Corporate Development

Smart Building as a Business

A guide for hardware companies on how to develop their smartification strategy

Porsche Consulting

Strategic Vision. Smart Implementation.

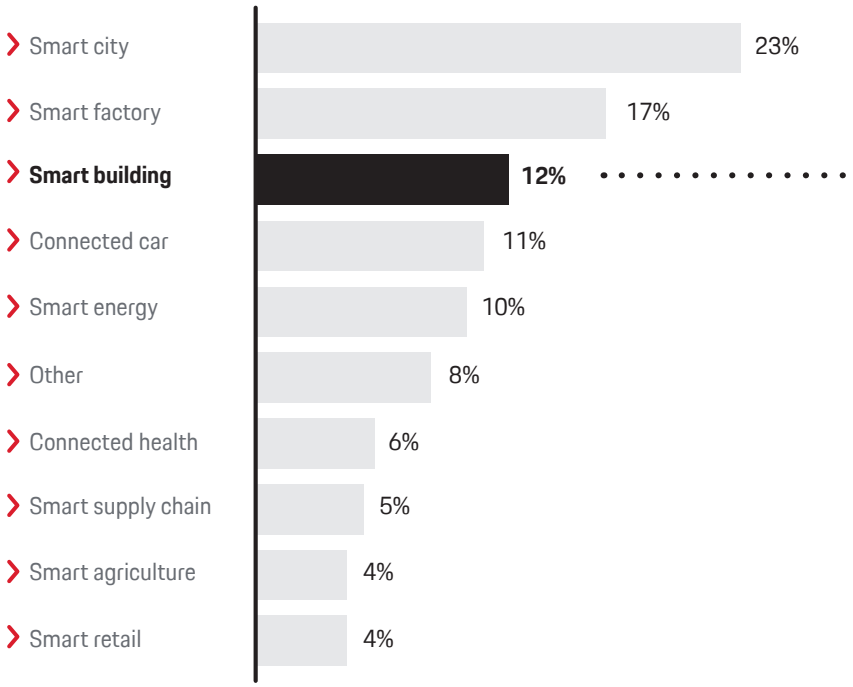
Enabled by the Internet of Things, smart buildings are gaining importance

Buildings are becoming smart. After many years of incremental innovation, rapidly increasing connectivity and intelligence are disrupting the real estate sector with two new sub-segments: smart home and smart building.

While smart homes target end customers' solutions, smart buildings address commercial and industrial solutions. Smart buildings incorporate (the connection of) intelligent hardware and software that enable real-time control and management of diverse building functions, ideally via a single interface. From a technological standpoint, smart buildings currently rely heavily on the Internet of Things (IoT). A recent analysis shows that, as of 2018, 12 percent of all global IoT projects refer to buildings, making them the third most important IoT application field (figure 1).

The main benefits of smart buildings are optimization and automation of individual building systems and the harmonized interplay of the various disciplines. The applications are often differentiated into building energy management, infrastructure management, network and communication, and security systems (figure 1). All of these applications typically incorporate hardware components, software, and services. Hardware components integrated into the different building systems collect and transmit various condition data via sensors, actuators, bridges, nodes, gateways, controllers, relays and the like. Software provides the intelligence required to interpret the condition data and to trigger the respective actions throughout the building. Such software solutions have tremendously benefitted from technological progress in cloud computing, big data, and artificial intelligence. Services include a wide range from building operations to maintenance and system integration.

Global share of IoT projects per application field[1]



Source: IoT Analytics, consumer smart home solutions not included

Overview on smart building applications

Building energy management
- HVAC control system
- Lighting control system
- Energy management platform

Intrastructure management
- Smart water management
- Elevators & escalators management
- Parking management system

Network & communication
- Connectivity
- Data management
- Telecommunication management

Intelligent security system
- Access control system
- Emergency management
- Video surveillance system

Source: Porsche Consulting

Fig.1 IoT projects and smart building application field

[1] https://iot-analytics.com/top-10-iot-segments-2018-real-iot-projects/; accessed on July 8, 2019

