



University  
of Glasgow

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SMART  
INFRASTRUCTURE

# University of Glasgow Smart Campus Digital Masterplan

November 2019

## Executive Summary

The University of Glasgow recognises the need to move beyond a traditional educational environment, where the current model in some instances is no longer fit for purpose. It is our responsibility to create a world-class learning and teaching environment and deliver the best possible outcomes to our students, staff and the wider community.

Recognising the necessity to maintain if not improve upon its proposition and survive in increasingly evolving pedagogical conditions – considering competition, growth and revenue, the University of Glasgow has embarked on an ambitious World Changing Glasgow Transformation Programme, comprising of extensive refurbishment and major development of exciting new buildings and public spaces. A core component of this transformation is the Smart Campus initiative. Simply put, the initiative seeks to install helpful technological interventions and digital capability into the fabric of the University to enhance learning, research and the operational efficiency of the estate. In summary, this digital masterplan:

- outlines the ambition, vision and objectives of the Smart Campus;
- promotes this unique opportunity and explains ‘why now’;
- defines the desired outcomes to be achieved through the end solution;
- provides an indicative implementation roadmap with sequential activities;
- highlights key benefits to be realised and critical success factors;
- indicates primary motivators, associated challenges, expectations and actions;
- acknowledges the adoption of the Gemini Principles as guiding values;
- articulates the components of an end solution and their relationships; and
- proposes next steps for procurement, design, implementation and operation.



## Strategic Context

Glasgow University has around 29,000 undergraduate and postgraduate students from more than 140 countries worldwide. It is a major employer in the city of Glasgow with more than 8,000 staff, including more than 3,400 research and teaching staff. It also has a global community of over 219,000 alumni. The University delivers transnational education in partnership with the Singapore Institute of Technology, Nankai University and the University of Electronic Science & Technology of China.

The University’s estate is spread across 18 sites, with more than 320 buildings and a total gross internal area of approximately 480,000m<sup>2</sup>. In 2017/18 the University consumed 144,947MWh of energy. Its carbon footprint in 2015/16 was 69,591 tonnes CO<sub>2</sub>e, with a 20% reduction target to 55,500 tonnes CO<sub>2</sub>e per annum by 2020/21.

The University has initiated an extensive investment programme in its physical estate, including a major development of the Gilmorehill campus, the single largest construction project in the City of Glasgow region. This will extend the estate by 14 acres to approximately 70 acres, with a daily footfall of around 35,000.

The campus development includes exciting new buildings such as the James McCune Smith Learning Hub, Research Hub and Institute of Health and Wellbeing, amongst others. The investment programme also includes continued upgrades and refurbishment of the existing estate to improve facilities and accommodate growth.

This investment programme is rethinking our approach to use of space to enhance the learning and teaching environment and deliver world-class research by:

- creating a more open and safer environment;
- emphasising entrances and gateways into the campus;
- enhancing pedestrian movement arteries;
- reinforcing character of buildings and settings as a social focus; and
- supporting a sustainable agenda.

The Estate Strategy seeks to deliver a campus that is:

“...fit for today and the future, is innovative and courageous in design, and is reflective of the University’s history and of its ambition, inspiring current and future generations.”

Source: University of Glasgow Estate Strategy 2012



## Smart Campus Vision

To support the University’s mission and deliver the ambition ‘to be a world-class, world-changing university’, we are embarking on an ambitious programme of development under the World Changing Glasgow Transformation (WCGT) Programme. This includes the Gilmorehill campus development, a comprehensive IT investment programme spanning to 2026 and a suite of transformation initiatives; one of those being the creation of a Smart Campus.

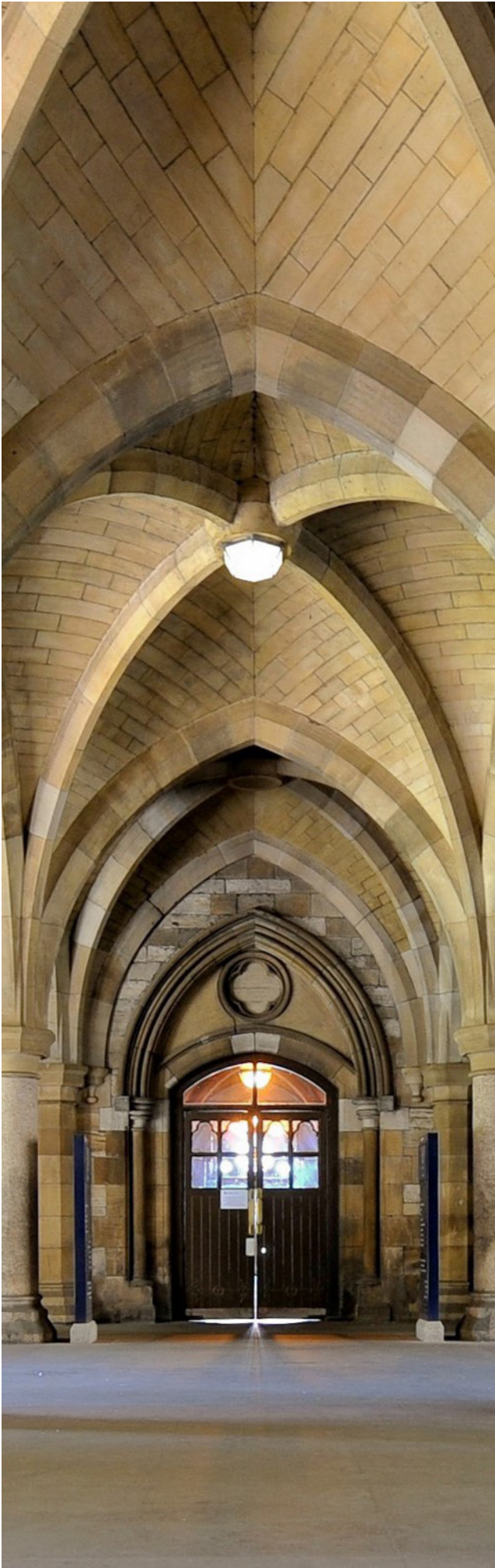
The Smart Campus vision is to create a campus that is open, connected, adaptable and sustainable

