SMART BUILDINGS | ADAPTING TO CHANGE.
Whether motivated by economic, environmental or social drivers; developers, owners and operators are increasingly searching for smarter and more innovative ways to optimize the performance of their buildings. Benefits can range from improved user experiences, higher yields, to attracting premium tenants and lower operating costs.

The real estate landscape in Asia is changing. Rapid urbanization, aging asset stock and socially responsive end users are forcing stakeholders to revisit how they plan, design and operate their buildings. The introduction of technology, and especially utilizing it to become smarter, has the potential to enable a building to adapt to change and improve its performance.

Although developers, owners and operators have long strived to improve the performance of their assets, the concept of a smart building is still relatively new. Given the rapid evolution of technology, and with global spend on building technology estimated to rise to US$57.81 billion by 2023, identifying the optimum solution for current and future portfolios is not straightforward.

Building stakeholders need to start by determining objectives, timeframes and desired outcomes for real estate investment before embarking on a smart building project. For example, an owner wishing to dispose of an asset in the short-term is unlikely to realize the returns from a smart elevator upgrade, despite it improving tenants’ experience and ultimately, commanding higher long-term rents. Conversely, implementing technology that immediately reduces operating costs could appeal to the same owner.

The three pillars of social, environmental and economic can provide a useful framework to align a building’s needs with the right smart solution. This allows an asset stakeholder to prioritize which technology will help them achieve their desired smart building outcomes. Viewing these three pillars within the context of technology is critical, as we are seeing exponential adoption of innovative solutions becoming mainstream in daily lives. This could include facial recognition to improve security (social), smart lighting to reduce electricity consumption (environmental/economic) and smart control of HVAC to enhance operational performance (environmental/economic).

There is also an important role for governments in enabling smart building success. Smart city initiatives in the last five years in China, Hong Kong, Singapore and the Philippines have all outlined how they will enable and promote the growth in technology and the adoption of smart. However, without cities providing an appropriate ICT infrastructure, such as 5G, and facilitating an open approach to data accessibility, stakeholders could become constrained in their available options to adopt technology when looking to enhance their property’s performance. Particularly at the interface with government-developed infrastructure and public transport.

This whitepaper explores the challenges and opportunities for developers, owners and operators in identifying and implementing smart building solutions. As business consultants, project managers, engineers and cost managers, Arcadis can support your asset lifecycle decisions in this digital age.
A SMART FRAMEWORK.

When faced with unfamiliar territory, it’s important to have clear objectives and a framework to help identify optimum solutions, inform decision-making, and enable practical implementation.

Using the framework of the three pillars: social, environmental and economic, a smart project can be effectively aligned with a building’s objectives, ensuring the identification of appropriate smart solutions.

SOCIAL
The social element of smart building adoption considers how to improve quality of life for an end user. What this looks like can differ between building types, but the outcomes can include, but are not limited to, improving employee satisfaction for commercial occupants, regenerating living spaces for residential tenants and boosting a building’s attractiveness for future prospective occupants.

For example, innovation can enable employees to check desk availability, book meeting rooms on their smartphones and use facial recognition to make building access easier and security more effective. According to Deloitte, organizations with stronger connectivity and social networks are 7% more productive and increase employee engagement, corresponding to an 87% increase in employee retention.

ENVIRONMENTAL
Managing a building’s energy use, pollution and emissions is critical and can enable stakeholders to optimize their operational expenditure and carbon footprint. As developers, owners and operators, it’s important to understand how to minimize these effects.

For decades, people have been aware of low-flow toilets and energy efficient light fittings. The introduction of new technology now allows users to enhance these measures. Smart HVAC can not only reduce power consumption and carbon footprint, but can boost productivity by up to 11% by improving air quality. Also, with new builds, developers can use renewable materials, lowering the building’s carbon footprint from its inception.

ECONOMIC
This pillar looks to assess the application of smart technology from the lens of an economic benefit. It identifies the appropriate technology that can be used to meet the financial objectives of a building, and make sure it translates into a benefit for the end user.

Critically, there is a need to consider the timeframe to when an economic benefit could materialize. It needs to be understood if the technology that has been adopted will provide a short-term saving, or if it will generate a more long-term reduction in operational expenditure.

An example can be seen in adopting technology to match building occupancy patterns with energy use. Doing this can enable a building to self-optimize its energy consumption and control the output with smart lighting, meaning lights will only be in operation when a building, or a certain section of the building, is occupied – reducing operational costs.

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Governments in Asia are increasingly reviewing public policy as part of their commitment to embracing smart technology to enable their city vision. Whilst environment is not always the primary focus for a smart city vision, it still has a significant role to play with buildings contributing approximately 40% of all CO2 emissions. Governments and private sector organizations are recognizing the benefit that smart buildings can have on the environment and what the real estate industry can achieve at a macro-economic level.

