-estate assets would appear valid.

Despite this, if we work on the principle that services can increase the value of the building, this competitive argument can rapidly be brushed aside in view of the plethora of services rendering them highly volatile, such as Wi-Fi – which is now free in most hotels –, and was once the advantage of business centre type hotels.

New usages are modifying the value of real-estate assets in-depth

According to SBA experts, buildings operate over a long cycle, therefore it is very difficult to determine which services have a future and which services users will opt for. On this basis, real-estate assets can only be valued based on their ability to develop services and therefore provide a "Ready2Services" profile, where the Internet infrastructure can be used to offer a service portal at a marginal cost. If an accommodations unit offers hotel-type services – student halls, homes for the elderly or tourist residences –, the optimised management of services and the operation of the building contributes value de facto. Service features are already emerging in collective accommodation: buildings can no longer be delivered without an equipped DIY workshop, shared electrical vehicles, etc. **THE TRANSITION IS STILL SUBTLE, BUT THE WHEELS ARE TURNING, AND HAVE DEMONSTRATED THAT PREJUDICE AGAINST OVER-INVESTMENT IN R2S BUILDINGS IS DROPPED IF THE VALUE-IN-USE IS DEMONSTRATED TO THE OWNER OR INVESTOR.**

Based on these in-depth changes, which are bringing out new values and a different cost/benefit ratio, SBA is seriously considering the ownership of the data collected, the identification of innovations which truly contribute to the value of real-estate assets, which parties are liable for funding the infrastructure and constructing a long-lasting economic model. The aim is to provide indicators in order to identify the value of an asset and a method used to increase the value of connected and innovative real estate.

1 - Jean-Pierre Leac – "L'innovation de rupture, c'est quoi ?" [Just what is disruptive innovation?] – Les cahiers de l'innovation.com

Technological changes

The digital world holds immense power, and it is impossible to determine which innovations will change our daily lives in the future. Technological monitoring is necessary to plan ahead for and, above all, prepare for, expected changes. For this reason, SBA is working on the identification of the main issues now and in the future, mapping and advertising the disruptive technologies associated with these issues, and studying their social impact in the construction sector. These technologies sometimes push the boundaries back substantially, paving the way for other significant changes in our habits.

SBA is working on the identification of the main issues now and in the future, mapping and advertising the disruptive technologies associated with these issues, and studying their social impact in the construction sector.

VOICE AND FACE-TO-FACE INTERFACES

Transparent technologies are starting to emerge and are expected to play an important role, particularly for the support of those suffering from disabilities: thanks to voice options, the blind can activate home applications or turn a computer on to receive a service. Individuals with severe mobility disorders (particularly quadiplegics) can make their daily lives easier thanks to a face-to-face interface: thanks to the recognition of head movements and facial expressions, they can use a computer, without necessarily needing specific accessories or to implement a complex configuration.

In terms of work, start-ups can already offer “smart chatbots”. These virtual assistants are able to manage diaries, organise working meetings, arrange appointments, etc. and aim to relieve busy professionals, who do not necessarily have the means to recruit someone to assist them.

ENERGY HARVESTING

With 80 billion connected objects expected by 2020[1], the idea that these products would operate using fuel cells, which would need changing on a regular basis and never at the same time, seems unrealistic. The principle of energy harvesting, which can ensure energy independence by recovering energy in the immediate environment, will necessarily lead the way. A rotating movement, pressure from a finger, a temperature difference, engine vibrations, etc. energy is all around us, available, free of charge, we simply need to recover it so that devices can run on a standalone basis. This principle has long been used in watches, and is widely used in the construction industry. To name just one of the most obvious examples, radiator electrovalves react to the temperature difference. However, power storage combined with miniaturisation is an issue with a scope far larger than replacing fuel cells; remote IT is emerging and is one of these innovations which are expected to boost the development of this technology.

1 - “Internet of Things: une base installée de 42 milliards d’objets en 2015 promise à une forte croissance” [Internet of Things: an installed base of 42 billion objects in 2015 indicates strong growth], ITRNews.com.

LI-FI OR COMMUNICATING LIGHT

Internet-based lighting has already arrived; Li-Fi is starting to appear in museums, large stores, etc. Digital lighting can transmit data simply with the addition of an electronic chip in an LED light. This technology should complement Wi-Fi in many beneficial applications and lead to the development of new and customised information services. This market is estimated at over 6 billion dollars for 2018 according to the US agency, Markets & Markets[2]. When combined with geolocation, Li-Fi can provide worthwhile context data for stores (current special offers), museums (comments on the exhibits), stations and trains (passenger information), cities (cultural agenda, road traffic, etc.), billboards (product characteristics), etc. Li-Fi does not emit electromagnetic waves and no relay antenna is required, meaning it can be installed at locations where interference must be avoided, such as hospitals (to access patient files) and aircraft (flight information, countries flown over, etc.). LI-**FI USES THE LIGHT SPECTRUM AND CANNOT THEREFORE PASS THROUGH WALLS; THIS TECHNIQUE IS OF PARTICULAR INTEREST FOR HIGHLY SENSITIVE SECTORS SUCH AS BANKS, MILITARY SITES, RESEARCH**, etc. as you must be within the beam of the light to connect the computer or the smartphone to the Li-Fi and access the information. In the construction sector, this technology will become a means to geolocate equipment and people; in a coworking space, it can be used to provide the right level of lighting for each individual, regardless of the computer used.