We have defined a set of long-term, stable objectives that define this over-arching vision:

- A world-changing University that is adaptable, connected, healthy, vibrant and sustainable.
- Provide a world-leading, technology-enhanced learning and teaching environment for the entire University community (local and remote).
- An agile and adaptable campus that supports discovery, fosters innovation and builds collaboration.

The University will be at the heart of a new, economically productive, urban quarter for Glasgow, supporting high value businesses and job creation; the Smart Campus however is designed to extend beyond the boundaries of the physical campus, integrating the City of Glasgow, University satellites and facilitates national and global connectivity of its people and systems.

The vision for a Smart Campus is more than educational, whilst it seeks to improve the experience of students, staff and the community it interacts with; it is also efficiency and outcomes driven, with expectations for greatly reducing the carbon footprint and operating costs of the University going forward.



## Digital Masterplan and Roadmap

This digital masterplan is not a technology strategy. It is a planning and guidance document with people and information at its core, it provides the basis for understanding our Smart Campus vision and supports the design and delivery of that vision, whilst bringing insight into how we will embrace digital ways of working to unlock real value.

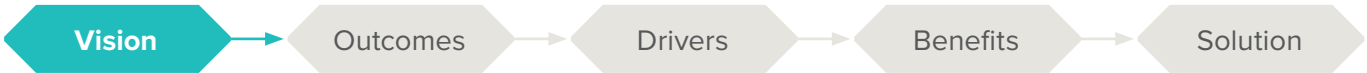
Whilst providing visibility into the strategic direction of the Smart Campus initiative, the digital masterplan serves to act as supporting material for market engagement, illustrating both expectations, desired outcomes and a narrative for its development. It defines the key elements for a plan that will ultimately form the implementation methodology for the Smart Campus end solution.

The digital masterplan:

- brings together the goals and aspirations of the University and demonstrates a systematic concept to enable design of a solution from the market;
- defines the Smart Campus objectives and vision, outlining the key features and desired outcomes that should be addressed during solution inception;
- identifies key benefits to be realised through adoption of a solution;
- highlights the importance of a balanced relationship between technology, people and information; and
- provides a high level, indicative implementation plan by way of a roadmap with sequential steps that are aligned to the Smart Campus vision streams.

The roadmap sits at the centre of this digital masterplan. It sets out a series of high-level steps, with an aim to support the detailed design and delivery of the Smart Campus by the market. The activities are categorised by vision streams (page 8) and are sequentially ordered as short, medium and long term actions within the plan. The Roadmap presented herein (pages 16 & 17) is intended as an example of a route to achieving the Smart Campus vision, where steps represent key features sought by the University in the end solution.

Digital ways of working can enable faster delivery of desired outcomes, with greater certainty. With a smarter campus we can realise greater value across its operational life.

