NEW CAMPUS MODELS

for a learning society

FUTURE CAMPUS TRENDBOOK

SUMMARY

INTRODUCTION

Campuses are transmuting under the effects of the digital revolution; the push for sustainable development; greater flows of people, goods and information in the wake of globalization; evolving economic and governance models; higher demand for lucrative degrees; and more competitive labour markets – forces that are also changing the means of education and the makeup of students.

No aspect of campus life is unaffected. The geography and everyday experience of education, modes of teaching and learning, the position of learners, and the structure of research are shifting in line with three main trends shaping the campus of tomorrow: connectivity, urban identity and socioeconomic awareness, and social responsibility. Campuses must rise to these challenges and find their footing in a context of stiffer international competition between higher education institutions.

Bouygues Construction sought to combine its thoughts with the knowledge and experience of students, experts and players to draw the outlines of the campus of tomorrow.

- What will the needs and expectations of various campus stakeholders such as students, teachers, researchers and residents be?
- How can the opportunities offered by the digital reinvention of learning content, methods, space and equipment be seized?
- How can campuses be given the means to educate tomorrow's citizens and professional workers?
- What do environmentally and socially responsible campuses look like?

The aim of this trendbook is to present the trends shaping education today and suggest ways of anticipating them. It will set out best practices and inspiring examples, give voice to higher educators and researchers on the ground, and list recent Bouygues Construction benchmark projects to illustrate how these trends are playing out in campuses all over the world. In order to offer a broader perspective, each of the three trends features a campus scenario set in 2030.

Happy reading!

#1.

THE CONNECTED **CAMPUS**

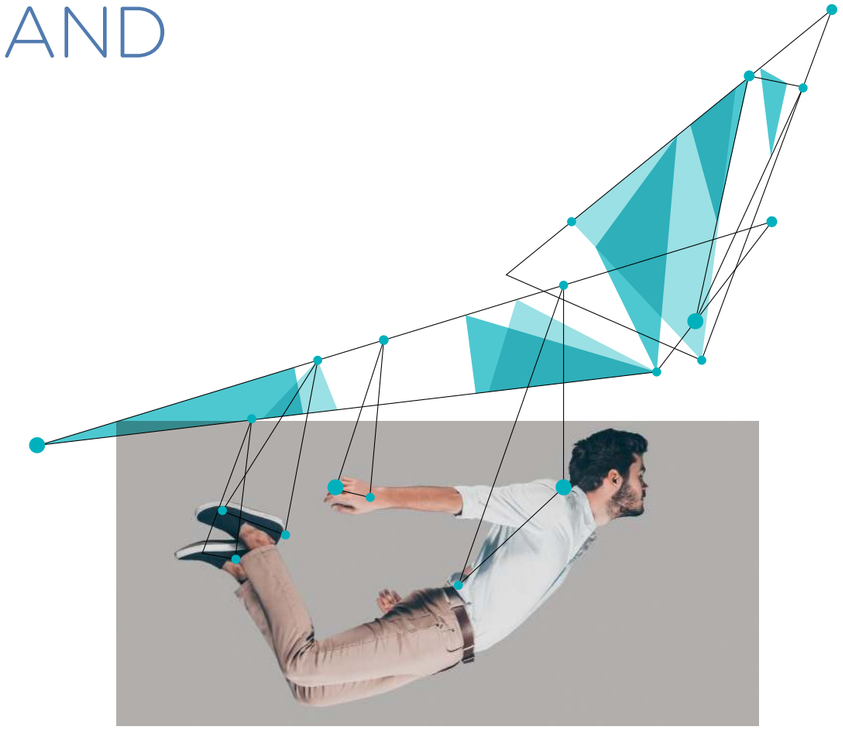
In 2014, three of four telephones bought in France were smartphones[1]. In 2015, 58% of people in France owned a smartphone, up by 12% on the previous year[2]. More and more smartphone apps are being downloaded and geolocation services searched for with 52% of the French population on social networks, 10% more than in 2012[3]. According to one estimate, by 2020 there will be 50 to 60 billion connected objects in the world, or six on average for every person[4]. These astonishing figures show the extent to which the advent of new information, communication and Web 2.0 technologies are altering our behaviour down to our daily activities. No aspect of life is unaffected and education is no exception. Digital technology is changing how and where we learn, how research is conducted and even the cognitive profile of students. The modern campus needs to be connected and able to cater to new ways of learning. ■

[1] Insee première n° 1554, June 2015
[2] CREDOC, Digital barometer, June 2015
[3] See Note 2 above
[4] Gartner, 2017

CHANGE DRIVERS AND **TRENDS**

Volatile information

New information and communications technology (NICT) – which includes the Internet, smartphones, instant messaging and email – is the pillar of our digital age and has turned information into a commodity available anywhere, anytime at a very low cost. The shift to overabundant information has had a profound impact on its relation to knowledge. Today's education systems are no longer faced with the need to transmit knowledge, which is available via other channels, so much as to guide students to find, organize, manage and use it efficiently.



29,000 gigabytes

of data are generated online across the world every second – or 2.5 billion gigabytes a day.

Source

Young people at the heart of the digital upheaval

Students too have changed. Their relation to knowledge and the world is different. In 2001 the education consultant Marc Prensky coined the term "digital natives" to describe children growing up in a digital world saturated with smartphones and networks.

Digital natives—comprising Generation Y (those born between the late 1970s and late 1990s) and Generation Z (those born in the late 1990s and the 2000s)—are thought to be naturals at processing information in real time, adept at multitasking, eager to network and partial to fun modes of work.

Prensky is not alone in thinking that the digital disruption is so far-reaching that it is affecting the brain functions and cognitive structures of the individuals concerned. In its October 2013 edition, Sciences Humaines ran the following cover story: "The digital generation: mutant children?"

Not birds of a digital feather

Sociologists have pushed back against lumping an entire generation into one behavioural category and have suggested that the digital divide also applies within generations so that members of a particular age group may not all be equally at ease in the digital world. Research in France and the United States[5] shows that technological skills may vary according to the socioeconomic and cultural background of individuals in the same age group. This makes instruction in digital tools and practices necessary to avoid usage gaps between students.

Reinventing teaching and learning methods

For the large majority of digital natives, daily life is set by the technological conventions of the new digital world: 24/7 connectivity, immediacy, volatile knowledge, information sharing, social media and more. Education must integrate these major changes by adapting teaching methods, offering new ways of learning and rethinking facilities and equipment accordingly

From pupils to learners

The availability of information and the active stance of individual Internet and NICT users are reconfiguring the traditional relationship between knowing and learning. The picture of the passive pupil sitting before the teacher receiving instruction from on high is out of date. Universities are adopting the flipped classroom model with pupils becoming active learners who are developing their problem solving skills rather than memorising academic theory. Teachers are switching from shaping minds to guiding them. Pupils are even taking an active part in their education as the emergence of digital tools whereby students assess their teachers shows.

> Teachers are switching from shaping minds to guiding them

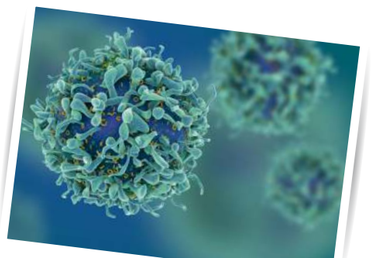
[5] Pierre Mercklé and Sylvie Octobre, 2012, The social stratification of digital practices among adolescents, revue RESET. Eszter Hargittai, 2010, Digital Na(t)ives? Variation in Internet Skills and Uses among Members of the "Net Generation", Sociological Inquiry

Panorama: assessing how teachers teach

A startup founded by two Yale students, Panorama upends the one-way student-grading model by putting teacher assessment tools in place in order to help educators better understand their pupils.

Biology Stack Exchange: scientific exchange between peers

The online Q&A platform was designed for tertiary biology students, researchers and teachers. It allows members of this scientific community to get answers to informed questions from their peers. More than 16,000 questions have already been asked on the forum.



Project-based interdisciplinary learning

Collaborative projects is the name of the game in this active learning teaching model. The project-based approach is an active teaching method based on learning by doing in a practical context. It generally offers the opportunity to nurture and use cross-disciplinary skills and remove barriers from within fields of knowledge and study so as to effectively prepare students for the professional and business worlds which increasingly require interdisciplinary graduates who are creative and open to various currents of thought.

Collaborative innovation

Collaboration has taken on a new dimension with the rise of NICT and the Internet. Digitized content lends itself to being reproduced, shared and added to by others. Wikipedia is an acclaimed example of the principles underlying collaborative work whereby content is continually improved, several people can work on a given task separately and changes can be tracked.

In his 2009 book Enterprise 2.0 published by Harvard Business School Press, Andrew McAfee stresses the importance of linking the employees of a firm together to access their collective intelligence. Ever more campuses are adopting these new workplace processes and setting up spaces, equipment and tools dedicated to these practices to initiate their students into a culture of entrepreneurship.

3
types of enterprise collaboration

- **Participatory innovation:** firms involve salaried employees in their innovation strategies via mechanisms such as collaborative platforms and innovation competitions.
- **Joint development:** firms bring in employees, partners, customers and specialists on developing concepts and products.
- **Open innovation:** firms create value on the basis of sharing and collaborating with external players such as startups and SMEs.

Foldit: a collaborative game for science

Foldit is a game developed by the University of Washington's Center for Game Science and Department of Biochemistry that draws on the collective intelligence of players, most of whom have no background in biology, to investigate the structure of proteins. The 3D structure of a protein in the simian immunodeficiency virus (SIV) was determined through Foldit in under three weeks whereas scientists had been butting heads with the problem for ten years.

StartUpLift: a usability test platform to help startups grow

StartUpLift is an online platform on which startups can lay out their ideas and receive useful advice/comments for which users can be paid. It serves as an online consulting and usability test tool for startups.

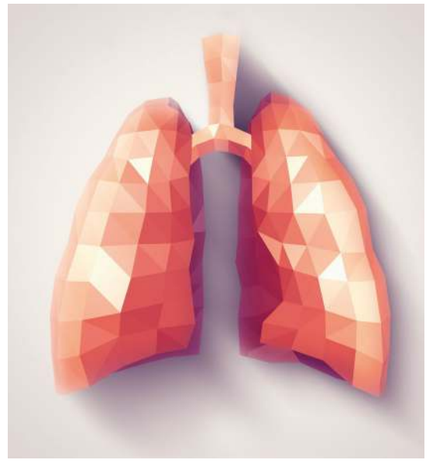
Digitized content lends itself to being reproduced, shared and added to by others

Making learning fun and realistic

Looking to harness young people's taste for fun forms of learning, educators are showing increasing interest in "gameification" which are "games that do not have entertainment, enjoyment, or fun as their primary purpose"[6] and that make effective teaching tools. These games encourage students to think collectively about a complex problem while allowing them to experiment and to work on their soft skills, defined as people and relationship skills such as being
a good listener or communicator. Students can also be assessed throughout the game via their scores.

