ARUP

The Future-Ready University

Introduction

Universities have existed in some form for over a millennium. In that time, they have had to continuously evolve in response to external events, from wars to plagues to changing economic systems. This ability to adapt is one of their greatest strengths.

Today, the higher education sector is going through another period of significant change, with social, technological, environmental and economic trends shaping how, what and where students learn. This report aims to elucidate these factors and explore what they mean for the future of universities and tertiary education institutions.

The most immediately pressing factor is, of course, the COVID-19 pandemic, which has had a particularly profound impact. It caused major disruptions to campus activity, and transformed the way students learn, pushing lectures and study online. This once in a generation event has accelerated certain trends that were already emerging, and triggered a wholescale rethink of what we really want from higher education.

This report aims to think about how higher education is changing, and what this will mean for the design, operation and experience of universities in the coming decades, both in terms of the physical layout of campuses and buildings, but also in terms of how education is delivered.

Arup has a strong network of partnerships with tertiary institutions predominately in the UK, Europe, North America, Australia, and Asia. We have conducted interviews with experts at partner universities worldwide to identify key issues affecting higher education, and learn how individual institutions are addressing them.

Future research will look to expand both the breadth and depth of engagement, particularly in geographies such as Africa and South America.

Our research and interviews identified six key factors shaping the future of the higher education sector (right). We first look at how these issues vary by geography, before delving into each in greater detail.

Key trends shaping the higher education sector

Hybrid teaching
the move to enhance learning with digital methods and materials

Net Zero
the increasing need to address the climate crisis

Resilience
developing capacity to withstand shocks and stresses

Commercial pressures
new commercial models to increase business resilience

Campus operations
better management of facilities

The physical campus
how physical campuses and spaces will adapt

Snapshots of regional challenges facing universities

This report examines a variety of trends, experiences, and new issues facing academic institutions around the world to understand their responses to change. Every country has its own unique culture and history of higher education. It is therefore valuable to consider how these issues interact with local contexts. Based on our interviews with experts in local higher education institutes, different regions highlighted different issues.

Key insights from Europe

Many universities are thinking hard about resilience when faced with an uncertain future. Despite the incredible success of COVID-19 vaccines, risks and uncertainty remain. The disease's continued global spread, the rise of new variants and disparate impacts across swathes of the global population give reason to be cautious.

With education being defined by interaction in this region – collaboration and conversation among educators, students and their peers – the pandemic has challenged the fundamental business models and delivery methods across all forms of higher education in Europe. The pandemic forced many universities to reconfigure their operations and adapt, almost overnight, to a fully remote model of learning.

Increased workload, stress and anxiety, coupled with the further blurring of the boundaries between work and home life, have been challenges at all institutions. Students have had a particularly difficult time. They have experienced solitude and isolation, in addition to the strains of relentless screen-based education. All this at a time they should have been immersed in a stimulating, enjoyable and highly social community-based environment, and those in fee-paying countries feel they are not getting value for money.

Our respondents expect a hybrid of blended physical and digital learning to remain central to the student offer. This is shaped not only by the current pandemic, with the risks of a resurgence and the potential for reinfection, but also by the digital transition that was already underway. The shift to remote working quashed the persistent myth that "shirking from home" was both

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undesirable and unworkable. Instead, a new culture of trust and transparency has emerged around digital education. New challenges have emerged, not least the increased risks in terms of cyber security.

Key insights from East Asia

Asian universities were less severely impacted by COVID-19 than their counterparts elsewhere. Governments in these countries, having learned lessons from the SARS outbreak of 2002-2004, were able to enact measures with high compliance quickly and isolate themselves relatively well from COVID-19.

All major universities took measures to control access to campus and implemented early remote learning protocols. Local enrolments remained relatively high, particularly from (mostly) local undergraduate students. The bigger hit came to postgraduate programs due to the constraints around international travel.

As a return to 'normality' came earlier to East Asia than most parts of the world, universities were able to open up sooner, enjoying strong demand for the on-campus experience, in addition to the hybrid lectures experience.

The nature of East Asian cities is an important factor. Apartments are generally small, home to multiple generations and unlikely to contain dedicated office space – making it more desirable to return to campus. The density and co-location that universities depend on will need to be continually assessed and managed. The ongoing operations of lecture theatres, offices and residences will need to remain agile, with processes and protocols put in place to enable executive bodies to respond rapidly to the ongoing dynamics of current and future pandemics.

Key insights from Australia and New Zealand

To date, Australia and New Zealand have been successful in limiting infection and death rates of COVID-19 relative to other OECD counties. This has been achieved through closing borders early and enforcing strict quarantine measures for all entering. The benefit of distance from other parts of the world and being island nations has helped with these actions.

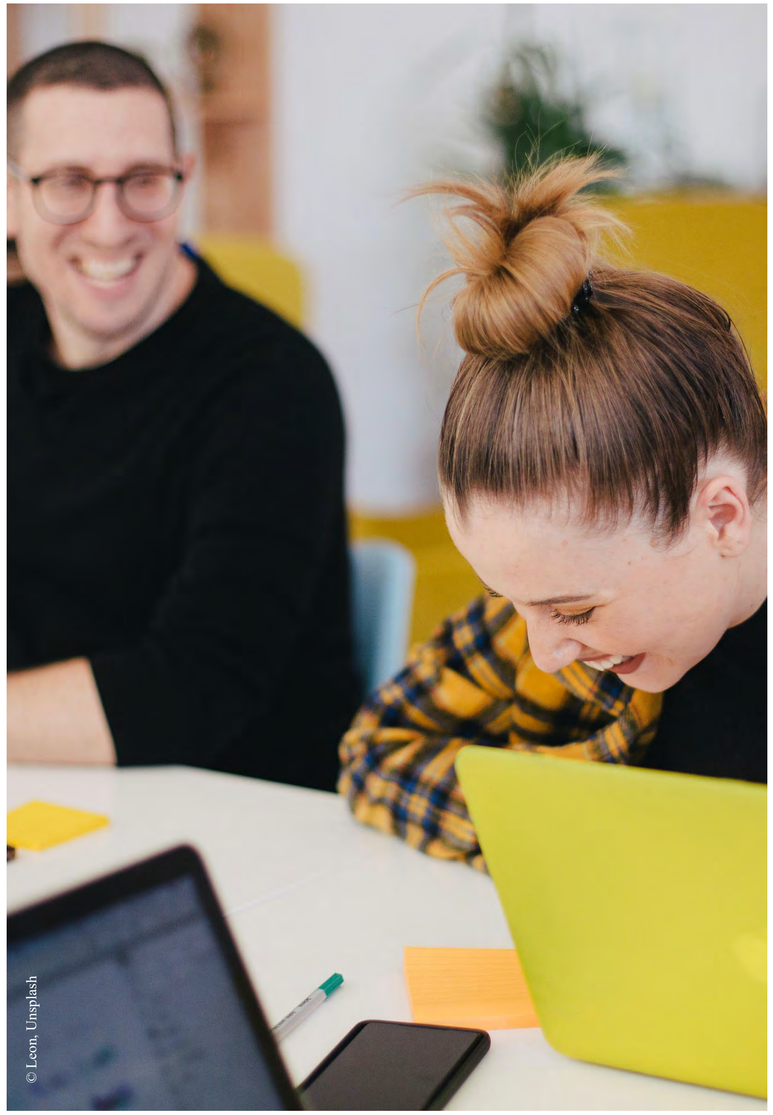
Strict international travel restrictions have had a significant impact on the arrival of international students resulting in disruption to academic programmes and major cash flow challenges for universities in this region. Universities have had to prove their resilience; adjusting to an online learning model while proactively controlling capital spend and reducing operating costs. The situation remains strained while borders remain closed and there is a strong desire to welcome back students from overseas.