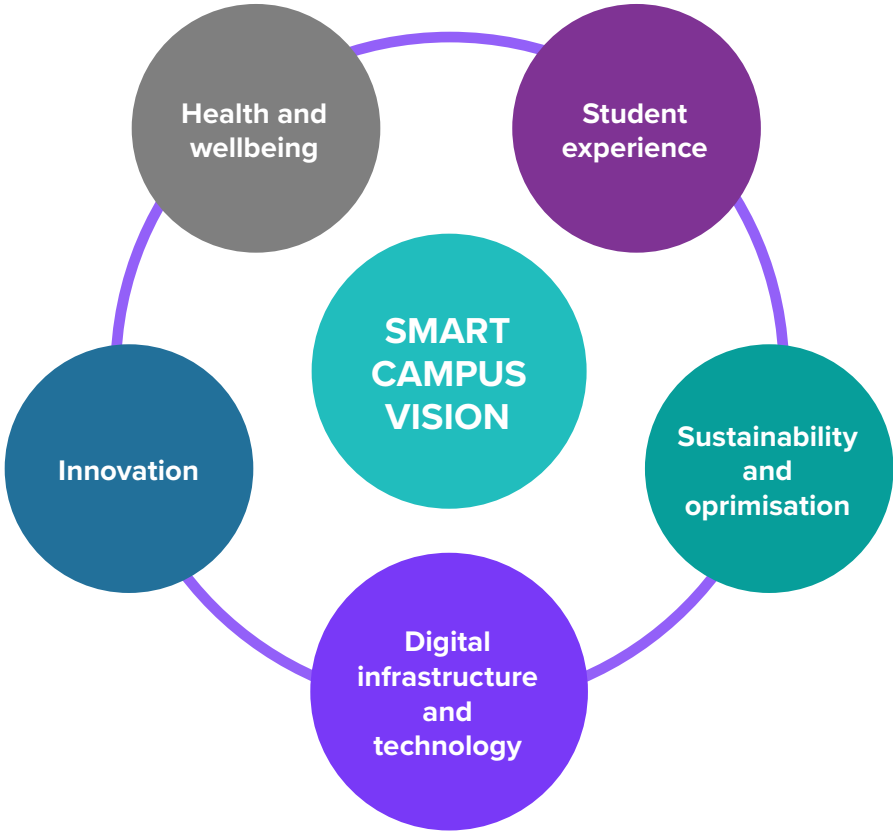


Delivering the vision

To support the University of Glasgow’s long-term investment objectives and our vision, five strategic vision streams have been developed specifically for the Smart Campus, to provide both a home for its components and a means to channel activities.

To put this to action, we must constantly adapt and challenge ourselves to achieve continual improvement, change instinctive habits and embrace new, digital ways of working, develop new skills and adopt challenging behaviours. This includes both becoming smart in our outlook on what an educational campus of today means, as well as enabling the right level of digital infrastructure to support the data needs of a modern university.

The **vision streams** are considered as intrinsically connected yet promote different focus areas and derive unique outcomes. Whilst we recognise technology is central to the vision and at the heart of any digital transformation agenda, the Digital Infrastructure and Technology stream underpins the four primary streams and should be leveraged to bring these to life and unlock the opportunities within.



The aspiration behind the Smart Campus is to embed the use of smart, contemporary technology into the daily lives of students and staff to the enhance the way they interact with their environment. This will be underpinned by city-wide engagement and co-creation with industrial partners to capitalise on new opportunities.

The following vision statements define the meaning and purpose of the streams:

- **Student experience:** A campus that creates an enriching and rewarding student experience by leveraging innovative technology, blending the digital and physical campus.
- **Health and wellbeing:** A campus that is healthy, welcoming and safe; that optimises the physical environment and working practices to enhance wellbeing and productivity.
- **Sustainability and optimisation:** A sustainable campus that optimises the use of its resources. A campus that is energy efficient, lowers utility costs and optimises use of spaces by digitally monitoring usage and occupation in real-time, enabling the use of a sustainable built environment.
- **Innovation:** An agile and adaptable campus that supports discovery, fosters innovation and builds collaboration.
- **Digital infrastructure and technology:** A campus with the infrastructure and technology to be open, connected, adaptable and future-proof.

“The Smart Campus will transform our University, establishing an immersive digital environment that will benefit our students, staff and visitors.”

Source: Chris Pearce, Smart Campus Board Chair, University of Glasgow, 2019



Our vision is to  
create a campus  
that is open,  
connected,  
adaptable and  
sustainable.



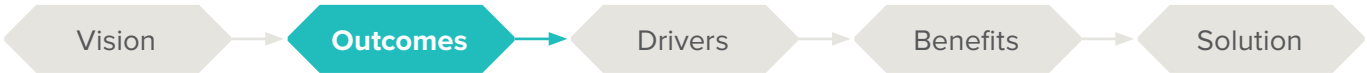


Desired outcomes

The Smart Campus initiative has been created with an ‘outcomes’ focussed approach, thus providing insight into what is to be achieved rather than prescribing exactly how the solution should be designed and delivered; this encourages both innovation and flexibility within the market place, but ensures we always retain focus on the end objectives.

The Smart Campus is focussed on enabling desired outcomes for the end-user and promotes the art of the possible through better connectivity. The end solution should not be considered as simply a rollout of digital.

Adopting an outcome-based approach allows supply side innovation in determining the Smart Campus end solution whilst retaining a focus on the long-term objectives. A non-exhaustive set of desired outcomes is presented opposite and demonstrates the relative affiliation to each vision stream, it is however anticipated that outcomes will be realised across multiple vision streams e.g. promoting ‘sustainable mobility’ through the Sustainability and optimisation stream will evidently enhance the overall Student experience.



Health and wellbeing

- Enhance a feel safe and secure University (in both cyber and physical aspects).
- Ensure ongoing compliance with health and wellbeing regulations.
- Provide the University with better information to foster positive interactions between students, schools, estates, ecosystem partners, and the wider community.

Student experience

- Foster a collaborative culture enabled by digital technology.
- Enhance services for students and staff and on-campus experiences by leveraging digital technologies.
- Enable a “learn anywhere” environment through innovative, interactive learning models.
- Leverage big data and technology to guide each student on their path to educational success.