Another digital tool which is rapidly gaining traction in higher education is digital simulation. One area where it has a particularly relevant application is healthcare training. It can draw on virtual reality (VR) technology to completely immerse users wearing a VR headset in a 3D environment. Different degrees of interaction are possible from simply visualizing content to manipulating it by means of haptic or neural devices.

[6] Definition suggested by game designers Sande Chen and David Michael in Serious Games: Games that Educate, Train and Inform, Thomson Course Technology, 2005



Teaching with Serious Games: a MOOC to understand the teaching potential of serious games

Launched in May 2017 on the FUN platform by the education faculty of the University of Montpellier, the MOOC aims to help teachers integrate serious games into their teaching approach. Over the course of its seven weeks the MOOC addresses questions such as what kind of games to use, how to link them together and how to make them fun.

Virtual Anesthesia Machine: better training for future anaesthetists

Developed by the University of Florida, the VAM simulates the internal mechanisms of an anaesthesia machine and a ventilator by representing the bellows, dials, cylinders, tubes, ventilator settings and anaesthetic gases. It seeks to enhance patient safety by enabling future anaesthetists to better understand anaesthesia equipment as well as the consequences of their actions or of a malfunction in actual anaesthesia machines.

Pulse!: the first 3D medical simulation serious game

Developed in 2007 by Texas A&M University at the request of the US government, the simulation recreates the hospital patient pathway from arrival at the emergency department to surgery in the operating theatre, including the clinical consultation and diagnosis. It allows emergency doctors to practise responding to emergency situations according to the severity of the patient's state of health.

Learning online

Since MOOCs first appeared in N America in the late 2000s and spread rapidly from late 2011, much ink has been spilled on whether they entail a revolution or disillusion and will make or break universities. Opinion may be divided but the figures are clear: by 2015 the total number of MOOCs announced since their emergence had reached 4,200 with over 35 million students signed up for at least one course[7]. They rest on four basic principles encapsulated in the letters making up the acronym.

MOOCs are based on four fundamental principles, each represented by a letter in the acronym.

Massive: MOOCs are aimed at a wide public with no place limits. In 2015 a single session of the "Understanding IELTS: Techniques for English Language Tests" MOOC taught by the British Council and provided by FutureLearn registered a record 440,000 students[8].

Open: anyone can sign up regardless of their age, occupation or level of education.

Online: courses are designed to be followed entirely on the Internet so that teaching resources are available online, exercises and tests are done online, and tools such as forums to allow students to communicate with their peers and the teaching team are made available online. However it is becoming more common for MOOCs to extend into the real world with tests organized in the classroom or informal sessions of participants of a given MOOC held at physical locations.

Course: courses are provided by higher education institutions and sometimes conclude with an examination and the awarding of a certificate. There are two main types of MOOCs:

- xMOOCs resemble top-down academic courses structured around the transmission of knowledge;
- cMOOCs are based on connectivism where learners play a more active role and can shape how the course is structured.

Coursera and edX, the American platforms that dominate the global MOOC market with 46% and 23% respectively of courses announced between early 2013 and November 2015[9], and the French platform France Université Numérique (FUN) by far offer mostly xMOOCs. This has led some observers to criticize MOOCs for reproducing the existing education model.

Another criticism levelled at MOOCs is their low completion rate. According to a study in late 2013 by the University of Pennsylvania, only 5–10% of those who sign up for a MOOC go on to complete it[10]; other studies have since confirmed these figures which might be explained by the time constraints faced by students (most of whom work or study full-time) and the lack of external constraints so that there is no incentive to complete a course if it ends up falling short of one's needs or expectations.

Such misgivings cannot change the fact that MOOCs have had a noticeable impact on learners and learning:

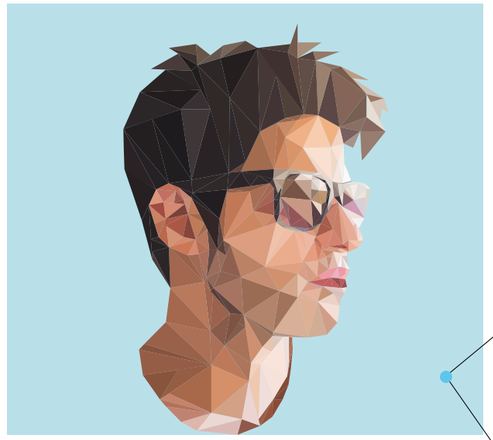
- **Learning paths are becoming more personalized** as MOOCs offer a wide choice of courses running the gamut of academic disciplines, thus making it possible to chart open learning itineraries adapted to the needs of students eager to delve further into a subject first encountered in formal education or of workers wanting to explore a new field or acquire new knowledge or skills;

- **Courses are becoming international in scope as the world's top universities throw open their "online doors";**

- **Content is adapting to and being specifically developed for online access.** A MOOC is not merely a lecture that is recorded and put online. Campuses are investing in film studios and professors are discovering their inner television presenters, as Le Point magazine noted in 2014 ("MOOC, when profs make a scene").

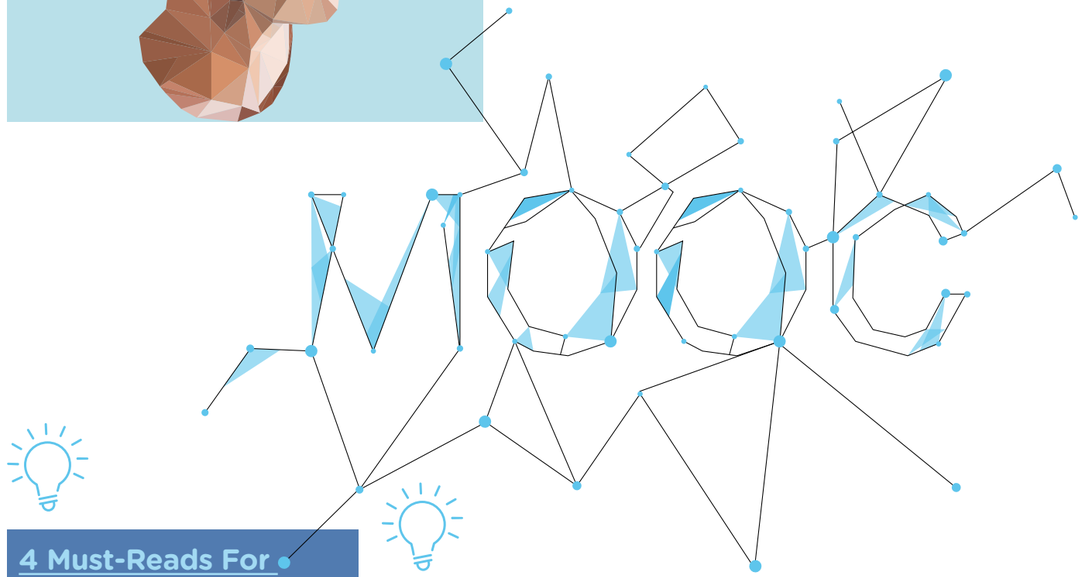
- **Students armed with an Internet-enabled device can attend a MOOC** at any time and any place with an Internet connection (such as a campus hall, home or a coffee shop), thus changing their relation with time and space in terms of learning.

By being open to all, MOOCs are making access to higher education universal—but maybe not for much longer on account of the freemium model on which most are based whereby paid certification is offered alongside free learning. That said, profitability remains a challenge.



Making it personal

"Personal branding" took off with social media and has grown steadily since. Self-promotion, self-presentation, setting oneself apart from others and controlling one's reputation has taken on new meaning in a digital world where our interests and the stands we take are recorded and visible to all on the Internet. Like DIY and coaching it forms part of contemporary values that stress the importance of the individual. Out of this context has emerged the figure of the student as curator and influencer who sorts and selects content according to his or her affinities and convictions and who demands an increasingly personalized education path.



4 Must-Reads For Developing Your Personal Brand: making students aware of the importance of personal branding

A website set up by the University of Michigan to help its students integrate the world of work, offering personal branding advice to help them build their e-reputations with topics such as practical steps to building one's personal brand, why students cannot afford to overlook their personal brands, and how to use one's personal brand to launch one's career.

Scoop.it!: curated content for content intelligence

Scoop.it! is a content curation and distribution platform on which customers can organize their online resources, such as articles, images, videos and links, into specific topics. Internet users can then subscribe to these topics, comment on them, suggest additional content, or become fans and keep up with content updates. The integrated search engine can be used to find other topics relating to a given area of market intelligence and thus enrich content intelligence.

[7] Source: Class Central, By The Numbers: MOOCS in 2015

[8] See Note 6 above

[9] Forces shaping MOOCs worldwide, La révolution MOOC, EducPros blog by Matthieu Cisel, PhD education student

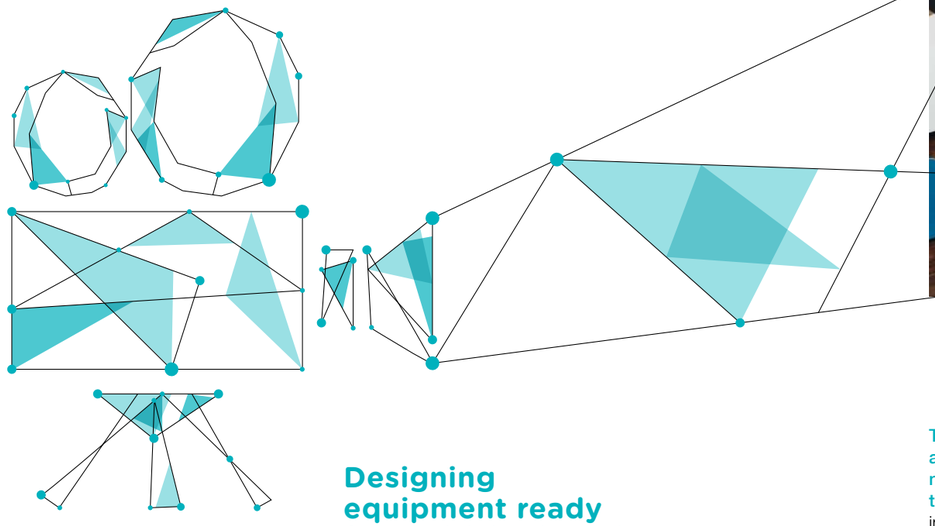
[10] Are MOOCs really the future of university?, Les Echos, September 2014

SUGGESTIONS

SUPPORT THE RISE OF ONLINE AND **DISTANCE LEARNING**

Turning campuses into audiovisual content producers

For online and distance learning to continue their rise, courses must be recorded in and converted into various audiovisual formats with built-in teaching aids, then indexed and transmitted live or made available for replay in universities' Digital Workplaces (platforms giving access to universities' digital services). This entails setting up a digital network infrastructure, including servers, high-speed Internet access and content administration platforms, and making simple audiovisual content creation tools available, such as basic audiovisual studios and autonomous recording and scripting equipment.