As city visions continue to develop with a focus on the evolving needs of citizens, governments are updating their policies in areas such as ICT infrastructure, data collection, storage, sharing and accessibility. One consistent theme across Asia is that technology is evolving at a faster pace than most current city infrastructures can support, meaning buildings will struggle to realize the full benefits. Reliability of power, security of networks, high-speed connectivity and high capacity of data should all be considered when determining the appropriateness of what technology to adopt.

Collaboration between governments and the private sector is essential to ensure technology and city infrastructure evolves in parallel. Data will play a critical role in this. For example, data collected in new public smart assets such as lamp posts, can capture information such as pollution levels, car movement and pedestrian footfall. It’s important for a city to create a process where this data is collated, stored and made readily available on an open platform, for all city stakeholders to access, not just for government use. Similarly, the data that is collected in the private sector needs to be shared with the government. By establishing an informative process, a city can define the right policy and ICT infrastructure to support smart adoption, fueled by data and insights in collaboration with private sector companies.

Asia is at the cusp of the fourth industrial revolution – a term characterized by a fusion of technologies – that is blurring the lines between the physical, digital and biological sphere and marked by emerging technology breakthroughs. These technologies are disrupting almost every industry, and the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance. In response, China, Hong Kong, Singapore and the Philippines have all launched initiatives geared towards incorporating the use of big data, analytics and smart insight to embrace the change ahead. These governments are also responding by offering incentives, and adopting regulations and codes aimed at enabling smart development.

**CHINA**

China is a global leader in enabling its built assets to thrive in a technological environment. There is an openness to allow its cities and private sector companies to test new technologies and innovate. Reported in 2018, there were over 1,000 global smart pilot programs, with China home to around 500. This market-leading position has created an environment that fosters smart adoption with forward-thinking policies, including the active promotion and incentivization to develop AI, Robotics, AR, VR and driverless technology.

The trend in adoption of sensors can be seen in China’s recent buildings, with the Jin Mao Tower in Shanghai, built in 1999, having 10 sensors, the World Finance Center in Shanghai, built in 2008, having 100 sensors and the Pingan Building in Shenzhen, built in 2017, incorporating 10,000 sensors.

**HONG KONG**

The Hong Kong Smart City Blueprint has outlined areas of focus including Smart Environment and Smart Government, which directly impacts the future of buildings. Smart Environment incorporates provisions to encourage sustainable green building design, retro-commissioning, information technologies, water meters, and LED-lighting retrofitting, while Smart Government is set up to promote Building Information Modeling (BIM) and Common Spatial Data Infrastructure (CSDI). Integrating these technologies with additional applications, such as the Internet of Things (IoT), can solve complicated challenges in building management and provide valuable insights for developers, owners and operators.

**THE PHILIPPINES**

The Philippines’ Build Build Build scheme has an outlined investment of US$180 billion in infrastructure over the next decade across 75 flagship projects, which the government believes will improve the movement of people and goods, encourage investment and create jobs. Critical to this is the development of its buildings and making sure a smart approach is used to solve the complex challenges faced by end users, such as connectivity and rapid growth in population.
Arcadis uses data analytics to create annual savings of US$460K for a building owner

**OVERVIEW**
A building owner in Hong Kong needed to improve the current performance of its HVAC system to reduce operational expenditure, minimize energy consumption and increase the operational lifecycle of its chiller units.

**CHALLENGE**
The project needed to develop a solution to identify, procure and project manage the installation of an enhanced HVAC system. The project required rooftop operations in difficult-to-access areas without disrupting the current operations of the building. Reducing noise pollution for current building occupants and residents of adjacent buildings was also a priority.

**SOLUTION**
Arcadis provided data analysis and project management for the building owner to upgrade and replace its chiller units to improve operational efficiency. The Arcadis team collated and analyzed a large data set to identify a smart solution to optimize the current chiller unit performance. To add value to the project, the team engaged with the building’s facilities management to implement predictive maintenance of the new system to optimize the future operations of the building.

**IMPACT**
This resulted in a 30% reduction in the total number of required chiller units, creating an annual energy saving of US$460K, a reduction in operational costs of an estimated US$81K and an increase in operational lifecycle of 20 years.

**OUTCOMES**
- Analysis of the building’s existing operational data to identify smart solution for the HVAC system, leading to optimized usage and cooling loads of the chillers
- Integrated project management between Arcadis’ Business Advisory and Project Management teams
- Testing and commissioning of the final installed chiller units

The urban environment has a significant role to play in the adoption of the most appropriate technology.