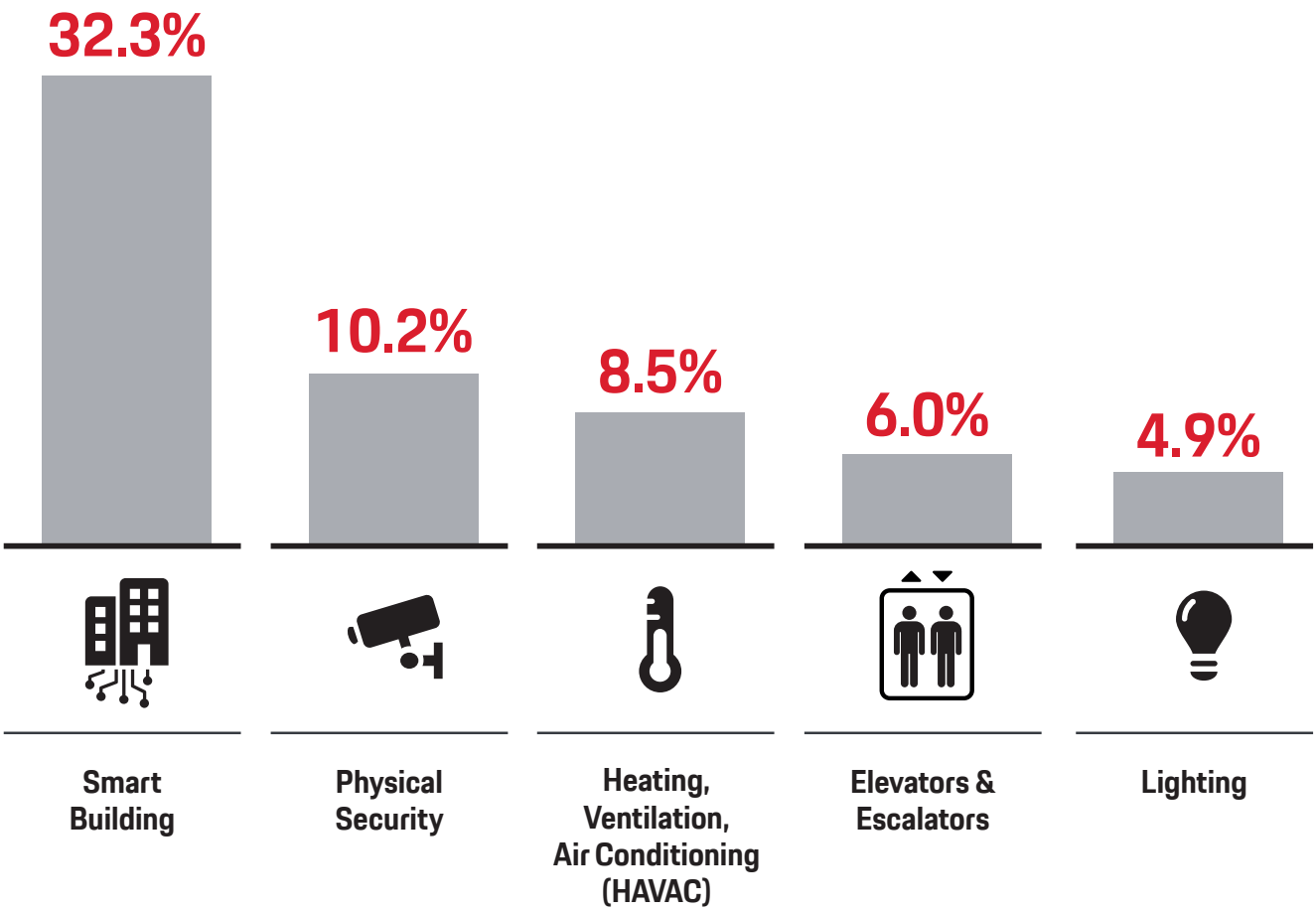


Fig.2 Market size development 2018–2025 (CAGR in %) of smart building and other selected building sectors (Source: Porsche Consulting consensus estimate[2])

Bullish market forecasts indicate the growing importance of smart buildings. Considering the consensus estimate of six different global market studies, the smart building market is expected to grow with an impressive average annual growth rate of 32.3 percent between 2018 and 2025 (figure 2). Meanwhile, hardware-driven building systems such as HVAC (8.5 percent), elevators and escalators (6.0 percent), and lighting (4.9 percent) are expected to report only single-digit growth during the same period. It can thus be concluded that the relative importance of revenue from software and services, as compared to the hardware business, will soon increase significantly. Building hardware manufacturers should therefore be alarmed in the face of these estimates of market development.