Designing equipment ready for multisite learning

Automating education and introducing mechanisms for teachers and remote students to interact can add real value to campuses offering remote and/or multisite learning. Connecting online applications to devices such as microphones and cameras could enable students to take part in lessons (audio and/or video), ask questions and send their own multimedia content in real time while allowing teachers to collect feedback through surveys, student participation and interactive exercises; likewise, synchronizing remote learning systems, university schedules and the availability of campus teaching facilities could result in the automatic configuration of links between campus equipment and learning sites.

Offering work and living spaces suited to digital learning

The digital disruption of modes of teaching and learning is driving campuses to offer new work spaces that are better suited to usages. University libraries are turning into learning centres providing computer resources, assistance with multimedia production, cultural events and career advice. Within or without learning centres, various spaces such as group work spaces, creative spaces, fabrication laboratories (fab labs), informal work spaces and casual spaces can be set up in a flexible and modular manner so as to best adapt to usages. The interior layout of such spaces can be adapted to various needs by means of movable partition systems or furniture on wheels. They can also feature available-on-demand furniture hidden in the floor or ceiling and multiple plug points.

The shift to distance learning also concerns students' living spaces, in particular their accommodation. Student residences are set to become fully-fledged components of campuses and will need very high-speed Internet access and integrated work spaces. In the UK, Uliving's Pittville Student Village for the University of Gloucestershire includes dedicated student study space away in the heart of the accomodation village.

University libraries are turning into learning centres

Best practice

- Third places such as municipal libraries and student aid centres in university residences fitted out as part of Rennes 2 University's UEB C@mpus project to give students access to "study points" near their place of accommodation;
- Everywhere (e.g. cafeteria, gardens, walking area) in Delft University of Technology in the Netherlands is a potential work space thanks to campus-wide connectivity. This is also standard practice in the UK with Eduroam connectivity across all campuses and accommodation allowing students a seamless access to course materials;
- The Living-Learning Center at the University of Oregon offers student accommodation along with facilities for distance learning classes, group work or student events.

PUT A SINGLE SERVICE ADMINISTRATION AND INTEGRATION SYSTEM **IN PLACE FOR EACH SMART CAMPUS**

Centralizing campus management entails putting in place a single administration system linking all campus services together—i.e. connect campuses with public transport systems in real time to facilitate commutes and shorten commuting times, connect premises to manage them and make them accessible to new students, oversee the energy consumption of buildings, manage rainwater supplies according to consumption and weather forecasts, maintain premises and equipment ahead of time, announce current events and available premises in real time, manage lecture times optimally in view of available premises, equipment or professors, oversee waste management, and forecast catering needs. For campus users, a smartphone app could make a very handy "ID tag" to access halls and rooms, use equipment pay for meals.

DESIGN DIGITAL CAMPUSES MADE **FOR RESEARCH**

Enabling collaborative and multisite research

Collaborative and multisite research programmes are growing in number. They have received a boost from calls for projects issued by international organizations and by the prospect of sharing resources, financing, skills and experimentation facilities.

Researchers need facilities to work in private and in calm as well as facilities to work together. Some campuses even design their facilities so as to bring researchers into contact with one another.

Collaborative research also means that researchers travel a lot and thus that campuses need facilities to host them temporarily, such as serviced offices, accommodation and various services.

Best practice

■ With its shared facilities and many formal and informal meeting places, Biomedicum, the research laboratory at the Karolinska Intitutet in Sweden, is designed to encourage interaction among the 1,600 researchers from various fields working in the building.

Designing campuses as digital labs

Whether built from scratch, renovated or converted (e.g. EcoCampus or smart grids), campuses have the opportunity of designing their premises as fully-fledged laboratories. It is a matter of fitting out the buildings and infrastructure with sensors, meters and systems turning the entire campus into a technological platform for research projects.

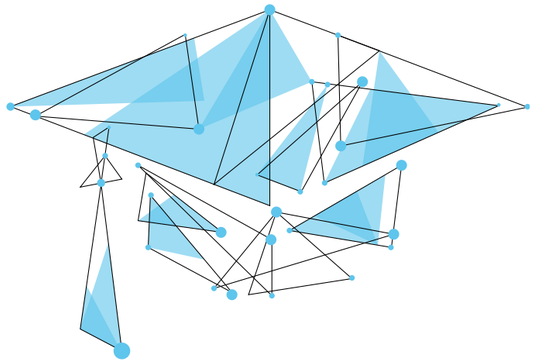
Best practice

■ **La Fabrique à Images** ("The Image Factory") is a set of laboratory buildings designed by the Université de Valenciennes et du Hainaut-Cambrésis to constitute a technological platform. For example, a film theatre fitted with sensors makes it possible to study audiences' perception of and reaction to content shown.

■ **LOUSTIC** is a cross-disciplinary research platform facilitating research projects based on observing and analysing new usages related to digital services; it was set up under UEB C@ ampus, a regional digital campus grouping various institutions and universities in Brittany, France.

LUMINY CAMPUS AT AIX-MARSEILLE UNIVERSITY

Informal spaces, flexible learning and digital equipment to prepare students for the new ways of work



In 2008 the Aix-Marseille campus project was selected as part of Operation Campus, a national education plan aimed at raising the international appeal and profile of French universities. Three of the six main campuses of Aix-Marseille University—which was formed in 2012 out of the merger of Université de Provence, Université de la Méditerranée and Université Paul Cézanne—were specifically involved, including the Luminy campus in the south of Marseilles.

Located near the Parc National des Calanques, Luminy is first and foremost a research university organized around five major fields: integrative biology, the marine environment, mathematical modelling of information processing, nanoscience, and the origin and structure of the universe. It works closely with the major French research bodies (CNRS, INSERM, INRA, IRD, CEA), houses a mathematics research institute (the Centre International de Rencontres Mathématiques, or CIRM) and boasts a higher percentage of PhD students than the national average.

Not only were the premises, built in the 1960s, begining to show their age, but campus life in terms of cultural, sporting and community activities was running out of breath, despite dynamic student associations. The reason was the closing in 2000 of the campus hub, the emblematic Hexagon building, for safety reasons.

Bouygues Bâtiment Sud-Est and Scau, an architecture firm working with Marciano Architecture, won the Campus Luminy 2017 public-private partnership contract to renovate two large teaching and research buildings (while they were in use) and refit the Hexagon building.

The aim was to turn the Hexagon into an environment conducive to interactions among undergraduate, graduate and PhD students, researchers, lecturers and business. Designed as a functional and spacious area, the Hexagon's central patio will abound with informal and modular spaces, small rooms and "breathing spaces". Wi-Fi and laptop-enabled screens will be available throughout the building, making it possible to organize informal meetings and small group work at a moment's notice—optimized work conditions that make for a true Learning Centre. With numerous services and functionalities, such as exhibitions, conferences, communal areas, a university library and facilities for international students, the Hexagon is set to become popular with future users.

Work began in April 2017 and will end in late 2020.

> The Hexagon's central patio will abound with informal and modular spaces, small rooms and "breathing spaces"

HOW DIGITAL TECHNOLOGY IS SHAPING DISTANCE **LEARNING AND MEETING STUDENT EXPECTATIONS**

Yann Bergheaud,
Head of the Digital Education Support Centre, Jean Moulin Lyon 3 University

> “Most students wanted more plug-in points, Wi-Fi hotspots and printer-scanners with Bluetooth connectivity.”

In 2015 the Digital Technology Department at Jean Moulin Lyon 3 University conducted an extensive survey of 4,500 students. The survey was intended to identify how students use digital technology and brought many insights on what they needed and expected from the University.

Virtually all students had a laptop computer with 85% of them using it during lectures. The goal is thus not to provide students with equipment or fit out lecture rooms but to create the best conditions in which to use devices. Most students wanted more plug-in points, Wi-Fi hotspots and printer-scanners with Bluetooth connectivity. These requirements are not limited to university premises but also extend to other places such as where students live: 85% of students said they preferred working from home. Such information matters in the light of the almost 30,000 new students who enter French universities every year. Some faculties are under particular pressure and are already having to turn students away for lack of space. Lotteries are now regularly held for admittance to degrees in law, psychology, sports science and medicine.

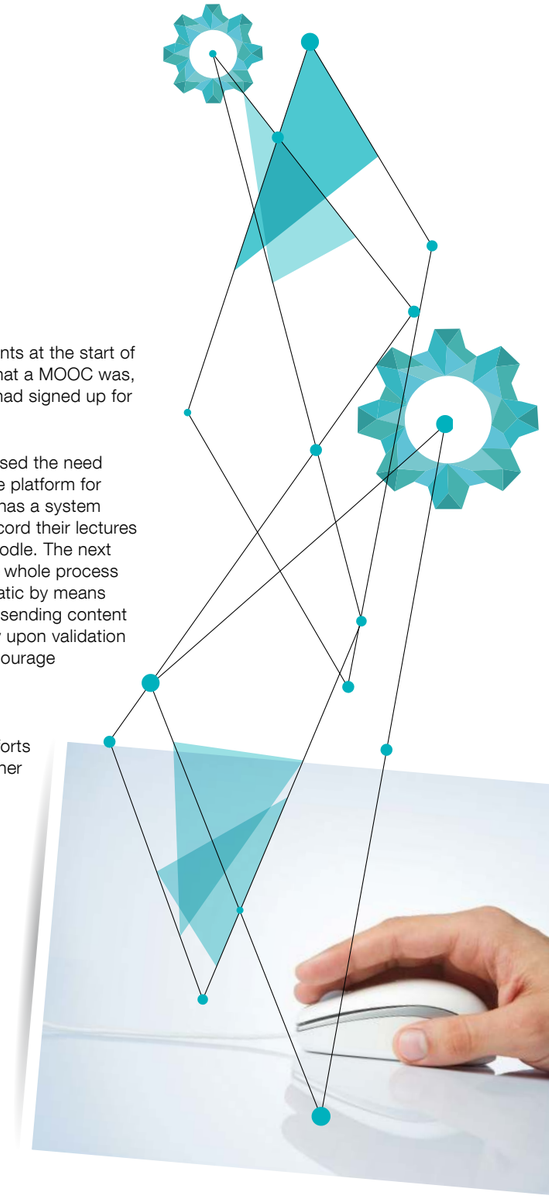
In this context, developing digital resources is essential. Jean Moulin Lyon 3 University tackled the digital challenge early on with its “e-learning days” which it began holding ten years ago to bring together various players to identify weak signals and share ideas on digital strategy pertaining to places of higher education and research. The last such day was held on June 2015 and dealt with connecting the living spaces of the University with those of the surrounding town. E-learning days will resume in 2018 in a new format currently under development.