Lockdowns have varied from state to state – including length and restrictions. These have been very disruptive for the education sector. While extended and re-occurring lockdowns across the country have advanced the technical quality and delivery of online learning material; the overwhelming feedback from students is a desire to return and have the campus experience. The importance of campus as a "haven" for students to study, spend time and connect may be particularly key in a country where many do not live away from home.

Access to quality data to inform decision making has also accelerated throughout the pandemic. Improvements in data collection driven by the need to report on contact tracing, agile timetabling and coordination of campus movement will provide ongoing benefits for campus operations.

A number of extreme weather events have affected Australia and New Zealand with unprecedented bushfires, floods and storms putting further pressure on the region. For these reasons and a general high awareness of the impact of climate change, tertiary institutions continue to be industry leaders in sustainability, setting targets and driving sustainable outcomes for the benefit of all who work, learn and visit on campus.

Other topics concerning Australian and New Zealand universities include re-evaluating the student mix to be more resilient given possible future border closures, developing aligned government and industry partnerships to help fund research and capital investment, and re-orienting certain research agendas to tackle climate change. There is also a renewed emphasis on the campus as a place of collaboration and social connection - shaped by better integrated First Nations' insights - as well as consideration of long-term hybrid models of student and faculty care.



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"The overwhelming feedback from students is a desire to return and have the campus experience."

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Key Insights from North America

Higher education across North America has been profoundly impacted by the COVID-19 crisis. In the spring of 2020, colleges across the continent found themselves racing to design hybrid curriculums and implement or extend the virtual learning platforms necessary to support them – all while facing increasing uncertainties.

With these programs now in place, university decision makers and designers alike are focused on how this cultural inflection point can be used to make educational institutions more agile and resilient, and better able to deliver high quality education within the context of a rapidly evolving pedagogy.

Faculty members have largely embraced digital learning and virtual platforms overnight. Education is transitioning from a resource that students must go and collect at a specified location to something that can be delivered to them on demand, wherever they are, via the internet.

In the longer term, real structural and institutional innovation is now being discussed in earnest. This includes the idea of lifelong learning 'subscription' models with universities developing 60-year curriculums tailored to suit people's evolving needs over the span of their lives. Pivotal to this ambition is the need to lower the barriers of entry for populations for whom higher education has traditionally been out of reach.

The industry is also experiencing an explosion in highly reputable third-party online learning platforms which are aligned with the continent's – and the world's – leading universities. The goal of these alliances is to share knowledge and intellectual resources across the world, and to engage a global student body wherever they are – all via low-cost or free online course offerings.

It is essential that research-informed decisions are made about which educational activities happen virtually and which occur on campus, and how both these spaces can be leveraged to optimise results. A key hurdle for North American universities will be the preservation of institutional "brand" in a hybrid environment, especially when part of the student population may only receive a virtual experience. This is not an easy challenge, and is the focus of many ongoing conversations among university faculty and campus planners.

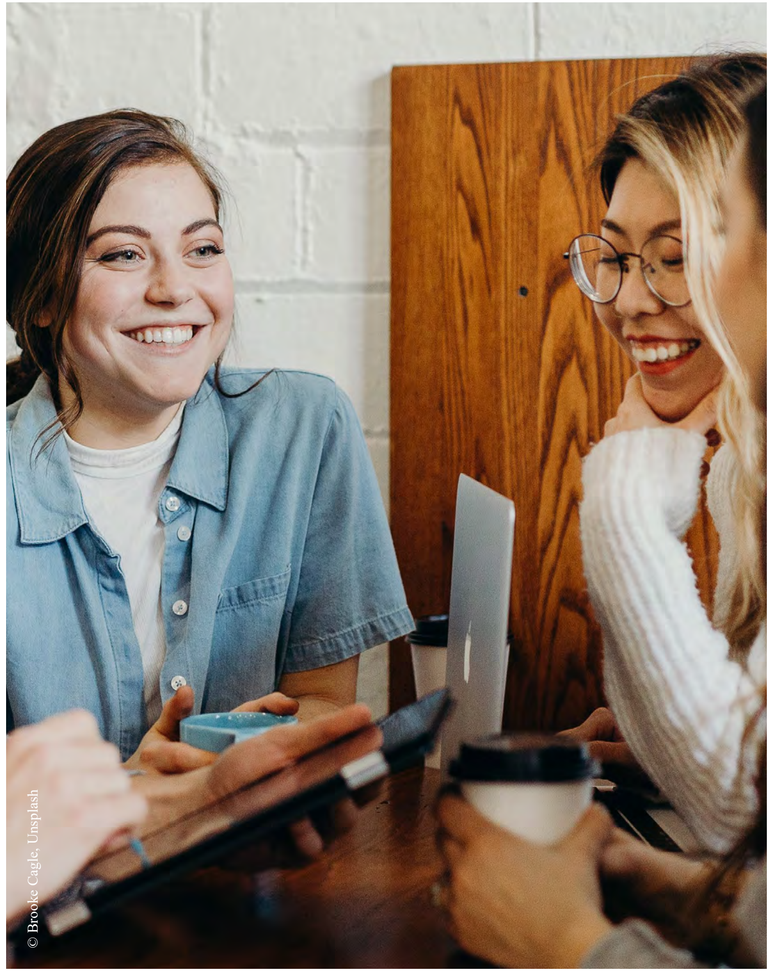
In the following chapters, we delve into the issues affecting higher education in greater detail, and explore what implications they have for the design of buildings, operations and management.

Hybrid teaching: a blended offer

Hybrid teaching refers to a model where universities provide part of their teaching in person on campus, and part online via the internet. This trend was already emerging prior to the pandemic but was massively accelerated as countries went into lockdown.

The way hybrid teaching looks will depend on the course, but also on individual students' and lecturers' preferences. In a chemistry degree, for example, we can expect students to spend several hours each week in the laboratory performing experiments. But it might be common to offer theory lectures over a digital learning platform that students log into from home. Meanwhile, students on a history course might have the option of either going to lectures in person or watching a live stream from home, but are obliged to attend small seminars where ideas are discussed with peers.