Innovation

- Foster an innovative and entrepreneurial culture that attracts innovators, research opportunities and strategic partners to the University’s digital ecosystem.
- Leverage existing IT and infrastructure investments to increase value for the University.
- Create an innovation zone to enable students, researchers and community to design, test, upscale and optimise innovative projects.

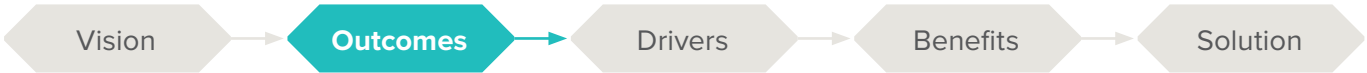
Sustainability and optimisation

- Preserve the University targets for reducing carbon footprint and greenhouse emissions.
- Reduce OPEX/CAPEX through improved operational efficiency of estates and effective asset management.
- Achieve a sustainable digital environment through effective integration of data and systems.
- Promote sustainable mobility on and around the campus.
- Enhance productivity through leveraging digital solutions.

Digital infrastructure and technology

- A campus with open, connected, adaptable and sustainable technology.
- Digital infrastructure and technology is the critical vision stream, where technology underpins and connects the desired outcomes to be unlocked within the other four streams.





## A unique opportunity

Our ambition for an enhanced learning environment is reflected in the substantial investment in the campus, which is adopted in the University Strategy and moving ahead at pace. As the University delivers on this strategy, the expectations and needs of the students, staff and wider community continue to evolve as does the potential capability presented by digital technology.

The demand is growing to maintain pace with the prevailing technological evolution, to enhance on-campus human experience and the learning and teaching environment whilst offering a cutting-edge centre for research and innovation.

As we seek to increasingly enhance and distinguish ourselves on a global stage whilst maintaining pace with an evolving technology landscape, the Smart Campus offers a unique opportunity to transform the University by developing a digitally connected environment that:

- balances the competing priorities of the physical and the digital within the Estate investment – this needs a strategic masterplan to inform and influence all of the University’s digital initiatives;
- attracts and retains the best students and staff, providing the very best physical and digital university environment and experience;
- meets the changing technology expectations and needs of our community;
- enhances our sustainability thereby demonstrating our commitment to the Climate Emergency;
- optimises and enhances the use of our estate to facilitate growth, improves planning and decision making and reduces operational costs; and
- supports and encourages innovation, research activities and strategic partnerships.

The University of Glasgow’s Mission:

“To bring inspiring people together and create a world-class environment for learning and research, empowering staff and students alike to discover and share knowledge that can change the world.”