[2] Market sizes and growth rates are derived from average consensus estimates of various market research providers: Markets and Markets (2017), Variant Market Research (2018), Data Bridge Market Research (2018), Stratistics Market Research (2017), Allied Market Research (2018), Zion Market Research (2018), Grand View Research (2018), Prescient & Strategic Intelligence (2019), Persistence Market Research (2017), Research Nester (2018), Memoori (2018), Research & Markets (2019), Transparency Market Research (2019). CAGR stands for the compound annual growth rate.

The smartification trend puts hardware companies under pressure

The rapid development of smart buildings is mainly driven by technological progress and increasingly sophisticated customer requirements.

Technological development has made building products more sophisticated and will result in a convergence of hardware, software and service. The initial step sees the physical product complemented by sensors. The second step enriches it with (wireless) connectivity, and a third step links it with related products or applications, eventually integrating it into the smart building ecosystem (figure 3). While yielding significant potential for additional value creation, this development requires hardware-driven manufacturers to gain new competencies.

Customers expect intelligent building functionalities to create value. As individuals experience multifaceted advantages to digitalization in their private lives, they increasingly demand similar amenities in their professional environment. Hence, commercial buildings are expected to be connected and to provide intelligent functionalities to make working life easier and more efficient. Hardware manufacturers must therefore develop solutions to ensure that product systems are compatible with building management systems.

Impacts of the trend in smart buildings is evident in emerging new business and pricing models as well as in the building sector's increasing competitive environment.

Business and pricing models in the building sector are becoming more diverse. The traditional ownership-based model requires customers to pay a one-off price for a product or service, regardless of how often they use it. In the usage-based model, which has gained importance, customers pay to use a product or service but cannot claim ownership. 'Lighting as a service' providers, for example, will install and maintain a modern LED lighting infrastructure on client premises for a fixed monthly or annual fee. Such business models help customers overcome the capital expenditure hurdle to installing an efficient and smart lighting system. Outcome-based models go one step further: the customer only pays for an agreed-upon outcome of a service rendered. Outcome dimensions can encompass reduced costs (e.g. minimized energy consumption) and increased productivity (e.g. higher output through improved equipment availability). Incumbent hardware manufacturers must ensure that their approach truly relieves their clients' pain points and that there are no missed opportunities in innovative business and pricing models.