Before the pandemic, most universities' online learning environments were fairly limited, existing predominantly as a kind of virtual library and timetable system. The pandemic has provided an opportunity to expand and improve what can be done with these environments. Universities are starting to use professional-grade software and hardware to provide engaging, enriching, useful, productive, accessible and collaborative learning environments. For instance, institutions such as the University of Wollongong in Australia and Harvard Business School in North America invested heavily in high tech teaching spaces. Students were given multiple monitors, tracking devices and touch screens to interact with tutors and other students remotely and have a professional and polished experience. By furnishing students, lecture halls and seminar rooms with smart technology, these universities are better able to deliver a truly hybrid experience that breaks down the barriers between those in the room and those connecting remotely. It also prepares students for the kind of technology they will be using at work once they graduate.



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What hybrid teaching will mean for students

For many students, the on-campus experience has been severely compromised throughout the pandemic, with a sudden shift to remote learning and interaction. What will a hybrid university experience mean for students?

In a hybrid future, face-to-face engagement may be prioritised for the more discursive, collaborative and practical sessions in smaller groups (e.g. seminars) and one-on-one or two-on-one meetings (e.g. tutorials). However, this "concentrate at home, collaborate on campus" approach could well prove too simplistic. Digital technology will only improve online collaboration as it evolves. What is more, many students will prefer studying in university libraries over cramped and noisy student accommodation.

In honing the hybrid offer, the very real impacts of online learning need to be recognised. Online interactions can feel very transactional to students, particularly younger students, according to an ethnographic study carried out by University College London (UCL). Being on campus provides international students developing skills in a second language, a very important opportunity to do so, through networking, interaction and learning. Digital platforms do not facilitate or encourage interaction in the same way that a face-to-face discussion can – although this could improve as technology advances over time. Universities will need to be conscious of these issues when planning courses.

That being said, the digital transition has offered a number of benefits. Lectures that are broadcast online give students more control and flexibility. Students watching live can still ask questions and interact remotely. They can also drop in and out, pause or replay key passages. And it can be popular. Lecture attendance was reported by some universities as being higher during COVID-19. This points to the end user experience and how important these factors are in providing choice, convenience, and accessibility for all.

Mature students, many of whom juggle competing responsibilities, also benefit from the flexibility that remote learning provides. Online lectures offer benefits from a neurodiversity standpoint too. For example, students that dislike physical proximity or who feel uncomfortable in crowded places can attend lectures remotely in a more comfortable environment where they can focus without distraction and anxiety.

Remote teaching modalities can easily facilitate the engagement of a wider, more international pool of lecturers and presenters too, no longer space-bound to a physical campus location. Academics could even 'call in' from the field, to give students an inspiring view of the most cutting-edge research.

Besides the learning experience itself, it is also clear that students around the world want the opportunity to socialise and interact within a vibrant campus-based community. International students also want the social and cultural immersion that comes from living and studying abroad. University is an opportunity to build life-long friendships and have fun too, so institutions must provide space to support this.

What hybrid teaching will mean for staff and faculty

As a result of the pandemic, many faculty members are now trained in the use of digital tools and platforms for teaching. Lessons have been learned from market leaders in e-learning such as the Open University, and from personal experience – staff now know more about how best to manage, or avoid, long hours and prolonged periods of screen-based teaching.

Ongoing hybrid learning will require that academics build on their familiarity with digital platforms and functionality. Faculty members will need periodic training and upskilling as more technologically advanced methods for hybrid teaching come on stream.

Over time, more technology will be introduced into the classroom or lecture hall. New digital solutions will cater for those joining remotely. As these become more embedded and robust, those joining online could enrich and energise the in-person lecture hall experience – through lively Q&A sessions or via tools such as real-time polling to canvas opinion, for example.

One emerging challenge that comes from the accelerated use of hybrid learning could be intellectual property (IP). Some academics fear that their job security could be threatened should their employer accrue an archive of their lectures over time. Considerations are needed should a lecturer decide to move on or retire – what would happen to their recordings and who would own the IP? These and other questions relating to the value of digital content will need to be addressed.

Hybrid teaching: key points

- A mix of digital and in-person teaching will become the norm
- Investment in digital technologies will make hybrid teaching smoother
- Students will expect universities to continue offering ways to interact face to face
- Issues such as IP and equity of access need to be addressed sooner rather than later

Net Zero:
responding to the climate crisis

Many higher education institutions have declared a climate emergency, setting targets to reach ‘net zero’. Some have put in place Climate Emergency executive boards with a remit to look at everything, from capital projects and estate rationalisation, to resource efficiency and procurement. The preparation, planning and execution of effective strategies is no small challenge given the complexity involved.

What does the climate crisis mean for universities as they plan for the future?

Perhaps most pressing is the topic of new construction on campus. Capital works programmes typically feature an abundance of new buildings which will result in significant greenhouse gas emissions being produced in their development. Universities may reconsider their focus on building new developments and could instead look for options to improve their existing buildings through refurbishment, energy efficiency, electrification and procurement of renewable electricity.

They will also need to think about how they are run. As part of day to day on-campus operations, universities procure extensive inventories of goods and services and this procurement carries a carbon cost. Universities also generate substantial volumes of waste for which collection and remediation processes produce additional greenhouse gas emissions.

Consideration also needs to be given to the carbon savings or costs that could accrue from the blended, hybrid model. At first sight, remote learning appears to promise lower emissions, since fewer people are on campus, and therefore using less energy. However, we have seen from the experience of many universities that energy loads and requirements persisted despite having minimal people on-site during lockdowns. This is in some instances due to controlled research environments needing to be maintained.

Capital assets and infrastructure also continued to require powering regardless, to either maintain servers or to keep buildings secure and habitable for a much smaller number of users. Furthermore, students would be increasing energy use off campus and therefore having an increased impact on the planet.

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One example of a university that is prioritising net zero is the National University of Singapore, which is taking great strides to become a sustainable, carbon neutral and 'cool' campus by 2030. The university has set up taskforces to tackle the sustainability challenge across water, energy, waste, and green space. The use of integrated photovoltaics is replacing traditional cladding, while natural ventilation and district cooling systems have been rolled out across the campus, especially targeting 'transient spaces' such as walkways. Green canopies are also being developed to promote microclimates around buildings and public spaces. For instance, the University has committed to plant 10,000 trees per year, with planting events becoming an opportunity for students to socialise.

New approaches to campus construction

Many universities expect rising student numbers in the coming years (see following chapter), and many plan to expand their footprint with new facilities. However, construction is a major cause of carbon emissions and biodiversity loss, so how can universities address these competing pressures?

One method is to reassess how universities approach new construction using the following value hierarchy:

- Build nothing

Before we explore reducing greenhouse gas emissions in design and construction, it is essential that universities first re-examine the need to build anything new at all. Reusing or repurposing existing superstructure and materials saves resources, saves cost, and saves carbon. However, refurbishment often involves a complex reworking of existing structures and services.