As with 90% of universities, Jean Moulin Lyon 3 University uses the Modular Object-Oriented Dynamic Learning Environment (Moodle), an online learning platform that organizes communities around educational content and activities through various tools such as e-portfolios, which allow students to organize their career plans (modules known as PPE/PPP and compulsory for degree programmes) and MOOCs, online podcasts and learning resources, and automatically-graded multiple-choice tests. The platform has seen massive adoption and has become as essential a rite of passage as instant messaging services. Some usages however remain at the embryonic stage.

For example, 51% of students at the start of the survey did not know what a MOOC was, and only 11% of students had signed up for a MOOC in 2015.

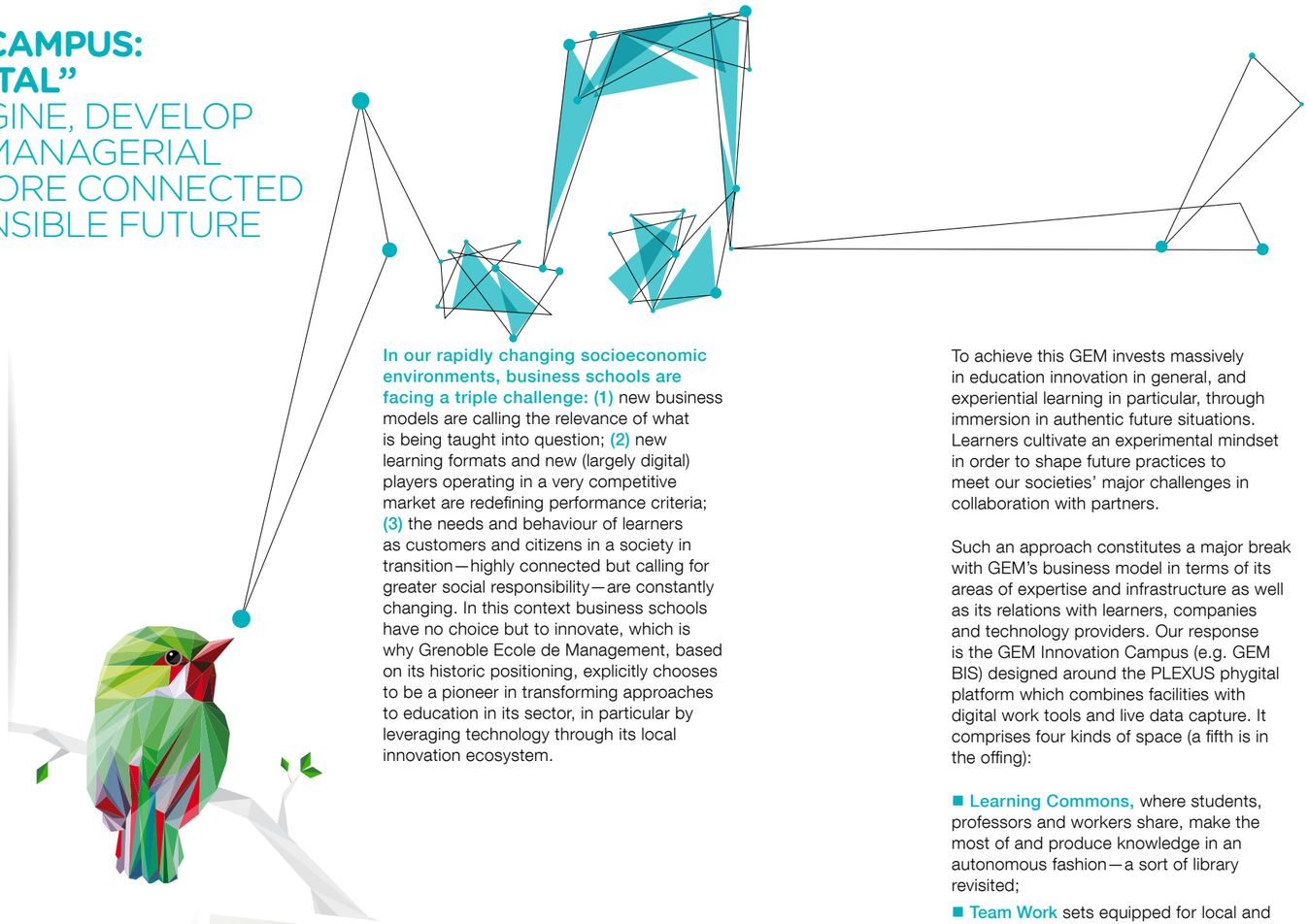
Most students have expressed the need to be able to register on the platform for all courses. The University has a system whereby professors can record their lectures and put them online on Moodle. The next stage will be to simplify the whole process (making registration automatic by means of a student name tag and sending content to the platform immediately upon validation by professors) so as to encourage greater usage.

The University is working hard on these and other efforts to prepare the future of higher education.



GEM INNOVATION CAMPUS: PLEXUS[11], A "PHYGITAL" PLATFORM TO IMAGINE, DEVELOP AND SPREAD THE MANAGERIAL PRACTICES OF A MORE CONNECTED AND MORE RESPONSIBLE FUTURE

Sylvie Blanco, Professor of Technology Management and Innovation, Head of Innovation & Experimentation, founder of GEM Innovation Campus, Grenoble Ecole de Management



In our rapidly changing socioeconomic environments, business schools are facing a triple challenge: (1) new business models are calling the relevance of what is being taught into question; **(2)** new learning formats and new (largely digital) players operating in a very competitive market are redefining performance criteria; **(3)** the needs and behaviour of learners as customers and citizens in a society in transition—highly connected but calling for greater social responsibility—are constantly changing. In this context business schools have no choice but to innovate, which is why Grenoble Ecole de Management, based on its historic positioning, explicitly chooses to be a pioneer in transforming approaches to education in its sector, in particular by leveraging technology through its local innovation ecosystem.

To achieve this GEM invests massively in education innovation in general, and experiential learning in particular, through immersion in authentic future situations. Learners cultivate an experimental mindset in order to shape future practices to meet our societies' major challenges in collaboration with partners.

Such an approach constitutes a major break with GEM's business model in terms of its areas of expertise and infrastructure as well as its relations with learners, companies and technology providers. Our response is the GEM Innovation Campus (e.g. GEM BIS) designed around the PLEXUS phygital platform which combines facilities with digital work tools and live data capture. It comprises four kinds of space (a fifth is in the offing):

- **Learning Commons,** where students, professors and workers share, make the most of and produce knowledge in an autonomous fashion—a sort of library revisited;
- **Team Work** sets equipped for local and remote collaborative work, simulations and serious games with shared interactive screens, small group configuration, mood setting, data, behaviour and information flow capture, and more;
- **The Business Lab,** where real business environments are recreated in which students can test their concepts in virtually real situations and thus prepare natural experiments—an R&D lab within the GEM;
- **The Amphi Scénique,** a theatre where immersive sequences can be played while their impact on the audience is tracked and managed in real time;
- **The Hub for Open Business Innovation** (HOBI 1) where the use of known innovation tools at the service of managerial innovation is taught in coached teams as part of actual collaborative projects.

The effect of integrating digital and connected technology in space and learning environments is clear: more open minds and a more responsible and advanced technological culture; greater motivation and a sense of usefulness and accomplishment on the part of learners as they regain confidence and cultivate self-learning for the rest of their lives; and greater value placed on teachers as recognized professionals who continually update educational content based on contact with partners, hone their engineering and scripting skills and build strong relationships with students. Last, the interest and involvement of partner firms, laboratories and training institutions clears the way for new training methods. All these are key lessons for programming the new building into which GEM Innovation Campus will move in 2019.

> "Learners cultivate an experimental mindset in order to shape future practices to meet our societies' major challenges in collaboration with partners."

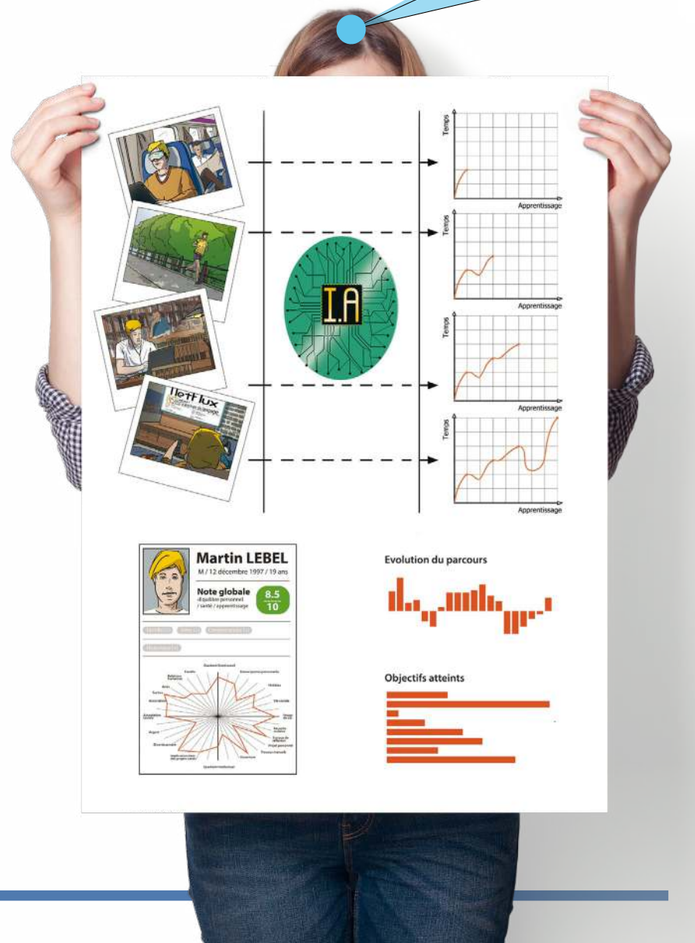
[11] PLEXUS (Projects as Learning EXperience for Unity and Society) is a platform developed with the partners of the Nanoelec Technological Research Institute which brings together 17 founding partners whose training programme is jointly run by GEM and Grenoble INP.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN ORGANIZING **UNIVERSITY LIFE**

It is 2030 and campuses are making ever greater use of technology to simplify their structures and the daily lives of their users. The progress of artificial intelligence has led to far-reaching changes in how people learn as well as how research is organized.