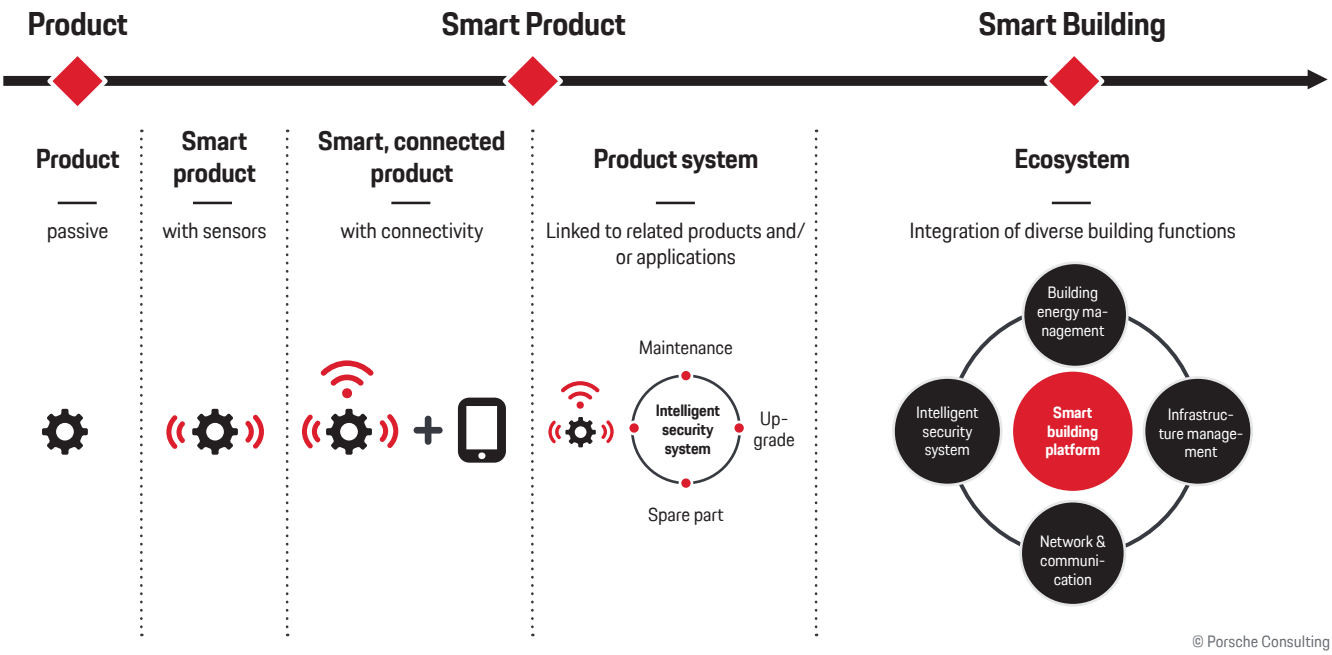


Fig.3 Smart building product evolution path (Source: Harvard Business Review, Porsche Consulting)