- Build less

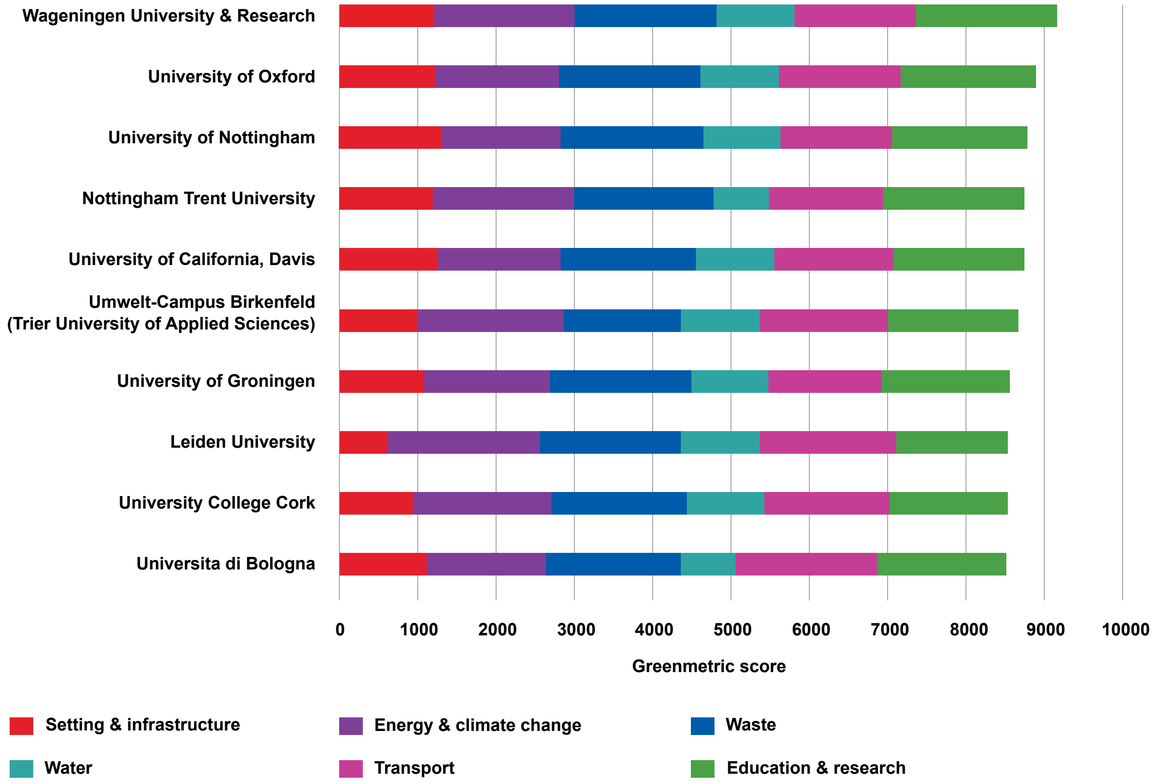
Once a new build is deemed necessary, we must consider how we can build less while still meeting the basic objectives of the planned asset. For instance, designing for multiple flexible uses to maximise utilisation, or reducing mass or materiality to reduce the accumulation of greenhouse gas emissions associated with an asset.

- Build clever

Once a new asset's design has been optimised, embodied carbon can be further reduced through clever design strategies. When designing, we must ask: can low carbon design considerations, materials, technologies, and products be used to minimise resource consumption and greenhouse gas emissions during the lifecycle stages of the asset?

- Build efficiently

The final step in reducing embodied carbon associated with new construction is to improve efficiency using low carbon construction technologies and



Top 10 most sustainable universities globally

According to the UI GreenMetric World University Rankings 2020

Cyprus International University
Nicosia, Cyprus

techniques. Active measures are those which seek to improve the efficiency of mechanical cooling, heating, ventilation and lighting. District heating and/or district cooling can be applied across campuses. The move to passive design where possible – using a building's layout, fabric and form to reduce or remove the need for mechanical cooling, heating, ventilation and lighting demand – offers massive opportunity.

While they come with an inevitable carbon cost, new buildings can and must achieve the best standards of sustainability (including international standards such as BREAM, LEED, Green Star and WELL). Existing assets can be made more efficient, and it is worth considering novel approaches to funding and financing.

For example, University of Oxford is investing in energy efficiency measures across its asset portfolio. The university plans to keep the cost of energy to their departments flat, and use the savings made through efficiency gains to invest in further energy-saving mechanisms.

Meanwhile Arup's masterplan for Cyprus International University provides a fully automated, naturally ventilated building. The building is also self-sufficient from an energy point of view with a large-scale solar farm built in tandem with the development. Other initiatives include a biogas plant to collect waste from local dairy and poultry farms and waste redirected from landfill. The output will be heat, electricity and fertiliser, demonstrating the range of energy options available to a campus operator.

"While they come with an inevitable carbon cost, new buildings can and must achieve the best standards of sustainability "

Business travel

Travel to conferences, seminars and similar events are an important aspect of academia, offering opportunities to network and disseminate new research findings. However, the carbon emissions associated with academic travel are significant and universities will need to find ways to reduce its impact.

To achieve net zero, universities will need to reduce business travel, at least until mobility decarbonisation is achieved at scale globally and airlines transition to low carbon aviation fuels. Some universities are limiting non-essential air travel, asking academic staff who wish to fly to justify the cost in greater detail. Others are prioritising international travel for early stage career staff, for whom it is much more difficult to network with peers and build important relationships without some face-to-face engagement (while their more experienced peers already have reasonably large networks).

Besides the environmental impact, the cost of academic travel can amount to tens of millions of dollars each year for some universities, so reducing it would save money. University College London, for instance, aims to cut academic staff travel by up to 50%.

Net Zero: key points

- Universities must find ways to reduce capital and energy expenditure on assets
- Institutions will aim to minimise new construction, and build ‘green’ when it is inevitable
- Reducing travel to conferences and networking events will cut university carbon footprints

Resilience: looking to the future

As the past year has shown, unexpected and challenging events can prove highly disruptive to universities. Institutions can benefit by developing plans and protocols for various threats and risks which could arise at any time.