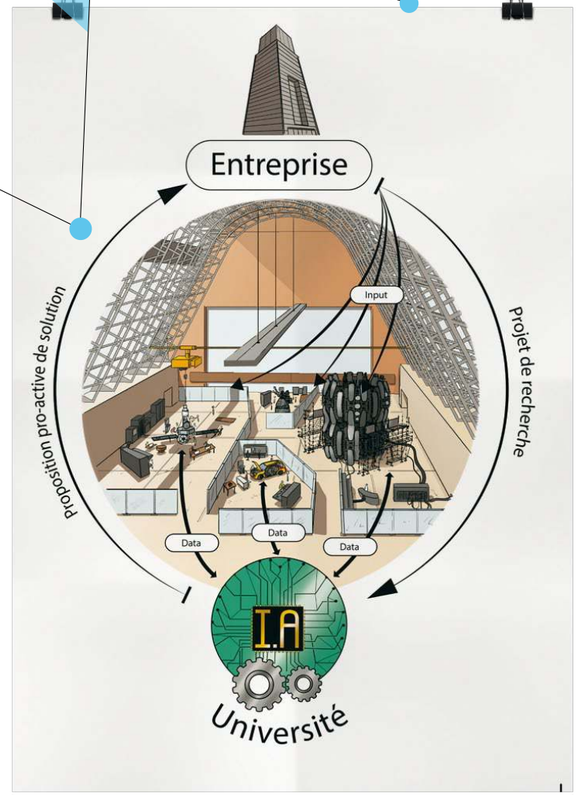
When starting university each student receives a personal learning assistant, a program designed to optimize their learning experience. Their cognitive profile and personality are analysed in depth to measure attributes such as affinity for manual labour, emotional intelligence, social intelligence, analytical skills, capacity for abstract thinking, and areas of interest; everything is examined in detail so as to best configure their education and ideal learning times. Some students reach peak concentration on a morning train commute while others are more receptive after an evening sports session. Every moment in life is a potential learning moment.

Campuses are adapting as a consequence and turning every part of town into extensions of themselves via interactive hotspots connected to personal assistants. Shopping has become an opportunity to calculate the probability of buying a product or to study social interactions. Personal assistants measure students' behaviour and progress in real time and simultaneously reconfigure learning programs by offering ever more personalized content. They offer career guidance and certify acquired knowledge.



University ethics committees watch over the protection of students' personal data which are stored inside campus data centres. Students can access Internet blind spots—unconnected areas where personal assistants do not work—on campus at any time.

Artificial intelligence has also brought applied research and the business community closer together by turning universities into company R&D departments. Now that they can analyse vast amounts of data from various sources, universities are positioning themselves as key players in business intelligence and branching out into picking up previously indiscernible signs of change in specific markets.
Their ability to anticipate strategic change is enabling them to conduct research ahead of the curve and generate concrete applications which they offer to business.
In this way they are reinventing their business models.



#2.

THE URBAN-SOCIOECONOMIC **CAMPUS**

Ten years ago the jobs of mobile app developer, community manager and cloud computing technician did not exist. Likewise Wagepoint, an American firm, predicts that 60% of jobs in 2030 have not been invented yet. What is more, 47%[11] of jobs today are up for automation as a result of advances in robotics and are thus at risk of eventually disappearing. Campuses will thus be tasked with preparing future workers for jobs that do not yet exist. Firms are already having to grapple with these issues as Europe faces a shortage of several tens of thousands of developers and the United States stares at a deficit of 140,000 to 190,000 data science experts between now and 2018[12]. Campuses and business will increasingly have to join forces to tackle these challenges. Campuses will also have to embrace their urban identity to educate not only tomorrow's workers but also tomorrow's citizens and equip them to face the numerous ethical dilemmas to come, such as the spread of automation, the use of data and the flow of climate refugees. ■

[12] 2013, Frey .B., Osborne, M., The future of employment: how susceptible are jobs to computerisation? Oxford Martin School
[13] McKinsey study, 2011

CHANGE DRIVERS AND **TRENDS**

School in the city

Forming links between cities and higher education institutions and helping to integrate these institutions into local economies represents a substantial break with the regional organization model that prevailed in France from the 1960s to the late 1990s which favoured setting up universities on the outskirts of urban areas or even outside them altogether. The failure of these campuses, disconnected from cities and empty at night and over the weekend, has exposed the need to rethink their connection with towns. Forming versatile links with modes of transport to make campuses more accessible, programming services and equipment to turn campuses into proper living spaces, and nurturing a pleasant and welcoming environment are changing student attitudes. Students increasingly take a more active part in campus life as campuses become more than just places to consume knowledge and conduct research. As campuses become new living spaces connected to cities, they are seeking to attract new users by sharing certain public facilities and services with cities in an effort to enhance their profitability and become focal points for residents. Attention is now turning to "flexible programming" to open up campus facilities in part or in whole to other uses, for example on weekends.

The three types of university[14]

■ **The urban university:** the historic model of medieval universities based in a particular part of a town or city. The university shapes its neighbourhood by virtue of its presence and the services it provides, such as libraries and student accommodation. In like manner it enjoys a certain quality of life provided by an urban environment, for instance living and social spaces, access to shops, and cultural activities and facilities.

■ **The university town:** the university is the heart and soul of the town where it is located and is closely associated with its brand. In France some university towns, such as Rennes, Brest and Toulouse, formed a national association called AVUF to exchange ideas and defend their common interests.

■ **The campus:** the American-style university is a vast space set clearly apart from the rest of the city where it is located and entirely dedicated to its own activities, formed to meet the needs of its staff and students and incorporating large natural spaces.

[14] Campus typology by Hélène Dang Vu, lecturer at Université de Nantes and author of a thesis on the role of universities in urban development: *L'action immobilière des universités mondialisées : le plan campus au regard d'expériences américaines, britanniques et belges,* 2011

The campuses, new livings space connected to cities

The cultural mission of the Universidad Nacional Autonoma de Mexico (UNAM)

UNAM, one of Mexico's largest universities, is committed to promoting culture with its 39 institutes and research centres, 143 libraries and 13 museums spread out within and without the main campus. Its Department for Coordinating the Promotion of Culture promotes and spreads culture and manages popular science activities. UNAM's Science Museum, better known as Universum, promotes science and technology for the general public.

Mutual benefit

In 2013, over 4.1 million students worldwide (two out of ten) went overseas to study[15]. Alongside traditional destinations such as the USA and the UK, new regional competitors such as Singapore, China and the United Arab Emirates are staking their claim. A number of universities have overseas campuses (eg. University of Nottingham and their campus in Ningbo, China). Competition between universities is intensifying at the national and international levels as institutions jostle for position in a number of rankings, chief among them the Academic Ranking of World Universities (or Shanghai Ranking). Many criteria other than the quality of teaching and research and the prospects offered by their qualifications determine the appeal of universities, which are adopting a global mindset to attract students. Universities are building strong brands to emphasize their unique identity and stand out from the rest—as are administrative regions.

It is increasingly in the interests of universities and their surrounding regions to implement cross-marketing strategies that mutually enhance their appeal. Universities enliven and raise the visibility of regions by creating economic opportunities. For example, the positive impact of Montpellier Business School on the Montpellier Méditerranée metropolis is estimated at €130 million a year[16]. Campuses are drawing new student populations and educating a skilled workforce, part of which will help to strengthen local economies.

Likewise, universities stress the assets and advantages of their regions to attract talented students.

[15] UNESCO Institute for Statistics

[16] Study conducted in 2015 via the Business School Impact System (BSIS), a tool created by the French Foundation for Management Education (FNEGE) and the European Foundation for Management (EFMD) to measure the economic, labour and social impact of business schools on their regions.

University of Utah: turning local features into global drawcards

"Welcome to Salt Lake City, Utah. Find out what makes Utah so amazing. [...] Utah is home to some of the greatest wonders on the planet." As with many of its peers, the University of Utah's website for international admissions does not hesitate to play up the advantages of its home state. A quality education, good employment prospects, and safety and fun on campus are no longer considered sufficient to attract international students spoiled for choice. Nowadays students are not only promised a great campus experience but also a unique learning environment they can explore and discover in the course of their studies.

It is increasingly in the interests of universities and their surrounding regions to implement cross-marketing strategies that mutually enhance their appeal

Lifelong learning: from students to learners

In 2016 young people in France thought they would have to change jobs four times in the course of their working lives[17]. Laurent Solly, head of Facebook France, reckons the real figure is most likely higher. He believes today's young entrants to the labour market will end up holding a dozen different jobs. As more people change jobs more often, technology, tools and knowledge quickly become obsolete and digital technology upends traditional work, the old model of studying for a few years to land a job on which to build one's career is fast coming to an end. Nowadays maintaining and developing one's skills require continuous education.

The idea of lifelong learning is not new, as evidenced by the continuing education courses offered by universities to the employed or the programmes set up by the French government to assist private and public employees and the self-employed in furthering their skills and/or qualifications (the DIF and CPF).

Yet the line between work and study is becoming blurred. Many students work and study at the same time or break off their studies to resume them at a later point. Some students even start businesses before graduating, earning the moniker of "student entrepreneur". For their part, more and more workers are going back to school. Universities must thus cater to a wide and shifting variety of students, some of whom are well along down their career paths, with different expectations from their courses and lecturers than students in formal education.

In the corporate world Small Private Online Courses (SPOCs) are gaining traction. SPOCs are versions of MOOCs used by firms to teach work-related content and skills to their employees. For example Unow, a French digital platform, offers SPOCs on using social media for work purposes or on how digital technology is changing how firms do business. It appears that learning is increasingly taking place outside the classroom.

A pilot project to develop continuing education at university

In January 2016 the French Higher Education and Research Ministry published a list of 12 universities or academic consortia chosen to work on strengthening continuing education within their curricula. The aim of the experiment was to raise the profile of continuing education at public higher education institutions which at the time accounted for only 3% of such courses. The University of Strasbourg was selected to participate in the project on account of its deliberate efforts to give continuing education a greater place in its offering. After extensive restructuring and transformation, revenue linked to continuing education rose by 25% between 2011 and 2015 to reach €11 million[18].

17 Homebox and L'Etudiant, Youth mobility barometer, OpinionWay survey conducted on a representative sample comprising 1,119 French persons aged 15 to 35 years

18 L'Etudiant, Formation continue : les recettes de l'université de Strasbourg

In good company

In 2014 French public higher education institutions—universities, schools and the CNAM (a respected continuing education school)—had close to 480,000 students enrolled in a continuing education course and awarded 90,000 degrees, or 11% of all formal and continuing education qualifications in the country[19]. Thirty-six percent of continuing education students at university are employed, making firms the top customers of continuing education.

The effect of the training is measured to adapt content and methodology accordingly

Many universities and schools are going further by offering customized programmes to companies on the basis of a tried-and-tested model:

- The context and business of the firm are analysed to identify its needs and critical market factors and translate these into training objectives;
- An education team is formed to put together a training programme;
- Teaching aids are produced and training sessions are set up;
- The effect of the training is measured to adapt content and methodology accordingly

Educating workers throughout their lives, linking with the world of work and helping professional bodies achieve their missions and objectives are social as well as personal projects. Higher education institutions also have to deal with the financial aspect in their search for new sources of revenue.