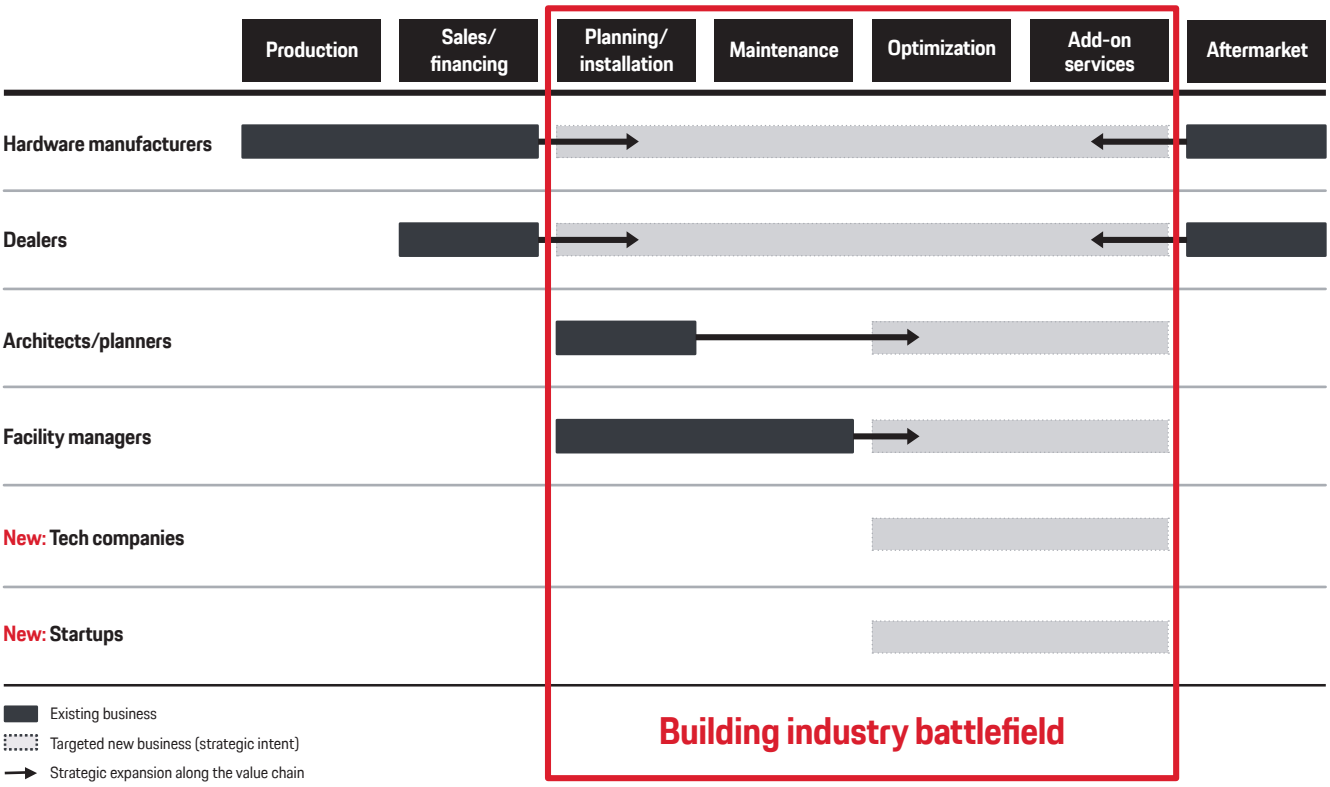


Fig.4 Shift of business focus per industry player along the building value chain and resulting battlefield (Source: Porsche Consulting)

The competitive environment within the building ecosystem is changing fundamentally. On the one hand, existing players are trying to tap new revenue potential stemming from increased software and service implementation in smart buildings, thereby creating a "battlefield" in service-related sections of the value chain (figure 4). On the other hand, the attractive growth rates of smart buildings and related markets (smart home, smart city) are attracting tech giants and startups, who are invading the market with innovative customer solutions. These players are leveraging their internal software know-how to occupy new emerging profit pools, further accelerating the trend in smart buildings. Their strategic rationale often relies on offering platform solutions that generate the real added value in smart buildings. In this market environment, hardware and equipment manufacturers face forfeiting competitiveness, as they might lack the capabilities required to deliver integrated services across the buildings' subsystems. Consequently, incumbent product manufacturers need to find a way to hold and expand their ground in the building sector.

Five-step approach to developing and driving smartification

01 | Collection and preselection of relevant use cases

02 | Evaluation of use cases according to business impact and feasibility

03 | Derivation of customized positioning within smart building ecosystems

04 | Definition of smartification road map and strategic initiatives

05 | Alignment of strategy and adjustment of operating model

In order to participate in the profit pools emerging due to smart buildings, incumbent hardware manufacturers are faced with the challenge of ambidexterity: they need to find the right balance between managing the present and shaping the future. Even though the smart building is already a reality, hardware-related revenue still makes up the majority of business for building component manufacturers. However, entering into the smart segment of the building market requires investment in new technologies with a long period of amortization. These investments must be based on a clear idea of a company's future role within the smart building ecosystem. After deciding on the general ambition and the intermediate steps to achieve it (see product evolution path in figure 3), developing the smartification strategy in a five-step approach is suggested:

01 | Collection and preselection of relevant use cases

Considerations regarding the smartification strategy must be initiated from the client's perspective. The challenge here is to figure out which use cases for smart buildings create real value from a building occupant's perspective. The good news is: there is no need to start from scratch. Use cases previously piloted in the market or in other industries can serve as a starting point. In order to enriching the initial collection of use cases, additional ideas need to be generated through in-house innovation workshops (e.g. design thinking), interviews with sales employees, customer visits ("go gemba"), as well as joint idea generation and open innovation formats via related (online) communities in a crowdsourcing approach.

Figure 5 shows some of the most popular use cases for smart buildings, structured by application (building systems) and characteristic of associated benefit. All activities for idea generation result in a consolidated longlist of use cases, which is then reduced to a shortlist of those highly relevant to the company. Applied filter criteria refer to fairly qualitative considerations such as the proximity to the core business, perceived customer value, or simply, management judgement.

Building energy management	Infrastructure management	Intelligent security system	Network and communication	Integrated use cases
• Occupant preference identification • Personalized work spaces through self-learning system • Predictive maintenance • Smart grid integration • Human-centric light • Smart metering • Daylight harvesting • Energy cost reduction based on real-time occupancy situation	• Autonomous ordering of consumables • Predictive maintenance • Predictive access and elevator system • Intelligent elevator management to reduce waiting time • Parking guidance/ availability system	• Facial recognition • Behavior and emotion analytics • Predictive maintenance • Intelligent evacuation management system • Intelligent fire alarm • Central security and safety management	• Indoor navigation • Individualize-point-of-interest information • Integration into smart city ecosystem • Predictive maintenance • Indoor asset tracking • Optimized cellular re ception and WiFi coverage • Cyber security management	• Integrated mobile apps for occupants • Predictive signage • Space optimization • Real-time availability of workspace, conference rooms, etc. • Building systems management • Condition monitoring dashboard