Source: University Strategy 2015-2020

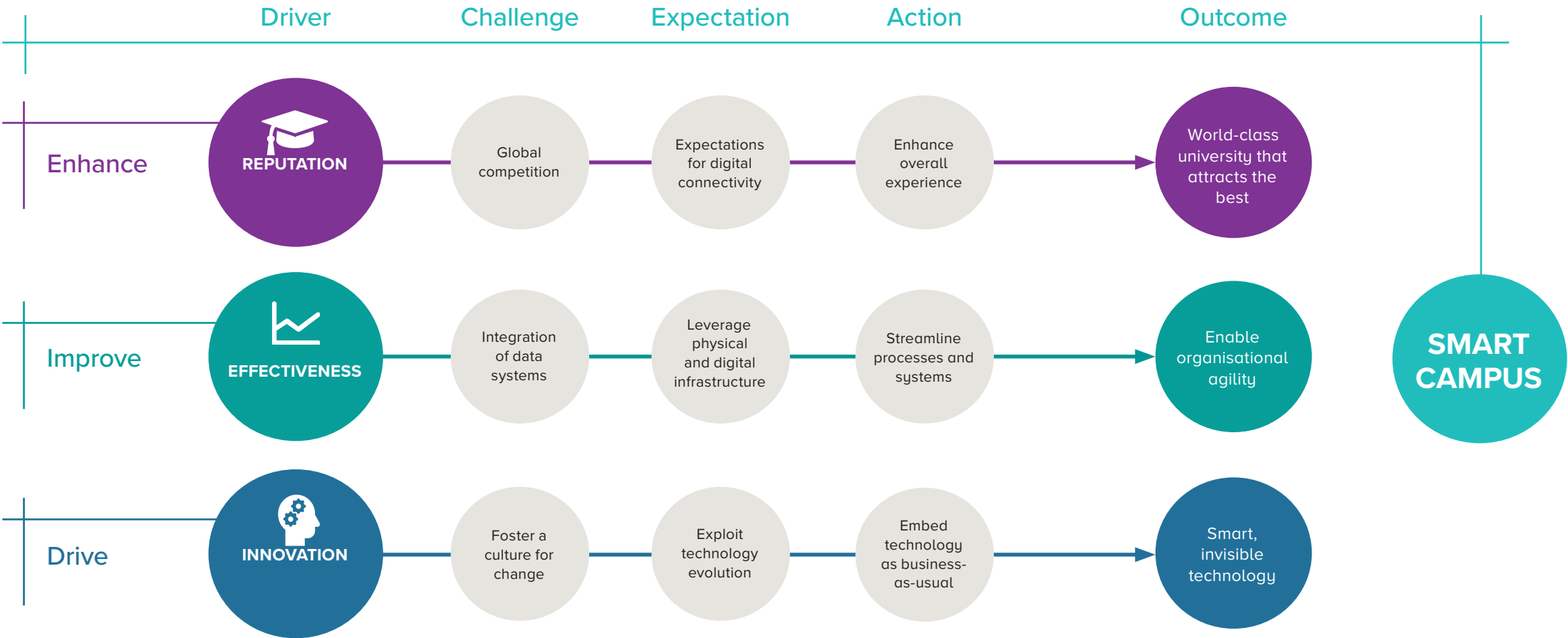




Drivers - case for change

The Smart Campus initiative is governed by three primary motivators; enhance reputation, improve effectiveness and drive innovation. Each face numerous challenges and are directed by various expectations, however through appropriate action these can be converted into meaningful outcomes and aspirational goals.

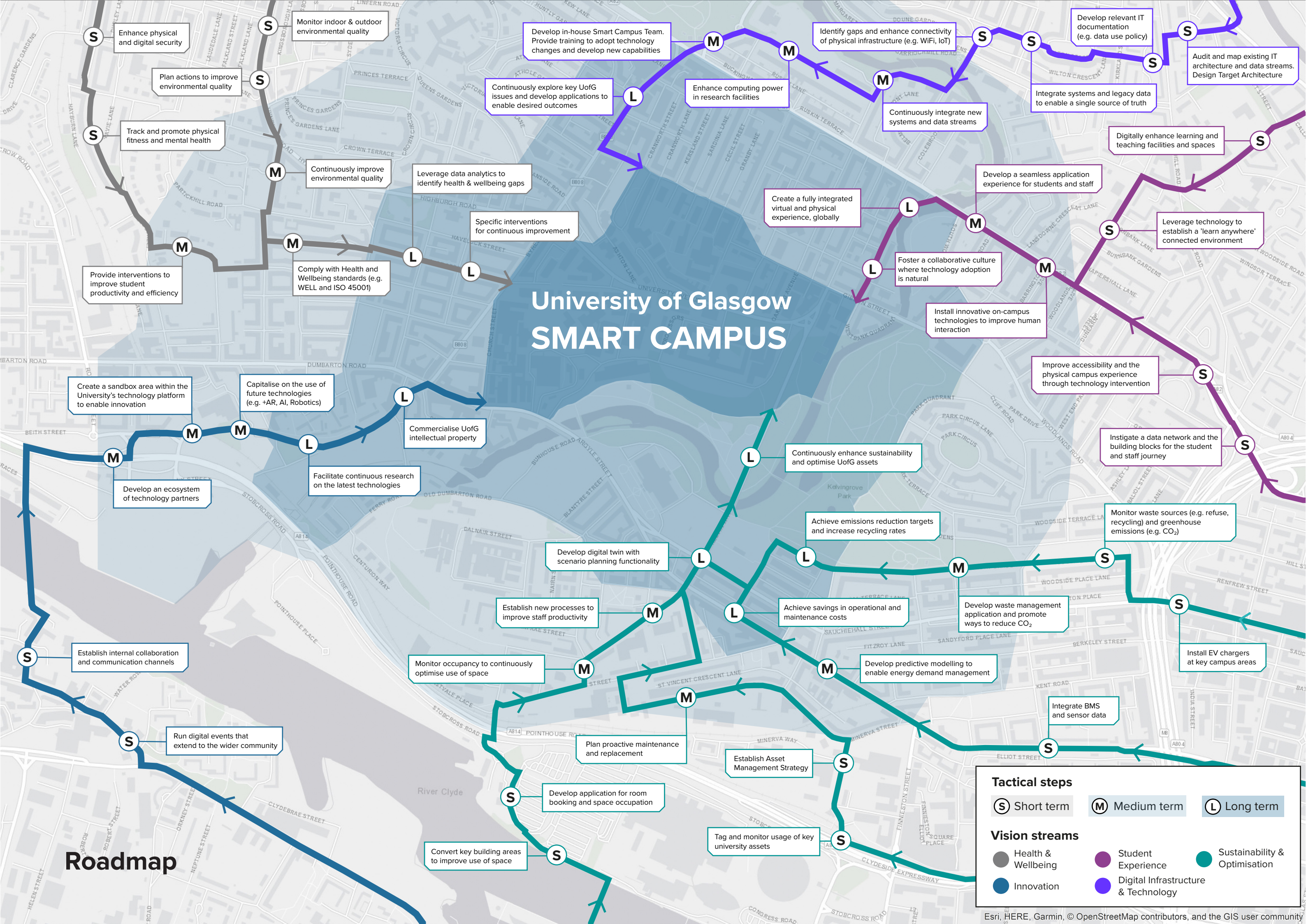
The following diagram demonstrates an example narrative that articulates the three motivators, their primary purpose being to support the design thinking approach to developing the Smart Campus end solution.





# University of Glasgow SMART CAMPUS

## Roadmap





## Guiding values - Gemini Principles

The University of Glasgow Smart Campus Board has adopted the Gemini Principles as guiding values for the Smart Campus.