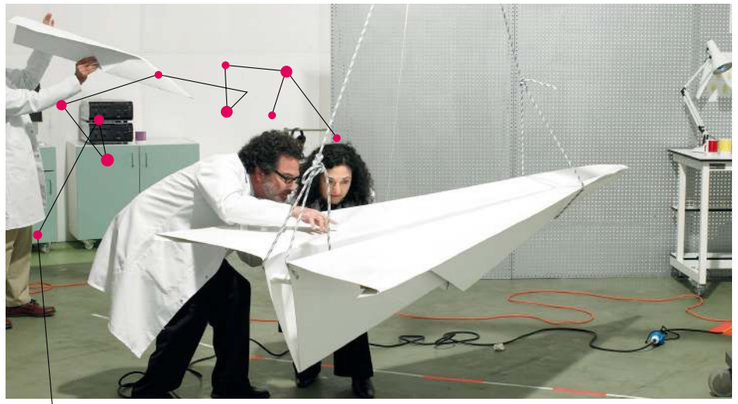
19 Éducation.gouv.fr, En 2015 la formation continue universitaire a délivré près de 100 000 diplômes, note d'information n°22, Octobre 2017

HEC Le Château: where firms go to learn

Situated in a park below the HEC Paris campus, HEC Le Château is a venue tailored to business. The setting, facilities and services were designed with conferences, conventions, board meetings, seminars and short training courses for business executives in mind. Everything from furnished accommodation to fine dining, not to mention a full range of services such as laundry and daily ironing, is available on site along with relaxation areas and facilities, including sports, morning energy sessions and reception lounges.

Putting campuses at the heart of local innovation

The synergy achieved between universities and business in Silicon Valley is a model of the impetus campuses are increasingly giving to local innovation ecosystems.
In France the turning point appeared in the late 1990s with legislation to promote innovation and research by facilitating the transfer of technology between research laboratories and firms. This initiative was given a boost in the first half of the 2010s with the launch of corporate entities (known as SATTs) formed for that purpose and the creation of a national legal status of student-entrepreneur enabling students and young graduates to start a business with as little risk and as much exposure as possible. In response campuses are building premises geared to a culture of entrepreneurship and innovation with fab labs, incubators, business zones and event venues.



IES! in France: promoting the development of higher education business incubators

To meet the growing need of students for help with projects, a number of universities and grandes écoles have launched their own incubators of which 30 are grouped under the banner of an association called IES ! (Incubateurs de l'Enseignement Supérieur). IES ! represents over 60 higher education institutions and has provided support to over 500 startups.

Launcht: crowdfunding and crowdvoting solutions for universities

Launcht is a crowdfunding platform that helps universities launch campaigns to fund their students' startups. For example, it set up UVM Start with the University of Vermont as well as a crowdvoting platform to choose the best ideas put forward by students at Southern Illinois University. These platforms are a way for students to connect with potential investors and users.

Startup Stipend: rewarding student-entrepreneurs

In 2015 Georgetown University launched an original initiative to encourage students to be entrepreneurs. Students wishing to pursue an entrepreneurial opportunity can apply for a stipend up to the amounts they would pay after graduation to repay their student loans. The intent is to free students from the need to find a stable job straight after graduating in order to repay their student loans. Student debt is a burden that can discourage risk-taking and turn students away from starting their own companies.

Working with the business sector

Legislation passed in 2007 made public higher education institutions as responsible for giving students career guidance and helping them prepare for and find work as they are for education and research. This laid the foundation for bridging the historic gap between universities and the business sector in France. The initiative is still in its early stages[20] but has already given rise to various measures such as job placement centres, compulsory career plan (PPE/PPP) modules, input from workers into university curricula, and research contracts. Recent years have also seen a rise in the number of university chairs awarded to people from the corporate sector. Generally valid for a period of three to five years, these chairs stem from collaboration between research and business partners on a common-interest project. As firms look for high-calibre graduates, universities and their students look to work placement, and all parties look at technological development and innovation, the links between universities, schools and companies will assume ever greater strategic importance for everyone involved.

[20] *University autonomy since the LRU law:* an impact assessment, Report, 2013

PEIPS: Université Paris-Saclay's entrepreneurship and innovation network

PEIPS is a network of 16 higher education institutions and 18 socioeconomic stakeholders that have come together to encourage Université Paris-Saclay's 70,000 or so students to be entrepreneurs and innovators. It organizes events to support the entrepreneurial spirit, runs training programmes to let students practically experiment with starting a business, gives access to experts to guide and advise students, provides resources to help start a business and makes available premises dedicated to entrepreneurship (four fab labs, four "connection sites" and seven incubators). PEIPS is situated in one of the largest private economic and research areas in Europe, a thriving ecosystem on which it draws to make a significant economic impact on the Greater Paris region and revitalize its industrial fabric.

University of Waterloo: Canada's largest co-operative education programme

The University of Waterloo runs the biggest co-operative education programme in Canada with 19,000 students alternating four months of study with four months of paid work at one of the university's 6,700 partner firms. As part of their degree students cooperate with firms on innovation projects. They are more involved in the workplace than interns because they are working on "actual" innovative projects. Students and their professors own the intellectual property relating to their innovations.

University of La Rochelle Foundation: linking the business and university sectors

The Foundation was formed in 2009 to create "a new space for dialogue to build a sustainable partnership with the socioeconomic sphere". The network comprises companies such as Alstom, Aquarium de La Rochelle, Banque Populaire Aquitaine Centre-Atlantique, Imprimerie Rochelaise and Suez and serves to strengthen the links between research, education and economic activity in view of contributing to regional and international economic and social development.

SUGGESTIONS

DESIGN CAMPUSES **AS URBAN ENTITIES**

Campuses that are integrated into urban ecosystems become important flag bearers for a region, neighbourhood or urban renovation project. Their successful integration rests on their architectural merits as well as their links with their surrounding regions and the quality and openness of their public facilities. Campus public facilities can be turned into spots for enjoying culture, sharing knowledge and engaging in sports or opened up to all and sundry—thereby enhancing the vitality and identity of the region.

Best practice

The University of Liège (Belgium) is situated on the wooded hill-cum-park of Sart Tilman which also serves as the location of an open air museum and is frequented by locals, visitors and educators of every stripe.

INVOLVE CAMPUSES **IN CITY LIFE**

Opening campus facilities to new users

Opening university premises to the public is an opportunity for all stakeholders. Universities would gain by securing an additional source of revenue or involving new parties in their educational mission; city dwellers would benefit from new facilities, services or events; and cities would get a boost to their brand and standing. Several prerequisites would have to be met including adapting the facilities to the needs of new users, checking that the revamped spaces comply with public-access safety regulations, and putting access and control systems in place.

Best practice

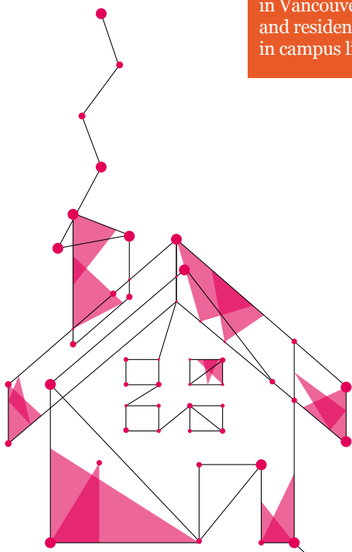
- The summer residential and commuter camps open to all people of all ages and backgrounds offered by Cornell University (USA);
- The semester courses of lectures offered by Université Inter-Âges de Paris-Sorbonne and open to all regardless of age and level of education.

Developing shared services with cities and nurturing a sense of community between campus and town

Providing local services on campus is one way of knitting closer ties with neighbourhoods and developing thriving communities. Multifunctional domestic facilities, eating spots, coffee shops, nursery schools, sports facilities, vegetable gardens, mobility services and coworking spaces are all examples of services likely to be used by both campus and local communities. Sharing local services is also a way for campuses to ensure their financial viability by enlarging their catchment area and to offer new services which might not be feasible within the campus community alone. Such services could even be staffed in part by students. Common digital environments, accessed via a smartphone app, could strengthen the sense of community and ties between campuses and their neighbourhoods. Other than making shared services more accessible to and easier to share among various users, such an app could also facilitate interaction among members, for instance via service exchange systems.

Best practice

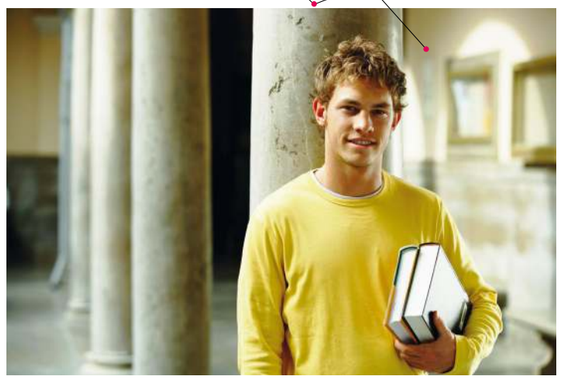
- The Yale Health Center is part of Yale School of Medicine and provides first aid (acute care) to students and residents alike.
- UTown is a campus community within the University of British Columbia in Vancouver made up of users and residents who take an active part in campus life.



Providing new forms of student housing

Intergenerational housing could meet convergent needs expressed by both students and elderly residents. Several options are possible, for instance lowering rents for students in exchange for services provided to their elderly housemates. This kind of housing would have to cater to very different needs and facilitate interaction and the provision of such services while ensuring the autonomy and privacy of each lodger.

Finding new sources of revenue is relevant to resident students and residence managers alike. Renting out student accommodation when not in use to people such as tourists or exchange students is one possible solution. This would require residences to be fitted with connected gadgets such as electronic locks to manage rooms as in a hotel, facilities to host members of the general public, and a range of basic domestic services such as cleaning.



OPEN CAMPUSES UP TO THE **SOCIOECONOMIC SPHERE**

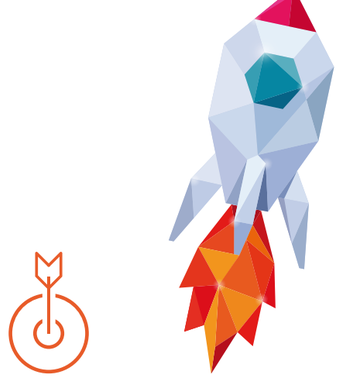
The campus as incubator

Integrating startup incubators and business zones in campuses

The ability to turn students into entrepreneurs and startup founders is a major drawcard for universities. This incubating role is manifesting in new spaces. Incubators, accelerators and business zones support aspiring businesspeople and entrepreneurs by providing collaborative offices and work spaces and shared services (hosting, Internet, and technical and legal assistance).

Making room for the makers

The rise of digital technology combined with design thinking has introduced a generation of makers who put prototypes, tests and simulations at the heart of their processes. Fab labs, which use rapid prototyping technology (such as 3D printers) and digital tools and resources to manufacture goods in small quantities, can support these new modes of production.



Best practice

The University of Cergy-Pontoise's Faclab makes equipment, infrastructure and support available to anyone—students, researchers, lecturers, regular folk, even children—wishing to bring an idea into being and start a project.