LI.FI: 100 times faster than WI-FI.

THE BLOCKCHAIN

The blockchain is a revolution with a future. This IT system saves and secures peer-to-peer transactions via a shared and anonymous data base, whether public or private, with no need to pass via the cloud. The blockchain puts an end to intermediation in contractual exchanges – a market with an estimated value of several dozen billion dollars – and is revolutionising the world of transactions. The strength of the system lies in the fact that the authenticity and uniqueness of exchanges are guaranteed via validation based on a series of highly complex, indestructible and unfalsifiable encoded calculations. A block is created for each transaction, and connected to other blocks, forming a secure chain. In order to hack data, a pirate would have to access thousands of independent data bases simultaneously.

The blockchain puts an end to intermediation in contractual exchanges and is revolutionising the world of transactions

Unlimited blockchain usages exist: authenticating assets (engineering structure, deed, etc.), individuals (safety, car sharing, co-rental, shared offices, etc.), investments (crowdfunding, financial transactions), etc. The banking sector was one of the first to consider blockchains but, with the era of the sharing economy, all service platforms could simplify their applications (smart contracts) with total confidence. In the context of a building, the smart key of a door could potentially manage access to a shared location, use of a shared connected object (washing machine, electric vehicle charging station, solar panels, etc.) and the billing of the energy consumed by service users... with no cloud and no intermediary.

2 - "Le Li-Fi, 100 fois plus rapide que le Wi-Fi, débarque dans les entreprises" [Li-fi, 100 times faster than Wi-Fi, and arriving in companies now], Leila marchand, lesechos.fr

POWER OVER ETHERNET (POE) AND DIRECT CURRENT (DC)

Power over Ethernet, which carries direct current and data (including control functions) via the same cable, represented around 7 watts per distribution hub in 1999. It is now worth 60 watts. At this power level, PoE can be used to manage applications such as monitors, sensors, videosurveillance, and now LED lighting. Digital lighting, the first disruptive technology to reach buildings, is expected to migrate to PoE in the coming years. The IT sector (servers, computers, etc.) is also strongly interested in the direct current network, which could additionally be used to integrate renewable energies, if native direct current system components are used. By avoiding the alternating/direct current conversion when supplying computers and eliminating the need for a converter for solar generators, a substantial amount of energy could be saved, eliminating the losses incurred in this AC/DC conversion and contributing to the stability of the power grid. This approach has been discussed for many years, and is expected to lead to a total change of direction in the building sector and for industrial players selling electrical equipment should it take shape.

It is important to create an environment suitable for the development of these technologies and their interaction in order to encourage innovation and use French excellence in this field.

AUGMENTED REALITY

Augmented reality is fun and can surprise at first, and offers real options for buildings, cities, the environment, the economy, etc. **THIS POSSIBILITY TO VIRTUALLY RECREATE AND SUPERPOSE A STRUCTURE OR AN OBJECT IN A DIGITAL MODEL, AND THEN VIEW IT IN A REAL ENVIRONMENT, OPENS UP THE ROAD TO A WIDE RANGE OF APPLICATIONS: VIEWING A BUILDING BEFORE OR DURING ITS CONSTRUCTION, RECREATING A HISTORICAL SITE AS IT EXISTED CENTURIES EARLIER, VIEWING A GAS NETWORK IN SITU, THE IDEAL LOCATION FOR AN INFRASTRUCTURE IN A BUILDING**... Augmented reality can help to make decisions as it converts non-existent items into tangible objects, removing all doubts, simplifying decisions and speeding up projects. Augmented reality can help local elected officials to improve their management of urban planning. In terms of tourism, it can enhance the appeal of historical sites. Augmented reality can help the technicians of building operators: modeling will optimise the time required for operations by providing the details of an electrical infrastructure, technicians can view the installation of an item of equipment before actually fitting it...