The Gemini Principles were published by the Centre for Digital Built Britain to guide the development of the National Digital Twin programme. The principles are well received as they are increasingly being embraced by cities and asset owners nationwide in support of their digital transformation programmes.

The Smart Campus Board have adopted and adapted the Gemini principles to inform and align with the specific circumstances of the Smart Campus, these are:

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**Purpose:**  
Must have clear purpose

- **Public good:** The Smart Campus is a University resource with the purpose of delivering benefits to the University and its wider community.
- **Value creation:** Improving the performance of the campus will create opportunity, increase productivity and reduce expenditure.
- **Insight:** Better insight based on better data will enable better decisions and lead to better outcomes.

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**Trust:**  
Must be trustworthy

- **Security:** Physical and cyber security are essential to ensuring the integrity of the Smart Campus.
- **Openness:** Data creates more value as more people use, contribute to and maintain it, subject to and supported by effective information governance to maintain data quality and provenance.
- **Quality:** The Smart Campus is built on data. It enables the integration of data. Therefore, that data must be of a suitable quality for the intended purpose.

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**Function:**  
Must function effectively

- **Federation:** The Smart Campus is an ecosystem of connected systems that are joined through secure and resilient data sharing.
- **Curation:** Responsibility must be taken for the Smart Campus and for the data on which the Smart Campus is based.
- **Evolution:** The Smart Campus must be agnostic to specific technical solutions and be able to adapt as technology evolves.



“...we have adopted the Gemini Principles as the conscience of our journey towards a Smart Campus.”

Chris Pearce at the Smart Campus soft market test event. June 2019





Challenges and opportunities

“The higher education landscape continues to change rapidly. Since the publication of our 2010–15 strategic plan, many challenges have arisen – but these also bring new opportunities.”

Source: University Strategy 2015-2020

The continual evolution of the higher education landscape brings many challenges and equally abundant opportunities. Our extensive investment programme seeks to tackle some of these challenges, however through development of a Smart Campus we seek to bolster this investment and maximise the opportunity value. The following areas identified within the University Strategy form key Smart Campus challenge and opportunity considerations:

- **Competition:** The higher education sector is extremely competitive, with around 30,000 universities globally; in response, institutions continue to raise the standards as to what constitutes a quality higher education experience. In this space a significant opportunity presents itself to grow our reputation and achieve the status as a world class educational destination of choice, alongside this attracting the best new talent is paramount.
- **Growth:** The demand for higher education degrees continues to grow, whilst students seek new learning experiences abroad the desire to be educated in country is equally appealing, this creates both spatial and transnational challenges. With leaps in technology there an opportunity to create global, digitally connected environments and new innovative learning models that overcome distance, where new ways of working can support better use of precious physical space while enabling greater student numbers.
- **Revenue:** Economic uncertainty and reduced public spending are limiting national funding for teaching, research and innovation, however opportunities to grow revenue from other sources are becoming increasingly available, such as through innovative strategic partnerships and leveraging ‘digital’ to unlock new commercial opportunities beyond the campus walls.



Benefits

The Smart Campus facilitates a compelling range of benefits to future, current and former students, researchers, staff and the wider community. It is intended to improve staff efficiency, enhance student productivity, advance the overarching learning and teaching experience and generally reduce the costs of running the University.



Improved effectiveness and efficiency of Staff



Reduced CO2 emissions spend



Reduced utility costs



Improved use of resources and better space utilisation



Reduced operations and maintenance costs



Enhanced staff and student productivity



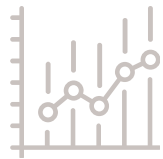
Enhanced collaboration across the University



Improved learning and teaching environment



Improved overall staff and student experience



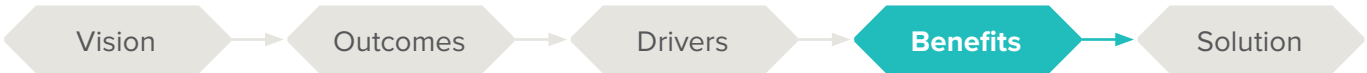
Increased number of overseas students



Enhanced University reputation



Enhanced student journey



“We want to grow our reputation as a place where the best students, regardless of background, are given an education that prepares them to go into the world and make change happen.”

Source: Chris Pearce, University of Glasgow, 2019

In order to support the Smart Campus vision and objectives, a set of critical success factors have been devised, which together with desired outcomes can be used to develop the strategic concepts and operating plans that drive a Smart Campus solution.

Whilst we do not know the full extent of benefits that can be unlocked, critical success factors are the areas of the Smart Campus strategy that can facilitate the unlocking of the anticipated benefits we are aware of. We have chosen the following six factors which are centred around the vision.

Essential to the successful delivery of the Smart Campus is the tracking, reporting and monitoring of these critical success factors. Associated metrics will be used to assess and measure progress.