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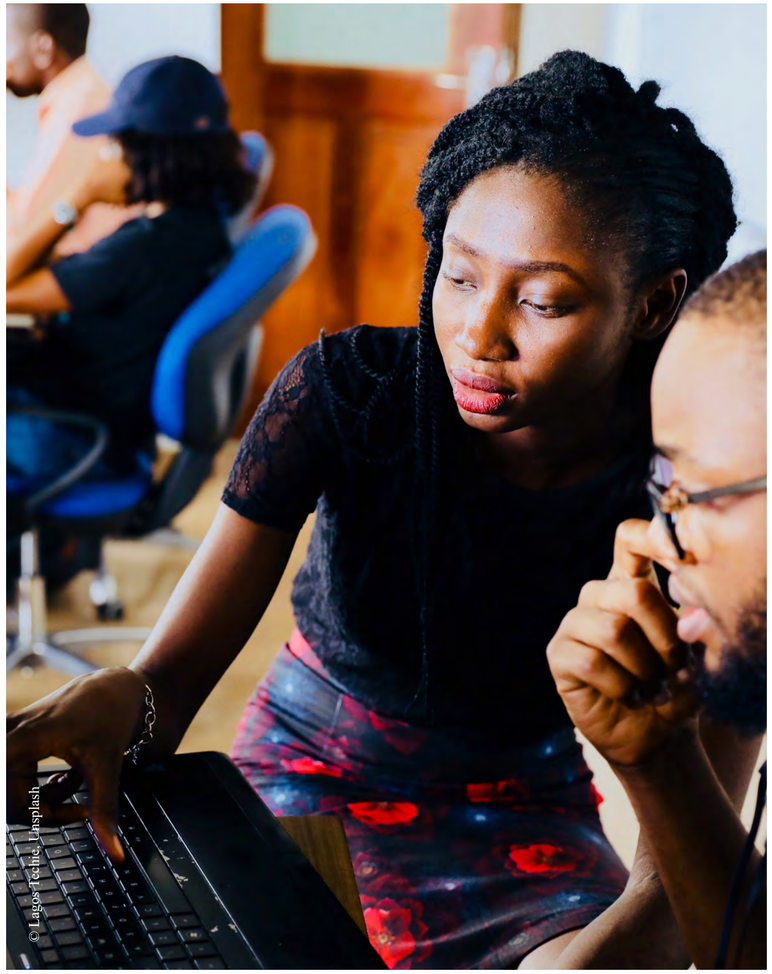
Future threats to universities include extreme weather events, cyber-attacks and civil unrest, will impact operations in geographies and regions globally to differing levels.

How universities bolster resilience in a world that is volatile and unpredictable is a key question that will need to be considered by leaders and decision makers. At the same time, they need to develop resilience plans for slower moving trends, such as climate change or a rising global population.

Preparing for robust demand

Global demand for higher education is predicted to increase from 160 million students in 2015 to over 414 million by 2030, according to UNESCO, driven by growth in middle classes in developing countries across Asia, Latin America and Africa. And in developed countries, demand for education will remain high. For example, regional community colleges across the United States are seeing an uptake in student enrolment as the current financial recession places increasing pressure on wages.

The growing demand for higher education represents a significant opportunity for higher education institutions. We are already seeing academia, employers, and industry “unbundling” degrees into shorter-form micro-credentials. These can stack into a larger curriculum, moving away from “one-and-done” degrees in support of



lifelong learning and upskilling. This trend could give some universities access to a much larger pool of students in the future.

Universities such as Queen's University Belfast are looking at shorter courses and different formats such as 10-week courses, to be more responsive to the demands of the market. This may mean using estates and facilities in new ways.

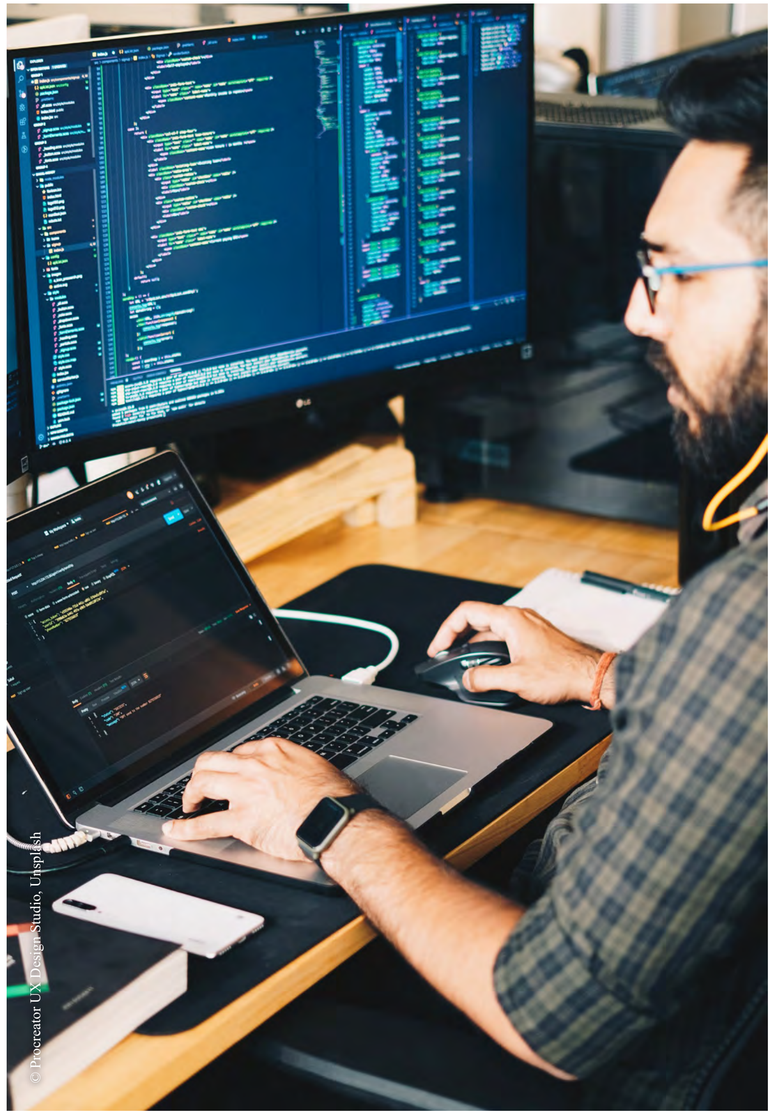
Another critical question to be addressed is how universities and their offers will remain relevant in a fast-changing world. Business and industry leaders have important views about future skills and capabilities which need to be heard and addressed, as market dynamics continue to evolve. Entirely new courses may be required to meet their changing needs. For example, we could see a growth in technological colleges, reversing a trend away from vocational education seen in some countries.

New and emergent models

In recent years we have seen the emergence of a variety of new educational models and partnerships that will affect how universities are run. These models are disrupting traditional notions of what university is, and established providers will need to consider new ways of responding.

Some universities are developing innovative responses here. For example, the University of Arizona's 'micro-campus' network, which has been developed and expanded over the past few years, pairs the university with an institution abroad so that students can take online classes from the University of Arizona and have a local faculty mentor to meet with in person.

There are also a growing number of partnerships between businesses and universities. One example here is a joint venture between Guangdong Machinery Technician College, a top vocational school in China, and German industrial conglomerate



"Business and industry leaders have important views about future skills and capabilities which need to be heard and addressed, as market dynamics continue to evolve."

Siemens that launched in Guangzhou in late 2018. Siemens sends teachers from its technical academy in Berlin to train Chinese teachers, with a focus on smart manufacturing. The company also offers students internships and job opportunities. The two institutions will also work together to establish an innovation and entrepreneurship programme, as well as training for the World Skills Competition, a world championship of vocational skills.