The adoption of technology in a building can be defined by a range of factors, such as the asset type, location and its overall objectives. In addition, it’s critical to know the needs of the end user, as significant capital expenditure can be wasted on solutions that don’t improve the bottom line or enhance the user experience.

There is an important distinction to be made between smart buildings, and technology enabled ones. Becoming smart is not just about the adoption of new technologies, it’s about making informed decisions with a reliable data set and making sure that the solution is aligned with the building’s insights and objectives. If the user experience of a building is improved through the implementation of technology, which in turn delivers a material benefit, it can be considered a smart building – making technology the enabler.

In Asia, where climate, land supply, topography and mobility vary greatly, it’s even more critical to be sure that the solution will drive measurable benefits. The urban environment has a significant role to play in the adoption of the most appropriate technology. In cities like Beijing, automated air quality control will be beneficial given the high levels of pollution. However, for others like Singapore where air quality is relatively better, the material benefit of a similar solution might not outweigh the cost.

Stakeholders also need to consider that technology can cause initial challenges, such as disruption in daily operations for both building operators and the end user. This outlines the need to have a balanced approach when considering the business case for adoption. For example, understanding the behaviors and footfall of shopping center patrons via mobile phone data can provide behavioral driven real-time insights for retailers, which can be leveraged to minimize daily operational disruption. Similarly, this approach can also be used to drive continuous customer experience as the asset evolves. However, before implementing, owners must consider whether the benefit to retailers outweighs the capital expenditure, as there could be a breakdown of the landlord/tenant relationship should the data become unavailable. Stakeholders must critically evaluate this as governance around data usage and privacy is still in early infancy for many cities.

**BUILDING INFORMATION MODELING**
There are significant benefits to using Building Information Modeling (BIM) if implemented to its full potential. It can create a one true source of data throughout the entire lifecycle of a building, provide greater visibility of an asset for all stakeholders and reduce design issues at the construction stage, all of which have material benefits for developers, owners and operators. However, adoption of BIM is not mandated across Asia.

For existing buildings, Arcadis is pioneering the creation of digital twins which provide building owners and operators with a reliable set of data from which to de-risk and optimize future building upgrades and ongoing maintenance.

During the operational phase of a building, BIM enables the representation of data in a graphical interface, where smart building components can feed live updates to facilities management software, which can articulate a responsive digital model for real time optimization. Even if not adopted during development, owners can install smart sensors and devices in key areas of the building to collect and interpret data to enhance operations by lowering operational expenditure and improving user experience.

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SMART DECISIONS

Having discussed how technology can benefit asset owners, operators and developers, the adoption of smart in buildings has the potential to be game-changing. With technology evolving and entirely new eco-systems being launched, stakeholders need to ensure they remain flexible in their strategy.

Adoption of smart technology programmed into Asia’s building stock needs to be managed efficiently, especially in existing assets. Identifying the appropriate solution is critical and it must be aligned with a building’s objectives and provide material benefits to the end user. Without this, no matter what technology is considered, if it doesn’t enhance performance it can’t be considered smart.

FLEXIBLE PROJECT DELIVERY

Progressing with smart initiatives requires clarity in the decision-making process. Essential to this is the due diligence around developing financially-focused benchmarks from which to track success. There also needs to be a pragmatic view of the pace at which technology is developing. In a short space of time, systems and software can become outdated and new technology can supersede them in capability. Stakeholders should remain flexible in their approach and consider pilot schemes or agile methodologies to address their most pressing challenges. This approach can reduce associated risk and even confirm a stronger long-term strategy.

IMPROVED COLLABORATION

The role and need for a fit-for-purpose and reliable ICT infrastructure in a city can’t be underestimated. Without the right enabling platform, technology in a building will not fulfil its potential and this must be acknowledged in the planning phase of any smart building project. If not, stakeholders could become constrained in their available options to adopt technology when looking to enhance their property’s performance. Data will be the foundation of collaboration between governments and private stakeholders, thus stakeholders must consider the future state of data needs in the asset planning stage too.

TECHNOLOGY

Smart innovations can improve reliability, performance, reduce carbon footprint and automate processes – all with the use of sensors, actuators and microchips. And with technology like machine learning, supported by real-time data, the optimization of a building’s performance can be achieved through data-driven insights, ensuring a building adapts to the needs of the end user.

The installation of technology in existing buildings needs to consider the associated disruption it could bring to the asset, tenants and workforce. Upgrading and installing new technology into an existing infrastructure and operational process will require major integration works, involving IT professionals working with building controls they may not be familiar with. This level of disruption can also bring with it resistance to change, so it’s not just about simply adopting software, there is a need to manage its engagement with the end user, the current process and existing culture.