**Student satisfaction**

In the learning and teaching environment, support, organisation and overall satisfaction

**Sustainable campus**

Improved energy efficiency (cost savings) reduced CO<sub>2</sub> emissions

**Research & innovation**

More innovation, entrepreneurship & collaboration, improved research facilities

**Staff satisfaction**

Through effective facilities, well supported, wellbeing and overall satisfaction

**Estates optimisation**

Reduced future CapEx and OpEx through better utilisation of resources

**Partnerships & relations**


Attracting and working with external bodies to ‘push the campus boundaries’



## Personas


To better understand how the Smart Campus will address the needs of its students, staff and those that will interact at various levels, a set of personas and scenarios were developed to bring the Smart Campus to life and to ‘make it real’ for people contextually.

The personas cover a range of roles, backgrounds and age groups and have been developed around two statements 'my problem is...' and 'I need...' for each. The personas provide insight into the technology, infrastructure and capability required to meet the respective needs, as well as identifying the likely benefits to be realised through the interventions. The scenarios aid the design thinking and enable an understanding of the challenges faced by a diverse set of individuals and how the outcomes targeted through the Smart Campus can provide solutions to challenges.



# Nazarene

PHD research academic | Computer Science



**My problem** is as a Computer Scientist, I'm applying my skills to the some of the biggest social problems in developing countries. But I feel isolated from the real world and other researchers. I want to work in a more collaborative way, I want to find ways of making sure my research has real impact - I want to be world-changing!

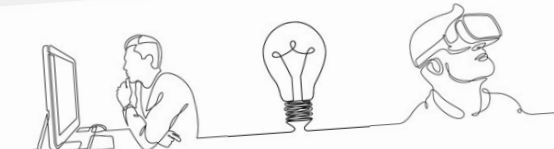
**I need** to break out of my office. I want to meet, interact and share ideas with other researchers, policy makers, NGOs and businesses. I need flexible access to spaces that encourage co-development, inspire innovation, fosters discovery and builds collaborations.

## Solution

### Innovation zone

Creating innovation spaces and laboratories with high value equipment to facilitate and optimise research projects and attract the best innovators.

## Narrative




## Benefits


Through investing in the technology that drives innovation, significant benefits can be realised in advancing research. Innovation requires creative thought and imagination, technology is the enabler.

Through implementation of an innovation zone we aim to:


- Improve data capacity, management and response time in research
- Provide students with state of the art equipment for innovation
- Deliver ground-breaking research, solve the seemingly impossible
- Enhance the University's reputation as an innovation leader
- Foster an entrepreneurial culture that enables innovative partnering



Enhanced learning and teaching environment



Enhanced University reputation



Enhanced collaboration and innovative ventures

**Adam**  
University of Glasgow - Facilities Manager

**My problem** is that I can't be everywhere at once! Lights and heating get left on for days when rooms are unoccupied, there is no way to monitor our facilities and it really costs us! It's difficult to manage maintenance staff efficiency when you don't have the facts.

**I need** to understand how our buildings are performing so I can head off inefficiency, cut costs and reduce waste. Faults need to be reported more effectively so my team can act quickly. Ideally I'd love to see a solution connecting the entire campus!

**Solution**

**Digital twin**

A dynamic virtual representation of physical assets and systems connected to real world data that enhances insight and decision-making

**Narrative**

**Benefits**

- By capturing data and reporting on how buildings, systems and spaces are used, we can make better decisions about utilities use, resource distribution and campus performance overall.
- Through implementation of a digital twin we aim to:
  - Reduce utility bills and enable a sustainable energy plan
  - Create to the minute insight into buildings performance
  - Enable proactive maintenance and better decision making
  - Optimise the use of space and enable scenario planning
  - Reduce energy consumption and wasteful processes

**Pavol**  
University of Glasgow - Social Sciences Lecturer

**My problem** is that students now seem to be based across the globe. I want to deliver a more flexible learning experience where distance learners can be fully integrated with my classes. Currently the equipment we have cannot facilitate this experience.

**I need** smart, flexible learning spaces that promote engagement from any location with devices that enable every student to feel present. The ability to record and make my lectures available at any time would be fantastic, as would enhanced visual displays!

**Solution**

**Digitally enhanced lecture facilities**

Improved technology to support learning environments, with interactive displays, lecture recording and live connectivity via an application.

**Narrative**

**Benefits**

- Creating virtual learning conditions that enable students and lecturers to be connected and interact through technology from any global location, improving connectivity and the overall learning and teaching experience.
- Through digitally enhanced, smart learning facilities we aim to:
  - Create a globally connected, learn anywhere campus
  - Improve the student and staff education journey
  - Enhance communication, collaboration and improve productivity
  - Attract the best talent

**Alison**  
University of Glasgow - Chief Digital Officer (CDO)

**My problem** is that I don't have the right level of digital infrastructure and capability to match the rapidly changing digital expectations of our staff and students. Digital transformation means we need to embrace new ways of working as well as have the correct governance and procedures in place to support the Smart Campus.

**I need** this infrastructure in place and to build dedicated in-house capability through recruiting and effective training to manage the digital challenges we will face. To make a return on our investment and realise benefits, we need the right people, processes and policy to drive change!

**Solution**

**People, Process and Policy**

Building an effective governance structure that enables pace keeping with advancing technology and the demands of digital transformation.