A subscription model

Online education providers have not yet revolutionised higher education, as was routinely forecast at the start of the 2010s. Nevertheless, providers such as Coursera have carved out a niche offering in the market, mostly by providing business-focused classes to older students. Once again, universities will need to respond to this potentially disruptive trend.

This is especially true given the seismic changes seen over the past year. Some of our interviewees predict a transformational near-term shift in pedagogy towards a subscription model of education which offers enrolment akin to membership. Instead of making a large upfront investment for three or four years of education during one's late teenage years, a student could instead pay a relatively modest monthly fee to retain access to in-person and virtual instruction for as long as they like.

The logic that underpins this innovative model is that an individual's educational needs evolve across their lives and careers. Such an approach could be adapted to suit one's specific needs over time. Moreover, this model affords the higher education provider with a steady, continual revenue stream.

Other even more radical propositions see blockchain and other transactional digital services as a way to 'tokenise' a student's education, whereby individuals or institutions "buy into" a student's education and receive a small portion of their income across their lifetime. Rather than having to prove the creditworthiness of a student, their prospects and attainment would define their value as an investment.

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Cyber security

An increasingly important concern from a resilience perspective is digital security in the context of the digital transformation and the hybrid, blended university offer. All universities are grappling with the cyber threat, which took on renewed significance with the reliance on digital platforms and remote learning in 2020. Many higher education institutions have already been the victim of targeted attacks.

Universities hold valuable intellectual property and are vulnerable to malware and ransomware attacks, or even espionage. For example, in the early months of the pandemic, the University of Oxford saw significant cyber-attacks relating to the vaccine it was researching. Insurers are now excluding cyber security risks from some policies and institutions are having to go to additional lengths to ensure their operations are protected.

The rise of the Chief Information Officer, a new role in some universities, points to the need to think strategically, working across multiple departments including IT and Estates or Facilities Management. Success here depends on investments in resilient cyber-security measures needed to provide security and resilience.

Much of this is relates to data protection formalisation and the application of good practice, e.g. two-factor authentication and security awareness. At the other end of the scale, there is the maintenance and resilience of server farms, and the design of spaces to enable effective 5G and Wi-Fi penetration at higher bandwidths.

Resilience: key points

Universities benefit by defining protocols for a variety of potential risks and changes

Adopting new business models will help respond to changing demand and expectations of a university education

Commercial pressures

All educational institutions were negatively impacted by the pandemic and had to compensate for losses and unplanned expenditure by drawing from reserves, especially in countries where university education is privatised. Institutions that entered the pandemic in a weak financial position could face significant economic challenges or insolvency.

While many governments provided short-term support, long-term cuts in government funding reinforces the need for universities to diversify revenue streams beyond student fees.

How are universities responding to these commercial pressures?

International fees

For many universities worldwide, international students contribute disproportionately to university income. The higher fees they pay help to fund capital works and research budgets aimed at improving university rankings. These resulting higher rankings in turn help to attract more international students.

However, while the pandemic persists, international travel will continue to be restricted and will only be able to truly return to ‘normal’ if a global vaccine programme provides a long lasting solution to the pandemic. Other geopolitical forces play a role in shaping future demand over the short-to medium-term. For example, UK universities have found it harder to attract students from the European continent, now that the UK has left the European Union. The disproportionate reliance on any one demographic or international cohort can be risky, especially in light of the ongoing pandemic. Some universities are reviewing their international student intake to ensure that dependence on these students is reasonable and doesn’t leave the university overly vulnerable to disruption in their numbers.

State support

In the aftermath of disasters, wars and pandemics, there is historically more taste for state involvement in various parts of society, including higher education. Some universities and higher education providers may find they are eligible for additional support in the coming years.

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For example, the US Department of Education has announced more than US$36 billion in emergency grants for post-secondary education under the American Rescue Plan Act. These grants will help over 5,000 higher education institutions and provide emergency financial aid to millions of students, with approximately half of the funding to be used by each institution to provide direct relief to students.

The Irish government has also seen the need to step in with a support package, offering a €225 million investment in further education, higher education and research under a National Recovery and Resilience Plan. This includes significant dedicated funding in support of upskilling and reskilling aimed at equipping workers whose jobs are redundant, including a focus on digital skills transition and a new Green Skills Action programme.

Partnership and collaboration

A key trend across the higher education sector is a greater emphasis on building partnerships with the private sector, through research, development and innovation programmes and activities designed to solve real-world problems, drive value creation and deliver commercial returns. In the 1970s and 1980s, as corporations shifted their focus to shorter-term results, many companies closed their in-house R&D labs. Today, with some notable exceptions such as Microsoft, IBM and Procter & Gamble, few companies maintain their own in-house, early-stage, exploratory scientific research programs. Instead universities are the place where innovation happens and partnerships are key to bringing ideas to market.

An example can be seen in the Oxford Science Innovation and Bio-Escalator. It invests in ‘spin-outs’, operationalising nascent ideas in the real world. The Bio-Escalator is associated with Oxford’s medical campus, and is about to build a new 6000m^2

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50%
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building on its science park, to enhance interaction between scientists and the world of industry. An example of a project that floated on the stock market is Knight Star, a company that has developed a cure to a form of genetic eye disease by injecting DNA into the back of the eye to cure blindness.

Meanwhile, the University of Technology Sydney's faculty of Transdisciplinary Innovation has established private sector partnerships to align with their undergraduate degrees. Private industry has been brought on to set capstone projects for the students as well as offer internships as part of their university curriculum. This engagement with industry aims to establish a stronger connection between students completing their study or research, and organisations who can benefit from these students who are entering the workforce.

There is increasing appetite for universities to fund new development through external partnership models. One example is Melbourne Connect, a new innovation precinct for the School of Engineering at University of Melbourne, built and operated in partnership with a consortium led by Lendlease. For many universities, research is a fundamental part of the commercial model that brings in significant revenue. Innovation programs, technology 'spin-outs' or 'spin-ins', or commercialisation of intellectual property (IP) are all important sources of income.

Commercial pressures: key points

University finances have been negatively affected by the pandemic, a drop in international travel and government funding

Applying for all available state support will be essential

Exploring new business models, including start ups and spinouts can provide a new revenue stream

The future of operations

Since the beginning of the pandemic, university operations have been severely disrupted, with start-stop classes and students stuck in their accommodation. How will this affect university operations?

Going forward, operations will have to remain agile, with protocols and processes in place to enable executive bodies to rachet up the response to COVID-19, if necessary, as variants emerge. For many, this will include extensive testing regimes, track and trace, as well as working with local municipalities, cities and government to assist in keeping potential outbreaks to a minimum.

Scenario planning will be needed to ensure that decision-makers are well informed of the potential pathways for the pandemic and other key factors shaping the sector.