All of these technologies are already in use, and will open up the road to new applications and services, radically changing usages and consumption habits. These technologies will naturally upset traditional markets. **THE GENERAL PUBLIC WILL VERY CERTAINLY BE THE FIRST PROMOTERS OF THIS TRANSFORMATION AS THEY WILL UNDERSTAND THE BENEFITS OF THESE TECHNOLOGIES AND THE ASSOCIATED SERVICES**; the general public will cry out for this transformation, and we need to prepare for it now. With this in mind, it is important to create an environment suitable for the development of these technologies and their interaction in order to encourage innovation and use French excellence in this field to take advantage of this formidable economic driver, i.e. artificial intelligence and services.

Supporting the sector

Changing skills and motivation are pre-requisites for the successful digital transition of buildings and the emergence of smart buildings. Some trades will necessarily adapt due to technological or regulatory changes. However, the real issue for smart buildings involves the integration of digital tools, and the drive to work differently, with a more collaborative and transversal approach. Involving every single player in the chain is indispensable. According to SBA, which aims to support the sector, this digital building revolution requires a vast training and communications plan. This plan is the price of change; if the sector fails to move on, its players would face a major risk, as proved by the disruptive technological switch to LED lights.

Historically, firms in the Internet and electronics sector operated at arm's length from the building sector; nowadays, they are competing with industrial players in the segment. **ACCORDING TO PLAYERS IN THE BUILDING SECTOR, IT IS IMPORTANT TO REALISE THAT THEY MUST CHANGE AND THEIR SECTOR MUST OPEN UP TO THESE NEW CONTRIBUTORS TO MATCH THE DIGITAL TRANSITION**. The aim is to protect existing ecosystems by ensuring that contributors obtain the right resources to evolve and adapt, establishing their positions as positive and long-term players in this new digital economy.

The secret to this success is the desire to learn, giving meaning to smart building projects, from the design phase and up to operations, presenting this change in trades as a major transformation project.

Training, improving skills as required for the digitalisation of buildings, must not be considered as a restriction, but as an opening. The secret to this success is the desire to learn, giving meaning to smart building projects, from the design phase and up to operations, presenting this change in trades as a major social project with more benefits than drawbacks.

Testing and training must be practical, which will be far more effective than sending professionals to spend several days in a classroom. In situ tests, participation in a project and crossing know-how will overcome fears, increase confidence and encourage commitment. Professionals having tried out new techniques or the global approach to a "smart" project understand the full benefits and are more likely to support the change – experience has proved it.

Tests must be carried out, relationships based on trust must be established between the different building trades and digital players. This trust could be backed up by a legal framework, committing companies to each other in order to better manage the risks inherent to innovation. We could consider joint management between an industrial player and an operator ... **THE COLLABORATIVE APPROACH MUST BE PREPARED** This approach is indispensable, if only to prepare for digital models, which will become mandatory and require transdisciplinary input.

For engineering firms and architects, the digital transition is an unprecedented challenge: they must adopt a global approach, work in an across-the-board manner with upstream and downstream players, apprehend digital models and specify the "smart" batch in the specifications, i.e. define the aim, define the resources required to achieve the aim, and describe a services and optimisation strategy.

Project managers (elected officials, council landlords in particular) must also change, and understand the benefits of smart buildings, the concept of services with added value, which will help to ensure profitable investments. A relatively large scale information campaign must also be organised, targeting local authorities, and focusing on smart buildings, which are frequently unfamiliar to elected officials. Local authorities are facing reduced budgets allocated by the State, immediate operational management problems, electoral pressure, etc. convincing them that services are beneficial could prove complicated despite the fact that they are the number one party involved when it comes to developing smart cities.

Launching R2S and R2G real-estate projects with major developers can lead to positive progress; the value of the model, if pertinent and if it gives the expected results, will breathe new life into the smart building market

The digital transition will change everything for operators. The BMS world was constructed based on a maintenance economy model. Margins are generated on operations. This model is endangered by SBA's vision, particularly with the operations BIM, which can be used to streamline actions, act remotely, and forecast figures to minimise the cost of operations. Operators could consider digital features and new players as a threat to jobs and a potential route to financial difficulties. However, a sector-based approach remains indispensable. **AN ALGORITHM CANNOT REPLACE THE OPERATOR'S FAMILIARITY WITH THE BUILDING; PERFORMANCE WILL REQUIRE COMPLEMENTARY DIGITAL AND BUILDING MANAGEMENT TRADES**. SBA is working on the question of operator support: defining the role of Facility Managers, their skills, the R2S facility management contract, etc.

Specialists in BMS will be able to move towards a different operating approach, such as customer advice, a more in-depth policy towards targeting performance, etc. They will benefit from greater independence in their actions thanks to the operations BIM, which will be able to provide complete building and equipment data... Assisting operators to understand the new digital tools and the associated services is critical if we aim to achieve excellence for buildings, with technicians able to manage smart buildings. Reproducing exactly what happened with BMS – systems which were so sophisticated that few operators were able to manage them – would cause extreme prejudice for the transformation from buildings to smart buildings.