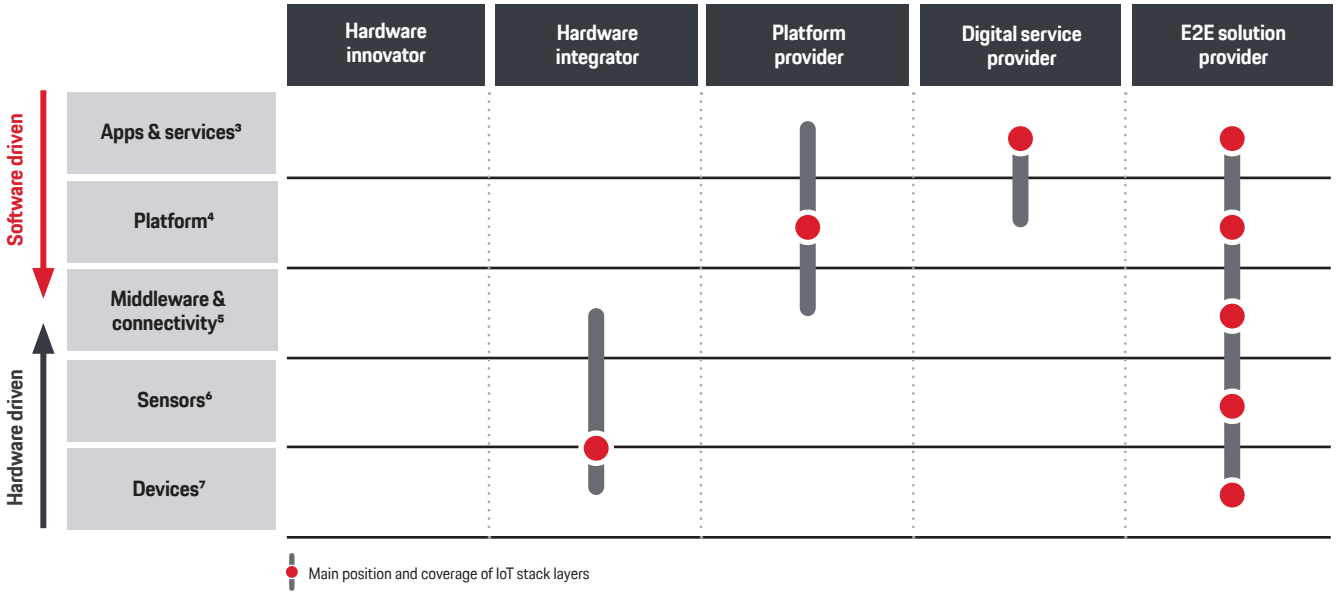
Fig.5 Selected use cases for smart buildings (Source: Porsche Consulting)

02| Evaluation of use cases according to business impact and feasibility

While the use case preselection serves as a product and service-related vision of the smartification strategy, this vision needs to be validated. A simple but effective approach using the two criteria business impact and feasibility for evaluation has proven successful.

Business impact is calculated by a specific market model per use case based on assumptions regarding volume and potential pricing. This analytical approach is typically time-consuming, so firms might resort to shortcuts, -for example by relying on secondary market data that is (however not always available at the required level of detail) or expert assessments from within or outside of the company. In the end, it is important to adequately estimate the commercial attractiveness of the preselected use cases.

Feasibility is determined by comparing existing and required competences per use case. A helpful structuring element in evaluating technological requirements is the smart building IoT stack (figure 6). This is key to generating and discussing hard facts on a use case level and not getting caught up in high-level discussions. The requirements specific to a use case are described along the different layers of the IoT stack. These requirements are then compared to a company's existing capabilities within the IoT stack, eventually arriving at a sound evaluation of feasibility.



[3] User-oriented application layer that enables access to content/data and software/hardware (e.g., dashboard, control panel)
[4] Logical connection layer (software) where data is provided, aggregated, structured, connected, and analyzed
[5] Software and hardware that enables connectivity among network participants to read and transmit data across different protocols
[6] Hardware that records conditions and generates data points (parameters) (e.g., temperature, noise, motion, fill quantities)
[7] Layer controls and regulates building facilities; activation triggered by controllers and actuators.