How will universities manage their operations going forward?

Reassessing capital projects

Post-pandemic, capital projects that had been on hold will mostly resume. Potential asset disposal will have been earmarked in case there is a need to raise capital, but the mood more broadly is buoyant as institutions recognise their role in building back the economy post-pandemic.

However, in response to the climate crisis, costed projects need to be evaluated and prioritised, taking into account a broad set of operational developments, considerations and needs. These include, but are not limited to, projections for student and staff numbers, timetabling, and the degree to which different courses are blended and therefore what space can be reclaimed and repurposed. See chapter 3.1 for more detail.

A new awareness of wellbeing

During the pandemic, mental and physical health and wellbeing measures were shown to be of utmost importance to campus staff and students. An increase in the provision of wellbeing support will need to continue post-pandemic. Even before the pandemic, many universities had invested significantly in student mental health services.

As the campus and student body evolves, so must the support staff that maintain it.

Future of operations: key points

Universities will need to perform more scenario planning

Increased data collection due to COVID-19 reporting will allow improved performance of campus operations

Increased attention to physical and mental wellbeing will be important for campus and curriculum design

The physical campus

Although a wide range of social and physical distancing interventions will likely remain, the physical campus has an important role to play in bringing people back together. This is clearly demonstrated in the transformation of Macquarie University where the new central courtyard has visibly become the campus heart, a space that is activated, alive with the buzz from students, visitors and all campus users.

More remote working should help to free up space to be repurposed for other uses. Some supporting departments and administrative staff groups (e.g. IT support) could continue with a degree of remote and flexible working.

In the case of practical or vocational degree subjects, students and faculty will continue to need access to research facilities and specialist equipment (for example, laboratories for medical students or model-making studios for architecture students). Cutting-edge digital tools such as 3D printing or immersive virtual reality require expensive setups, meaning that collective use in an accessible, campus-based location makes financial sense. These facilities, along with the social spaces, are key to the university experience.

Continued consolidation of physical space across university campuses is likely. Departments will begin to share common spaces rather than custom-building unique spaces per discipline. Moreover, campus planners and designers can anticipate an increased emphasis on the flexibility and adaptability of space.

Another issue could be ‘vaccination passports’ which would define access to certain spaces. But these are problematic, due to the discrimination inherent in mandating vaccines in return for access, and the associated administrative and operational costs necessary to enforce such restrictions. The disparity in vaccination uptake across demographics presents another challenge.

Macquarie University
Sydney, Australia

Finally, the campus' role in defining a university brand identity must evolve beyond the physical campus to be truly effective. A university's unique brand must be able to be as clearly defined and expressed online as it is on a physical campus. Ideally, the two environments must become seamless and must reinforce each other. With a generation of students who have grown up with the synergy of physical and digital, the same will be expected of the campus environment. And the university benefits by being able to expand its global reach, both virtually and via international satellite campuses.

Hygiene planning on campus

With airborne transmission being the primary vector of COVID-19, the physical design of campuses takes on additional importance. How both people and air move around a structure must be critically considered.

Advanced computer modelling can be used to track the dispersion, dilution and removal of pathogens and infectious agent transmission in building ventilation and space planning. Ventilation design and recommend interventions such as operational improvements to existing mechanical ventilation systems or by adopting space planning and routing in a way that minimises direct transmission.

The designing out of high-frequency touch surfaces is another important trend, given how disruptive flu seasons are, as well as other disease outbreaks common on campuses and student accommodation (such as norovirus). The addition of UV lights for deeper disinfection of high-traffic environment and high-touch surfaces at night, auto-running lifts, material selection for easy cleaning with anti-microbial high-touch surfaces all offer co-benefits for an overall sense of hygiene.

As with pedagogical uses, hygiene during other uses of campus spaces is also being questioned. The future of conferencing is uncertain with the cost and time associated in question.

"With a generation of students who have grown up with the synergy of physical and digital, the same will be expected of the campus environment"


© Adrien Olichon, Unsplash

Student residences

Universities must provide a high-quality residential offering, not just because of the role it plays in establishing campus life, but also because of the heightened role student accommodation has played throughout the pandemic.

Where lockdowns were enforced for long periods, many students found themselves in their residential accommodation for periods far beyond what they were ever designed for. While physically they may have been adequate, the psychological challenges of being confined to small and shared accommodation was always going to be a challenge.

Shared accommodation is unlikely to be in demand on account of a possible pandemic resurgence. Students typically want en-suite units, rather than shared facilities. What will be important is shared social space, with access to spaces for social events or entertainment together with services such as laundry, post collection, advisory services and other uses. All in all, students want choice, so a modular approach may be required. Apprentices or first-year students will always have different needs compared to post-graduate or mature students.

A Higher Education Design Quality Forum (HEDQF) survey on social learning spaces revealed that 80% of students would study in their bedroom outside of teaching hours and this could be projected to increase in the era post-pandemic.

The traditional Student Centre building typology is expected to evolve considerably as the learning model transitions from one where students ‘go to collect’ their education to one where students ‘receive’ their education where they are. As such, the Student Centre will need to adapt to become a space for respite, recreation, and learning.

When considering digital connectivity, many students, especially those living off-campus, may not have the right environment at home to join lectures or seminars remotely at all times. Universities will need to be aware of this and support those that need access to quiet spaces if they are unable or unwilling to travel into the university. Some universities are investing in city centre spaces that provide an off-campus environment with spaces to work quietly.

80%

of students would study in their bedroom outside of teaching hours

The value of public space

Surveys have shown students value external spaces for social contact and learning. The pandemic has heightened our awareness of the benefits of time spent outside, in the fresh air and in contact with nature. The physical campus environment offers a setting for social interaction and the exchange of ideas. Surveys have shown students have a preference for the physical campus setting over virtual alternatives and there are a range of issues that need attention through good design to improve the university experience.

Universities, in their role providing sports facilities and maintaining grounds for example, can also take a lead and set the agenda for how we use our public spaces, particularly post-pandemic. The School of Architecture at The Chinese University of Hong Kong undertook an initiative to study a year without public space with the COVID-19 pandemic. The study highlighted the need to build social and health resilience by establishing open environments for discussion and learning while taking advantage of technology and virtual platforms that many could access for free. The hybrid model of learning will require hybrid considerations of space.

The academic office

Single occupancy, cellular offices, synonymous with the professorial lifestyle, may not endure to the same extent in a post-pandemic future. Lack of resources, inefficient utilisation of valuable space, and inability to modify are some reasons this approach may change.

One alternative to small individual offices is open plan or shared offices, with systems in place to allocate a limited number of hot desks according to supply and demand. Open plan must be accompanied by sufficient space for peer-to-peer collaboration, informal socialising, side meetings and one-to-one discussions.

Lecture halls

The foundational role of the large lecture hall in pedagogy is now under question with some universities suggesting that lecture theatres are very much a thing of the past. Historical and cultural context makes a huge difference in how they are seen, with some institutions viewing them as instrumental to setting the tone and defining the student experience, others see them as archaic, inefficient and underutilised spaces that stifle interaction and collaboration.