Bringing campuses and business closer together

Open for business

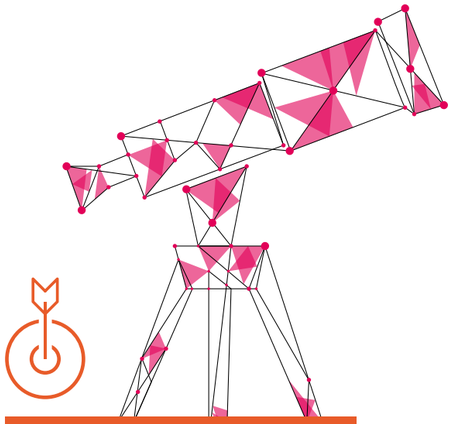
Hybrid facilities on university premises are one means to intensify exchanges between campuses and the socioeconomic sphere. Universities could turn valuable or unused property into facilities to host firms on their premises. This would extract value from existing assets and forge closer links with companies that could lead to cooperation.

Meeting the need for cooperation

Students, lecturers and researchers play an important part in transferring skills to firms. Exchanges between universities and the socioeconomic sphere could be facilitated and supported by integrating co-design spaces and living labs—places encompassing diverse players such as municipalities, companies, research laboratories, associations and citizens where new services, tools and products are tested in a spirit of open innovation. Likewise, technological platforms bringing together researchers, startups and business professionals are powerful drivers of regional innovation.

Location, location, location

Firms' R&D departments are forming ever closer ties with research laboratories through university chairs and (collaborative) research contracts. Setting up serviced offices or work spaces dedicated to corporate R&D partners on campus would strengthen these links.



Offering services to business on campus

Campuses can support the growth in customized continuing education programmes for the business sector by setting up dedicated facilities—such as training halls and rooms, relaxation areas, and food and hotel services—that are better able to meet the expectations of corporate customers and compete with traditional places of learning.

Universities can also host companies on campus by holding seminars or corporate events that require high-end facilities and are equipped with the latest technology. Last, campuses can open themselves up to local firms by making public Internet access centres and co-working spaces available to their employees. Together these services offer potential sources of revenue for universities.

Best practice

ADICODE is a network of innovation and co-design workshops set up by Yncréa Hauts-de-France, the fusion of three engineering schools (ISEN, ISA and HEI), that brings together various universities located in the Hauts-de-France region to gather Masters students, lecturers from various fields and partner firm R&D clusters under one roof to imagine the next disruptive innovation. Specific areas the workshops deal with include home automation for people with disabilities and dependent persons, EcoMobility, waste treatment and noise pollution reduction.

Best practice

The University of Montpellier rents out all of its facilities, including its amphitheatres, main courtyard, seminar rooms, halls and multimedia rooms.

INNOCITY, CENTRALESUPÉLEC: THE VIP TREATMENT

In 2009 the École Centrale Paris, *a grande école,* moved to the Plateau de Saclay (the European equivalent of Silicon Valley) and merged with Supélec, another *grande école,* to form CentraleSupélec and become a global leader in producing top researchers in the fields of science and technology.

It planned to renovate an existing building and erect two new structures; the design, construction and maintenance of one of these, comprising a total surface area of around 25,000 sq. m, was awarded to a consortium led by Bouygues Bâtiment Ile-de-France. The project was marked by the bold decision to set up business-oriented hotel facilities at the heart of the campus and have them run by a private investor.

The message to the business sector was clear: firms were welcome at CentraleSupélec where they could expect the VIP treatment. Innocity was the first residential Business Centre in the Plateau de Saclay. The unconventional hotel complex boasts 100 rooms, work spaces in the entrance hall and relaxation areas for members of the Paris Saclay scientific cluster comprising executives enrolled in continuing education programmes, business seminars, foreign university lecturers and academics attending scientific seminars.

Innocity is not separate from the rest of the campus. On the contrary, the project was intended to complement the sum of existing facilities, such as spacious meeting rooms, the amphitheatre, the campus main hall (which doubles up as a living space and meeting place), the VIP restaurant and sports facilities. The layout benefits everyone with comfortable working conditions and all the facilities residents of Innocity need, access for students and incubated entrepreneurs to firms, and a means for CentraleSupélec to enhance the appeal of its continuing education programmes with affordable accommodation.

The resulting opportunities for people of different backgrounds to meet are also a way to give life to the Open Innovation measures taken by big corporate groups that promote exchanges between students, researchers, incubated entrepreneurs and company executives.

Innocity was delivered in June 2017 and began its first academic year in September 2017. In the near future CentraleSupélec will be able to make good on its ambitions by making its campus attractive to firms and raising its profile in international academic circles.

> Innocity is not separate from the rest of the campus

PROJECT WEEK IONIS GROUP—BOUYGUES CONSTRUCTION 2016: **A TRANSDISCIPLINARY CHALLENGE**

Valérie Dmitrovic,
National Head of Teaching & Development, ISEG Marketing & Communication School

> “Close to 1,000 students studying public relations, marketing, design and programming among other subjects work in transdisciplinary project teams during a Project Week.”

In today’s knowledge economy, growth comes from the ability to innovate and disrupt. Firms are well aware of this: many of them have duly set up innovation departments, put collaborative thinking at the heart of their business processes and embraced Open Innovation by looking outside their confines for the skills, ideas and risk-taking that they cannot always cultivate in-house.

As one of the tasks of higher education is to bring up students able to meet the needs of business and the economy, institutions in the field are faced with the need to renew their teaching and learning methods and determine what educational approaches to adopt in order to develop the capacity of young people to be creative, innovative and proactive.

Creativity can only emerge when in-depth expertise in one domain is combined with the ability to gain a general understanding of other fields and other ways of working.

The IONIS Group seeks to achieve this winning combination by nurturing an approach to education dear to its heart, namely, transdisciplinarity. Forging links between academia and business and combining skills, knowledge and methods with a view to realizing a common project is the challenge the IONIS Group throws its students every year at its ISEG Marketing & Communication School, e-artsup and Epitech campuses.

Close to 1,000 students studying public relations, marketing, design and programming among other subjects work in transdisciplinary project teams during a Project Week. They have five days to come up with innovative solutions to a need put forward by a company.

Project Week 2016 was held in partnership with Bouygues Construction on ISEG’s Paris, Bordeaux, Lille, Lyons, Nantes, Strasbourg and Toulouse campuses. How can one live in a sustainable neighbourhood and enrich the life of the community using viable solutions? This is a question that occupies Bouygues Construction and which the firm put to those taking part in Project Week in three facets:

- imagine measures that would enable everyone to participate in creating their sustainable neighbourhood;
- find a means of encouraging as many as possible to actively move about within the neighbourhood;
- imagine solutions that would enable users to adopt and maintain environmentally friendly behaviour, with the goal of achieving zero waste.

The students rose to the challenge of working out an innovative concept and drawing up a proposal on one of these three topics incorporating marketing, public relations, technological development, graphical representation and digital design.

The event was a resounding success that showed the fruits of cooperation between campus and business.

FROM RESEARCH EXCELLENCE TO BUSINESS LEADERSHIP: **A WIN-WIN PARTNERSHIP BETWEEN HIGHER EDUCATION AND BUSINESS**

Zoubeir Lafhaj,
lecturer in civil engineering, Ecole Centrale de Lille

> “Research and innovation go hand in hand: to succeed, universities need firms and firms need universities.”

For the past 15 years the Civil Engineering Laboratory at the Ecole Centrale de Lille and Bouygues Construction have sought to get business and universities to combine forces on joint interest research projects and remove the barriers between two spheres that have long struggled to communicate. Everyone stands to gain: companies benefit from the laboratory’s ability to analyse markets and make suggestions in anticipation of their needs, and the laboratory has the opportunity to work on real-life cases and advance reasoned scientific solutions to deal with tomorrow’s challenges. It is a way for both parties to raise their skills in order to maintain business leadership and develop research excellence in targeted areas.

Such a relationship is long-term in nature and depends on the trust that is gradually built between both parties. The Ecole Centrale de Lille and Bouygues Construction have learned to establish this trust over close to 15 years. **Collaboration between the two has grown over time with course modules taught by Bouygues employees, vocational workshops (training and coaching) held, and work placement and doctoral programmes run at the firm, and reached a new level in 2017 with the creation of a Construction 4.0 university chair.**

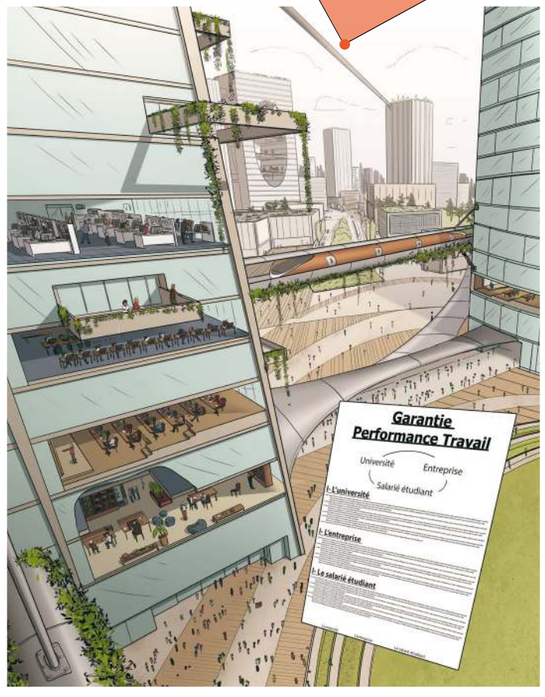
In this framework Bouygues Construction strengthened its commitment by allocating a dedicated resource to managing the partnership. Three doctoral theses were completed under the supervision of the heads of Bouygues Construction’s R&D departments on the subjects of safety, quality and productivity gains related to new forms of manufacturing (3D printing, automated manufacturing and data capture on work sites to assist decision-making) with the aim of expanding the firm’s competences in these areas.

Several Bouygues Construction employees devote a portion of their time to keeping up and working with PhD students in order to ensure that applied research is in sync with the company’s needs and market environment. The terms of governance and collaboration between the two partners are defined within the framework of research agreements and consortia and under the supervision of a Quality Committee and a Research Committee made up of top international scientists from countries including Germany, Japan, the United States, Sweden and Canada.

This longstanding partnership chimes with initiatives by business and universities within and across European national boundaries to come together. It meets two of the priorities set by Horizon 2020, the European Union’s Research and Innovation programme, namely, excellent science and industrial leadership. The partnership aims to be “the world leader in innovation to make tomorrow’s buildings excellent, safe and efficient”.

THE CAMPUS-BUSINESS-REGION NETWORK FOR **A LEARNING SOCIETY**

It is 2030 and the links between universities and business have strengthened to the point of forming hybrid conglomerates. The buildings housing them are architectural wonders that reflect their academic and economic power. Universities and companies are deeply interlinked thanks to the hybrid layout of campus spaces. Researchers, lecturers, students and employees constantly meet and interact in shared premises such as meeting places, flow spaces, creative spaces, relaxation areas, eating areas and third places.



This constant contact facilitates the application of the Work Performance Guarantee, a three-way undertaking between universities, companies and employee-learners. Firms are guaranteed the permanent employability of their staff by virtue of their status as lifelong learners who are in turn guaranteed employment suited to their interests and abilities.