Fig.6 Archetypal positions within the smart building IoT stack (Source: Porsche Consulting)

03| Derivation of customized positioning within the smart building ecosystem

After having prioritized a reasonable number of use cases, companies will have a much better understanding of which role, given their current and potential capabilities, is available to them in the smart building ecosystem. The positioning is determined from two directions: From the perspective of product/service offering, the evaluation results form the basis for an informed decision on which use cases to take on. From the capabilities perspective, the company needs to consider three different dimensions in use cases for smart buildings: development (reliance on technological skills, such as software know-how), operation (heavy reliance on scale effects), and commercialization (reliance on credibility and customer access). Integrating the two perspectives yields the company's suitable target positioning within the smart building ecosystem (figure 6). We generally distinguish five different archetypal roles of players in the smart building ecosystem (although hybrid forms are also possible).

The hardware innovators fundamentally build on their deep hardware know-how in both development and production. Smart building activities remain limited to sensor integration and assurance of seamless integration into building automation systems. Hardware integrators are conquering the smart building IoT stack from the ground up by ensuring connectivity and integration of different hardware systems, which requires profound know-how in various domains and good relationships to a range of manufacturers. Platform providers leverage their competence in software development and operation. In order to succeed they must be able to handle numerous protocols and therefore also require substantial domain knowledge. The digital service providers focus on an asset-light business model, specialized in application development through outstanding software and UI/UX capabilities. End-to-end solution providers seek to attract customers with integrated building management systems. This archetype requires broad domain expertise (in hardware and software) and strong collaboration with relevant partners.

04| Definition of smartification road map and strategic initiatives

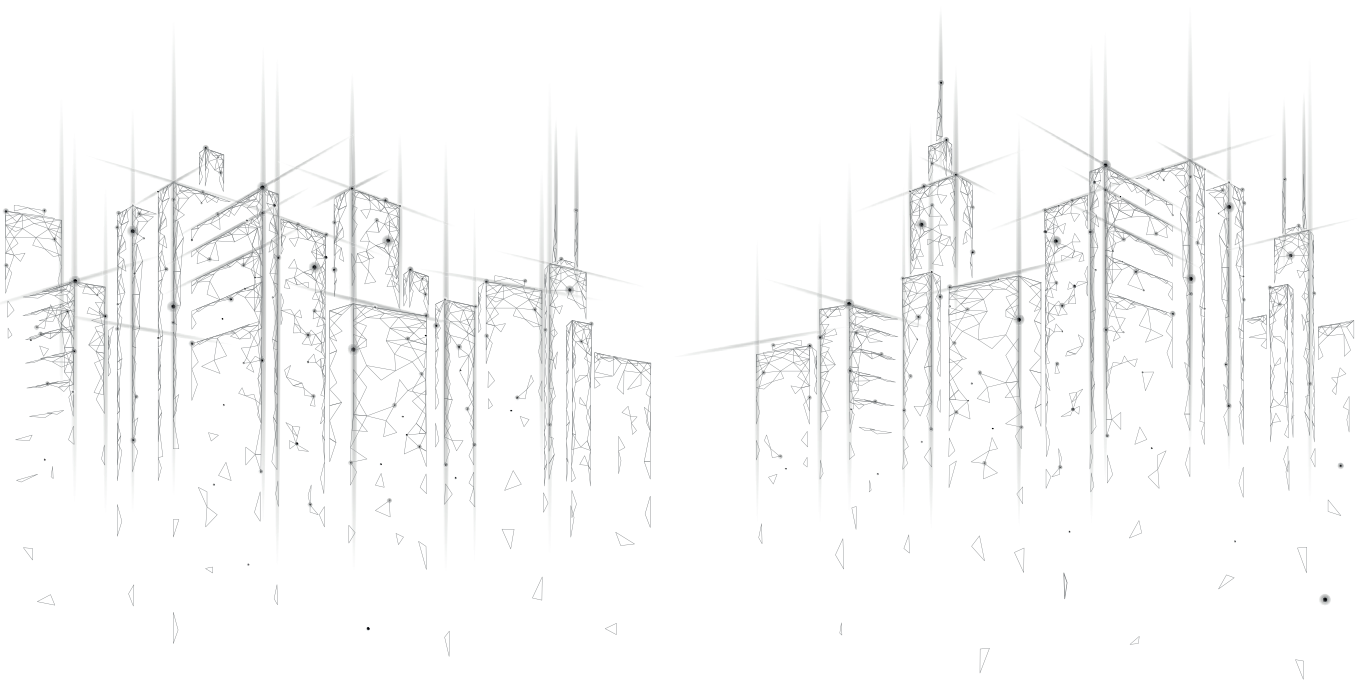
The target positioning needs to be translated into a smartification road map. Starting from a fit-gap analysis of required versus existing capabilities in development, operation, and commercialization, companies must define strategic initiatives to implement the smartification strategy. Development capabilities are typically acquired through investments in R&D and hiring new employees with expert knowledge in specific areas, such as data scientists, application developers, or UI/UX designers. Hardware manufacturers might also consider collaborating with external software developers or startups to accelerate transition. The operation of discipline-specific use cases for smart buildings at the customer's premises requires access to building management platforms, as the user prefers a single interface. Hardware manufacturers must therefore ensure that their solution's hardware and software allow interoperability. This is a key prerequisite to realizing scale effects. Commercialization of digital use cases requires fundamentally different sales capabilities and thus job profiles, as compared to the traditional hardware business. This must be reflected in the sales team's structure and composition of personnel. The initial situation and target positioning might require hardware manufacturers to engage in sales partnerships to commercialize their offering of smart building solutions.