“The pandemic has heightened our awareness of the benefits of time spent outside, in the fresh air and in contact with nature.”

© William Murphy

University of Maynooth
Maynooth, Republic of Ireland

Where they persist, as new experimental learning styles are tested and refined, a blended approach will see more seamless technology in lecture halls, allowing remote attendance. The opportunities to dial in eminent professors from around the world are significant, and will greatly enrich the student experience, whether attending in person or virtually.

University transit

Travel is typically a sizeable proportion of a university's carbon footprint. While the pandemic has shown that collaboration and conferencing can continue remotely, essential travel, both locally and internationally, will continue.

With regards to ground transportation, higher education institutions will need to provide greater choice and modal shift, which can be a particular challenge on suburban campuses. Scooters on campus, micro-mobility, demand responsive Uber-style electric bus services, cycle path routes and pedestrian walkways all need consideration together to give users choice. Where cars are required, fleets can be outsourced in order to take advantage of the latest, most efficient electric or hybrid cars. Some universities, like the University of Maynooth, have invested in smaller, narrower electric vehicles that can pass between bollards for use by maintenance and facilities management staff.

For suburban campuses, pricing strategies for car parks will continue to be key, to increase pricing over time, as more alternatives and choice become available. As electric vehicle uptake increases, supporting charging facilities will need to grow, which will have implications for peaks in demand and the wider grid.

The physical campus: key points

- Physical campuses will remain an important feature of higher education
- Universities will see greater use of mixed use spaces
- Buildings around the university may change

Key characteristics of the future campus

flexible, modular spaces and environments

technology for digital collaboration

on-site renewable energy

improved ventilation

drop-in health and wellness centres

sanitation points

physical collaborative creative space

walking and cycle ways

shared community spaces

quiet spaces

sensors and data

contactless interactions

passive design

sustainable transport options

access to green space

Conclusion

As with most other sectors of the economy, many aspects of university life will have changed permanently in the aftermath of the pandemic.

Perhaps most significantly, the emergence of hybrid learning will become deeply entwined with how universities operate. Expanded remote learning and assessment, appear very likely to stay. Universities will increase their provision of online learning environments and offer students more software for video calls, collaboration and group work. They will also invest in more hardware, from digital whiteboards to high quality cameras to new meeting rooms. That said, many kinds of learning will still require dedicated spaces and capacity to flourish. These may need to be redesigned for the purpose of hygiene but also collaboration with those connecting remotely.

Universities' reputations will continue to rest on the quality of the student experience, wider academic performance and increasingly, factors such as sustainability. Institutions that invest in sustainability will attract a generation of students that is especially conscious of the risks of climate change. Now is an opportune moment to reconsider capital investment, mobility strategies and energy procurement.

We can expect a shift in who students are, where they are from, and what they expect from education too. Universities will need to adjust to these shifts and find ways to provide education that truly responds to people's expectations – be that lifelong learning or more vocational training.

All transformational change comes with a degree of resistance, anxiety and friction. University leadership will need to manage the cultural change required to bed in new behaviours around hybrid learning and the technological transition.

Our aim in producing this report is to help summarise the state of the higher education sector and to share insights and strategies being tested in universities around the world. This report looks to start a conversation about how higher education campuses can be resilient to future change and act as a source of knowledge for those seeking to take fullest advantage of coming opportunities.

Appendix

The United Nations' Sustainable Development Goals

The focus on climate action as an urgent priority should not eclipse the imperative to address wider sustainability challenges in parallel. Looking at the three pillars of sustainability together – environmental, societal, and economic - the United Nations' 17 Sustainable Development Goals and their 169 targets are designed to end global poverty, stop environmental destruction and improve human health and well-being by 2030.

SDG 4 aims towards inclusive and equitable quality education and to promote lifelong learning opportunities for all. For the UN, much of this relates to the removal of barriers to primary education in the developing world. Worldwide, partnership working and action through mutually beneficial university-industry-civil society-government collaboration has a pivotal role to play in addressing many of the profound challenges that the world is facing. Academics need to think more entrepreneurially in all their activities to leverage new opportunities. As the pandemic response has shown, institutions can work more closely together than ever before through research and innovation ecosystems that span the whole globe.
There are a number of other key goals that speak directly to the role of universities in society and how they can focus their development in the 21st century to delivery positive and intersectional change:

SDG 10 Reduce inequalities:

Diversity and multicultural experiences offer opportunities for all. A merit-based admissions system makes it hard for universities to attract the best talent from more deprived communities while scholarships are costly. Universities are working with the secondary school system to help raise standards. For example, Queens University Belfast is looking at mission-based activities to address the learning deficit; and Oxford University has education programmes for school children and an initiative in place that twins colleges with primary schools.

SDG 11 Sustainable cities and communities:

There has always been a strong civic link between universities and the communities that host them. Covid has seen these linkages strengthen in many cases. For example, universities working with healthcare providers to run vaccination centres on campus. Many universities have porous borders, allowing the public access to grounds and facilities such as theatres and gallery spaces. Significant space is becoming available in different urban contexts. This off the back of the decline in retail and reconsidered office use post-pandemic. This presents an opportunity for campus universities to gain or further develop a city-centre presence (e.g. library services and quiet spaces for those who don't want to come into campuses that serve a wider community). The University of Queensland (UQ) has a "sticky campus" strategy where local communities are encouraged to engage in campus activities in order to activate the campus and engage students and others. UQ has an emphasis on physical activity on campus to promote health and wellbeing for all.

SDG 9 Industry, innovation and infrastructure:

Precedents exist where universities successfully deliver not just their core business, but also help to develop their surrounding communities. Newcastle University's Margaret's Technology Centre supports skills development in the community. Likewise, the University of Nottingham is supporting a new centre called Digital Nottingham to develop new technology skills to aid the region's recovery post-Covid.

SDG 15 Life on land:

In every built development universities deliver, and the grounds they maintain, there is an opportunity to embrace design that is regenerative in its impact on the natural environment. Preserving diverse forms of life on land requires targeted efforts to protect, restore and promote the conservation and sustainable occupation of ecosystems. Regenerative design and design for biodiversity are key approaches for universities who campuses have significant land holdings.

The Times Higher Education Impact Rankings

The Times Higher Education Impact Rankings measure universities against the SDGs to provide comparison of university performance across four broad areas: research, stewardship, outreach and teaching.
https://www.timeshighereducation.com/rankings/impact/2021/overall

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Universities interviewed

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Queen's University, Belfast, UK
Queensland University of Technology, Australia
Riverside Community College District (California), USA
Swinburne University of Technology, Australia
The Chinese University of Hong Kong, Hong Kong
The Hong Kong University of Science and Technology, Hong Kong
The Hong Kong Polytechnic University, Hong Kong
The Pennsylvania State University, USA
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