CASE STUDY

Arcadis improves space utilization of a car park by using data analytics

SOLUTION

By using data analytics, research and benchmarking, Arcadis provided data analysis of current and historical parking patterns for different user groups and produced meaningful recommendations on strategies to better distribute car park users. These included strategies to optimize a free parking policy, modifications in the policies around reserved parking spaces and advice on the adoption of modern IT systems to support future operations.

IMPACT

Traffic was spread more evenly across the car parks during busy times and reduced the overcrowding in locations with a high volume of cars. The owner was able to increase the number of hourly parking users without impacting the long-term subscribers.

OUTCOMES

- Tailored approach to ensure even spread of traffic across car parks and avoid overcrowding
- Price recommendation, through a benchmarking study against other sites across Hong Kong
- Rationalized free parking policy realized through study of trends and benchmark sites
- Recommendations on potential modern IT systems that could be adopted

OVERVIEW

With increasing demand for both monthly and hourly car parking spaces, a building owner and operator in Hong Kong was looking for ways to optimize the available car park space to maximise revenue and improve the user experience for existing tenants and the wider public.

CHALLENGE

The owner had been experiencing high traffic in certain car parks and low traffic in others, and wanted to achieve a better balance of traffic/occupancy across different car parks, within a district.

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- Recommendations on potential modern IT systems that could be adopted
The use of a framework to align and justify the capital expenditure for a new smart development, or a building upgrade is critical to ensure it remains holistic and practical to implement.

The primary objective behind any real estate project is likely to be influenced by the need to improve efficiency, reduce operational expenditure or minimize carbon emissions. Stakeholders today face a multitude of unseen challenges in the age of smart. The use of a strategic framework to assess and prioritize a building’s smart outcome is likely to not be fully understood or adopted.

The true definition of a smart building lies in the ability to integrate various systems and operate the building in such a way that allows the system benefits to be fully realized so stakeholders can ultimately improve the value of their real estate assets.

The rate of technological adoption in the built environment is expanding. As you look ahead to the future of smart buildings, one thing appears certain: tomorrow’s assets will be connected and supported by interoperable infrastructures with smart cities providing an extension of the environments that they operate in. It is important that developers, owners and operators adopt a framework now to ensure a balance across the three pillars of social, environmental and economic to inform these critical decisions of what smart building developments or upgrades to undertake.

Without such a framework to plan, manage and operate, stakeholders face the risk that their asset will not adapt to the pace of ‘smart’ technology within the real estate market. It is not the strongest or newest buildings that will prevail over time, it is the one most adaptive to change. Technology is disrupting the way we view our built assets. The main question is whether your building is smart enough to remain relevant.

CONCLUSION.
Stakeholders need to know how to implement a smart project, which will affect planning, costing, design, procurement, construction, project management, handover and operation.

Whether working on a new build or an upgrade, Arcadis can support at every stage of a project, from feasibility and design, through to planning, development and operation.

In Asia, Arcadis has four main service lines that can be delivered as a standalone service, or as part of a wider integrated delivery strategy.

**BUSINESS ADVISORY**

We understand your building’s challenges and have first-hand experience in the planning, operations and maintenance of major assets in Asia. We partner to develop a clear strategy that can bring unique insights to help your building achieve better results, with more certainty, through smart adoption of technology.

**PROGRAM AND PROJECT MANAGEMENT**

Smart buildings are complex and rapidly evolving. Developers, owners and operators can benefit from a Project Management Consultant (PMC) to simplify and de-risk the process of making a building smart. As PMCs, Arcadis can work closely to define aims, objectives and outcomes to ensure technology is adopted effectively. This includes developing a strategy to identify the most appropriate mix of technology solutions and implementation strategy. The complex nature of smart buildings often requires a multi-disciplinary team, which can be provided, procured and managed by the PMC.

**DESIGN, ARCHITECTURE AND ENGINEERING**

From tall buildings and residential blocks, to mixed-use developments and retail outlets, connected and smart design helps to improve quality of life for us all. Our specialist designers and engineers include the principles of smart design into new builds and upgrade projects to deliver exceptional and sustainable outcomes.

**COST MANAGEMENT**

Cost management is an integral part of the smart building solution. Our skilled people have unrivalled experience in costing major projects across Asia. Our team can outline the capital cost of smart building projects which is largely determined by decisions made at the design and concept phase. Cost planning and value management include the evaluation of alternative design against a value criteria for function, quality and durability. This enables optimization, delivery within budget and protection of the forecasted returns.
Cities in Asia are changing at a rapid pace. Stress factors such as urbanization, digital disruption, climate change and rising sea levels are creating a need for cities to adapt and look for innovative ways to remain competitive.

The Liveable Cities Series looks at the critical challenges facing a city’s natural and built environment, and what needs to be done to improve liveability for its citizens.

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