05| Alignment of strategy and adjustment of the operating model

The final step is to align the smartification strategy with the organization's other strategic perspectives to determine a consistent overall corporate strategy. The overall strategic fit is key to overcoming typical challenges of ambidexterity. Any strategic inconsistencies must therefore be identified and tackled with appropriate solutions. Potential strategic conflicts between the hardware business and smartification can range from investment policies to marketing campaigns. Our approach is to perform the strategic alignment process on all levels: corporate strategy, business unit strategy, and functional strategies.

In addition to strategy, companies need to establish the proper balance between the hardware business and smartification in their operating model, as services and software require working methods that differ from those of physical products. Experience shows that typical pitfalls in corporate digital transformation include a reliance on legacy organizational structures and a lack of speed, agility, and self-empowerment. We therefore recommend designing a coherent digital operating model that serves as a blueprint for structures, digital governance, mechanisms, and the culture needed to execute the smartification strategy at scale. This digital operating model consists of four central elements: digital organization design, digital governance, new ways of working, and capabilities and partners. Digital organization design defines roles, business lines, and coordinating mechanisms to drive digital transformation while leveraging scale and expertise.

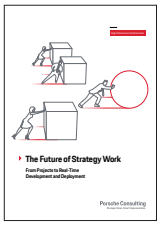
Digital governance outlines the steering mechanism of the digital transformation that yields high-quality decisions on strategic priorities, resource allocation, and business performance management. New ways of working include structures, mechanisms, and cultural norms to accelerate cross-functional digital innovation and go-to-market. Key pillars include digital product management, collaboration workflows, and innovation culture. Capabilities and partners describe the required digital competencies and define the mechanisms to integrate people, partners, technology, vendors, and startups to fill the gaps.



Smart building as one important component of the smart city

For the future increasing convergence of various "smart x" is expected. The fundamental principle that unites all smart-x segments is their use of connectivity and data to create insights across domain silos. Based on these shared characteristics, enormous potential lies in stronger integration and smartification of professional, private, and public sectors. Smart building is certainly not the final evolutionary step, but rather a significant element in a larger smart-city ecosystem. Imagine a world where buildings (autonomously) communicate and exchange data with traffic systems, power grids, and waste disposal infrastructure, to name only a few examples. In this "system of systems," value creation will significantly shift from individual, self-optimized hardware solutions to integrated digital services based on smart platform solutions. This forces hardware manufacturers to explore new ways of tackling increasing commoditization of their core business. If not, they risk missing out on tremendous revenue and profit potential in a rapidly evolving building value chain. The five-step approach outlined in this paper offers guidance in the transition to smartification.

Further reading



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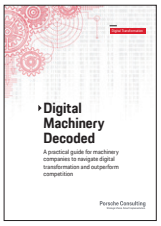

Digital Machinery decoded

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