Building-based competitive clusters are also focusing on this digital revolution. They expect deliverables and want solutions. Launching R2S and R2G real-estate projects with major developers can lead to positive progress; the value of the model, if pertinent and if it gives the expected results, will breathe new life into the smart building market.

The educational work involved is extensive. The lack of familiarity with these systems seriously hampers the use of digital buildings. However, prudence and high standards are required when it comes to the quality of the lessons learnt and the construction of this value chain. Training must be organised in real terms; demand already exists, and will intensify under pressure from project managers and users. We need to meet this demand.

Conclusion

SHARING AND JOINT SUCCESS

Smart buildings are connected and supported by shared and interoperable equipment and infrastructures, therefore they are compatible with multiple combined services to the benefit of users, who will gain in well-being, and investors, which will improve the value of their real-estate assets as new services emerge. Smart cities represent the extensions of smart buildings, and ensure a service continuum for users and active consumers at regional level.

In this context, and based on a collaborative economy, new trades are emerging in relation to services and uses, causing traditional economic models to be reconsidered. A new landscape is taking shape, where data are key and sharing data is fundamental for the deployment and/or use of web services, to implement combinations able to improve the performance and comfort of buildings, in order to construct and exploit quality buildings, in an across-the-board and yet global manner, via digital models, etc. Refusing to share data would mean walking alone, running the risk of missing out on the benefits of the digital revolution currently underway.

Sharing, the foundation for this entire ecosystem, clearly implies mutual trust between players. This means trust in data analysis and collection, with guaranteed confidentiality and security – a key matter! – thanks to intelligent governance. It also means trust in the economic models proposed. The trust of project managers can be gained by guaranteeing the scalability of systems and financing CAPEX with funds earned in services integrated into the building, which will also lead to these new and innovative economic models based on services. **SBA READY2SERVICE AND READY2GRID FRAMES OF REFERENCE CAN MEET THIS TARGET, MAKING THE LARGE-SCALE DEPLOYMENT OF SMART BUILDINGS POSSIBLE AT LAST**. There can be no doubt that the future is bright for operators able to federate and coordinate this entire value chain with a smart approach, while guaranteeing the role of each player in the ecosystem.

Now is the time for all players in the building segment, historical upstream/downstream operators, new arrivals, institutions, financial backers, insurers, etc. to become aware of the need to deploy smart buildings for smart cities. Until now, these models have mainly consisted of a series of “Proof of Concepts”, without really being applied on a large-scale basis, due to the lack of a convincing return on investment or user acceptance. However, all technological and financial conditions have now been satisfied for a successful transition. We must not walk alone.

SBA was founded because companies, its current members, realised that they needed to work together, and that smart buildings and smart cities could only be constructed via a global transversal approach. Our European neighbours are now paying close attention to the work completed by SBA in the last 4 years. SBA has demonstrated that a collective approach is required if this transition is to be a success. **SBA IS PREPARED TO FEDERATE AND SUPPORT ALL PLAYERS THROUGH THIS MAJOR SOCIAL PROJECT. LET US SHARE AND MOVE FORWARD TOGETHER.**

SBA PROVIDES SUPPORT TO THE CONSTRUCTION SECTOR, HELPING IT TO QUICKLY ADAPT TO THE CHANGES ARISING FROM THE WIDE-SPREAD INTRODUCTION OF DIGITAL TECHNOLOGY IN SMART BUILDINGS AND SMART CITIES. SBA OFFERS A GLOBAL VIEW BASED UPON POOLED INFRASTRUCTURES TO PROMOTE NEW SERVICES, FOCUSING ON USES THAT GENERATE EFFICIENCY AND BETTER SOCIAL COHESION.

SBA's actions

MEETINGS
Federate the sector with a transversal approach
SBA events, to share experience and monitor smart building issues in sustainable cities.

PUBLICATIONS
Share our vision and our recommendations
The Smart Building for Sustainable Territories Manifesto. Ready2Services guide to buildings and regions. e-SBA (bimonthly newsletter)

COMMISSIONS
Considerations of changes to buildings in smart cities
"Expert" commissions to define a common frame of reference for connected and open buildings.

RELATIONS WITH INSTITUTIONS
Ensure the awareness of public decision-makers
Ministries, public institutions, local authorities, trade unions, etc.

INTERNATIONAL COOPERATION
Cross-border relations
Discussions with international organisations

Become an SBA member alongside the Smart Building sector's leaders and experts and:

- Learn about the issues and the challenges
- Take part in defining and setting up baseline references
- Find out about and follow innovations in the sector
- Build a network and talk with your peers
- Meet experts from business areas related to yours

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Prix public 29 €
ISBN 978-2-95601-751-6

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