**Narrative**

**Benefits**

- By having the right people, processes and policy in place, the Smart Campus initiative is in the optimal position for success, to maximise its return on investment and realise targeted benefits and outcomes.
- Through design of a robust governance structure we aim to:
  - Minimise potential Smart Campus design and implementation risks
  - Enhance productivity through efficient systems management
  - Ensure data is safe, secure yet available
  - Enable joined up data, systems and thinking campus-wide
  - Have the right skills and capability to facilitate digital growth

**Digital Infrastructure and Technology**

- Maximise return on investment
- Enhanced staff productivity
- Improved effectiveness and efficiency of staff

**Other benefits shown in the cards:**

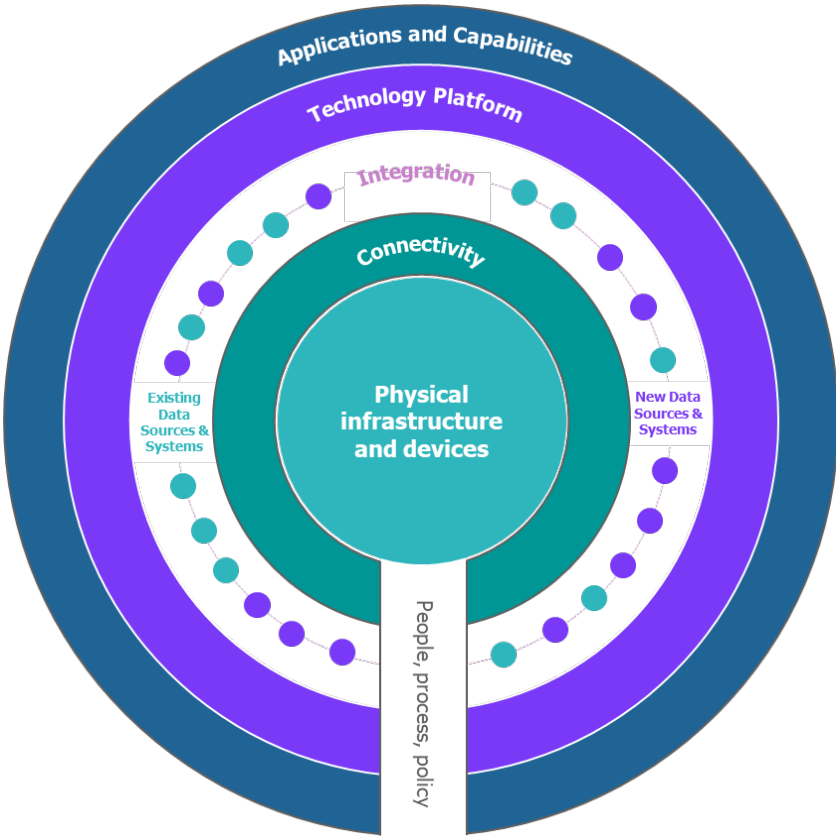
- Sustainability and optimisation
- Student Experience
- Reduced student journey
- Increased number of overseas students



Solution framework

Delivering the Smart Campus vision will require a long-term investment from the University, navigation of a complex and evolving technology landscape and new capabilities acquired to ensure efficient design and deployment of a solution.

The Smart Campus requires a diverse range of products, services and competencies to enable the design and delivery of a solution that will enable the desired outcomes and unlock value for each of the four primary vision streams. This solution will need to consider an array of attributes – spanning the underlying physical and digital infrastructure and target architecture, connectivity and integration of data and systems (existing and new) as well as a range of applications that make use of the abundance of information that will be generated. This complex technology landscape also requires a robust governance and support network that integrates people, process and policy to ensure a connected campus.



Next steps

Creating a Smart Campus requires deep understanding of a complex and evolving technology landscape to identify the best solutions.

The next steps on the Smart Campus journey are:

- **Procurement:** Establish the most suitable procurement route that enables the University to identify, select and contractually engage with the best delivery partner(s) in the market to lead the development of the Smart Campus.
- **Design:** Start developing an innovative Smart Campus design solution that demonstrates measures to achieve the desired outcomes and roadmap activities. The design should be future-proof and take into account inevitable evolution of the technology landscape.
- **Implementation:** Develop a plan to implement the solution and advise on activity prioritisation. This plan should balance benefits and opportunities with their impact on existing operations.
- **Operation:** Operational responsibilities will be discussed and reviewed at appropriate stages in the project lifecycle.

In addition to the above, Stakeholder engagement and change management are critical for the success of the Smart Campus and as such should span across its lifetime and therefore continue to evolve. The Smart Campus is above all a transformational initiative that intends to enhance the overall experience of its people and improve the quality of services provided by and for the University.

“Developing the Smart Campus proposition and how it could improve the staff and student experience at the University of Glasgow is an incredibly important part of the transformation of the University.”

Source: Chris Green, Chief Transformation Officer, University of Glasgow, 2019





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“Glasgow University’s Smart Campus initiative is setting the standard for higher education institutions to embrace digital technologies and create an environment that attracts the students, staff and commercial partners of tomorrow.”

Jamie Robertson, Smart Campus Technical Lead, Mott MacDonald, 2019





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