From upgrading skills to solving a concrete problem faced by a company, campuses that form part of the conglomerate can at any time develop a fully customized training programme targeting the needs of a given firm and adapted to the strengths and weaknesses of its employees. Hotlines enable firms to get hold of campuses at every moment for advice.

Campuses derive much sustenance from company activities and put firms in touch with a wide variety of economic agents such as scientists, lecturers, researchers, philosophers, artists, athletes and citizens in the context of research residences. As with the entire body of knowledge and research coming out of campuses, the results of this open and collaborative thinking lend themselves to widespread sharing. Campuses leverage their regional networks to connect with residents in towns and rural areas and fulfil their responsibility to foster social cohesion and spread knowledge. They coordinate museums, workshops, experiential travel and microevents to promote the personal development of individuals.

#3.

THE RESPONSIBLE CAMPUS

In 2012 AFEV, a student nonprofit formed to reduce inequality in urban education, and UNICEF France launched the ORSU, a watchdog to promote the social responsibility of universities and keep record of the best practices found in all areas of university life. The social responsibility of universities is based on the notion of a social contract between society and higher education institutions.
The concept posits universities as role models devoted to protecting the environment; as conscientious managers of their physical and cultural heritage over the long term; as institutions governed on the basis of ethics, equality and diversity and the health and wellbeing of the campus community; and as stakeholders involved in local community development, dedicated to nurturing respect for the environment, and committed to engage the academic community in civic action. ■

CHANGE DRIVERS **AND TRENDS**

Getting to grips with the energy transition

In 2008 the French government launched Operation Campus with the aim of breathing new life into French universities and bolstering their appeal and profile. It was also intended as a response to the dire state of certain premises with almost one-third of university grounds in a state of disrepair and some not having been renovated for 30 years.

In 2010 an review of the energy efficiency and carbon footprint of French universities as a whole conducted by Groupe Caisse des Dépôts (a state investment agency) and the CPU (an association of the heads of French higher education institutions) showed that French universities were doing badly on the environmental front with over 50% getting energy performance ratings for tertiary buildings of D or E.

Some buildings dating from the 1960–70s had aged and required extensive renovations while others dating from the 1990s and 2000s consumed large amounts of energy; failure across the board to maintain and renovate buildings had also led to their deterioration. Outlying universities attracted particular criticism for the carbon emissions resulting from long commutes to and from campus.

Reducing energy consumption to promote economic sustainability

Other than out of concern for the environment and as a means of complying with French and European official measures and legislation relating to the environment and energy efficiency, efforts to improve the energy performance of university buildings is a key driver of institutional economic sustainability over the long term. Reducing the cost of energy consumption and maintaining university grounds in good condition has become a top priority for universities since legislation passed in 2007 relating to their liberties and responsibilities. The law seeks to give universities financial and budgetary autonomy and to reform their governance so as to improve their performance.

Assessing the transfer of property ownership to universities

After being given control over their wage bills and overall budgets in 2007, universities in France were given the opportunity of greater financial autonomy with the option to take ownership of their grounds. A report[21] by the national auditor and the national education regulator released in late 2016 pointed to the fairly positive results of initial trials at the University of Poitiers, Toulouse 1 Capitole University and Université d'Auvergne (now Université Clermont Auvergne). The report noted that the transfer of property ownership to the universities had sped up measures to renovate their grounds and make them safer and more accessible. It also pointed to improvements in the management of university premises and the introduction of new management tools. However it found no evidence of a clear effect on the level of spending on fluids and energy or of any significant improvements in the usage rate of premises.

In 2011 Université d'Auvergne (now Université Clermont Auvergne) became the first French university to own its grounds.

[21] La dévolution du patrimoine immobilier aux universités, rapport 2016, Inspection générale des finances, Inspection générale de l'administration de l'éducation nationale et de la recherche

The energy transition in Rennes

Université de Rennes 1 and Rennes 2 University have joined forces to grab their institutions' energy transition by the horns and move towards the EcoCampus. Their ambitious goal is to reduce the energy consumption of their campuses by a quarter. After analysing the energy consumption and efficiency of the sum total of their buildings, the universities drew up a master water/energy plan and a plan of action setting out a wide range of solutions, including renovating buildings, promoting environmentally responsible behaviour within the campus community, conducting energy transition and energy performance experiments in real-life conditions on campus, studying the practices of students, faculty and staff to bring about cost-effective changes, and optimizing the use of buildings. These solutions involve the entire academic community and are expected to be applied across the board with the aim of saving enough on energy expenses to pay for the total renovation of both campuses.

Experimenting with smart grids on campus

Smart grids are electricity networks that use digital technology and sensors to manage the transmission and distribution of electricity. They offer greater transparency for consumers and are a means to make electrical grids more stable and to reduce energy consumption.

Incorporating renewable energy sources and energy storage facilities into smart grids offers the opportunity to improve energy efficiency; for instance, peak demand can be managed by offsetting the volatility of electric power generated from renewable sources with stored energy, or electricity can be bought and sold at any moment according to supply and demand dynamics on the same site.

Around one hundred smart grid demo sites exist in France, one of which is on the Lille 1 University campus in Villeneuve-d'Ascq. The Sunrise project covers the entire campus with 140 buildings, an urban network of 70km and 25,000 people.

The experiment was initially targeted at the electrical grid but the water supply system, sewerage system and heating network were added to it to observe the effects on all fluid distribution systems on the campus. The sensors and smart meters installed throughout the networks make it possible to measure consumption, analyse water quality, detect grid overload and issue alerts in case of a breakdown.
The experiment is expected to lower electricity, water and heating bills by 10–15%. Campuses were given an incentive to establish more experiments of this kind by the invitation to tender issued by the French government in 2015 under its smart grid plan to turn universities into innovation platforms via smart grids installed on their campuses. The four bid winners—Smart Campus Sophia-Antipolis, Livegrid Paris-Saclay, PowerGrid Campus Lille and Smart Grid Campus Rhône-Alpes—are developing their platforms to eventually become national benchmarks that will inspire a spate of collaborative R&D programmes between universities and public and private companies.

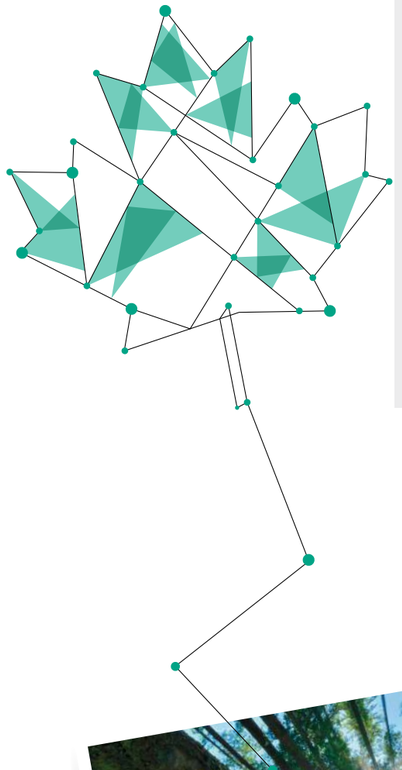
Managing property smarter

Alongside improving energy performance, getting more out of less square footage and making better use of available surface area is another avenue for driving down energy consumption and costs. Universities are in a position to seize the opportunities offered by the transfer of their grounds into their ownership.

Sustainable appeal

Since 2008 the REFEDD, a student association that promotes sustainable development, has organized a national survey every three years to understand and measure how students feel about sustainable development and how they act accordingly. The most recent survey, conducted in late 2016 with 10,500 students, showed that only one out of two students felt that their university took sufficient account of sustainable development in campus activities. A majority of students said they supported the formation of "sustainable development committees" on campus as well as using organic and seasonal products and placing composters at food courts.

Following the example of Université Laval in Quebec, some universities are putting their sustainable development efforts forward to attract students.



Carleton University targets classroom occupancy

In ten years Carleton University in Canada brought its classroom occupancy rate up from 46% to 91% during opening hours by means of a time management software program and by setting up a time coordination committee tasked with drawing up the university's campus time policy. The policy takes account of the duration of school days, acceptable workloads, special learning needs, research requirements and student needs, in particular the needs of students with disabilities or family commitments.

Fostering collective wellbeing and inspiring society through sustainable development at Université Laval

Since 2008 Université Laval has been committed to promoting every facet of sustainable development across its campus from the environment, culture, quality of life and mobility to community engagement and voluntary work. It was the first university in Canada to become carbon neutral on a voluntary basis by cutting its greenhouse gas emissions and offsetting them via the purchase of carbon credit and thanks to the nearby Montmorency Forest carbon sink, a teaching and research forest that literally serves as an open-air laboratory. In addition the university set up a health & wellness programme (Mon Equilibre UL) to encourage students, faculty and staff to adopt healthy living habits. Students can also sign up for a transdisciplinary programme focused on solving problems related to sustainable development which forms part of their degree and counts as a university credit.

Getting off on the right foot at NEOMA Business School (Rouen)

NEOMA Business School (Rouen campus) buys carbon credits to offset the carbon impact of trips by prospective students attending admission interviews (train ride from Paris and shuttle ride to the school) and allocates funds previously set aside for gifts for eligible candidates to nonprofit associations.

Rewarding best practice with the Green Gown Awards and Campus Responsables

Since 2004 the Green Gown Awards have rewarded sustainable development best practices adopted by higher education and research institutions in areas as diverse as teaching and research, buildings, diet and quality of life—an initiative and concept that spread to the French-speaking world with the creation in 2014 of the Responsible Campus Awards of which Bouygues Construction is a proud partner.

Les Trophées des campus responsables Francophones
L'édition francophone des Green Gown Awards

Created in 2006, Campus Responsables is the leading network of French-speaking *grandes écoles* and universities committed to sustainable development.

Its aim is to induce and help campuses integrate sustainable development into their degree programmes and facilities management. Members of the network have access to support, events and training and can take part in projects revolving around specific themes, such as sustainable catering, student wellbeing and the impact of campuses on their region, to test new ideas. The network is made up of members from across France and from Belgium. Bouygues Construction has supported the network and its activities for several years.

Taking student wellbeing seriously

In the most recent survey conducted in December 2016 by the OVE, a government agency that monitors the quality of student life, 67% of female and 53% of male students said they often felt exhausted while 69% and 49% respectively reported high levels of stress. Such troubles may not be new, but the figures show that student living conditions have worsened since the last survey in 2013. More and more students are foregoing medical treatment, often for want of money, and increasingly relying on work, welfare benefits and government grants to pay their bills while getting less help from their families.

Universities are aware of the problems facing students outside the strict confines of education and are taking measures to address them. Other than a successful education and career, both of which are strongly correlated with student wellbeing, the personal development and flourishing of students are at stake.

In the UK, Student Minds supports students with a range of mental health difficulties and work with all members of the university community to promote positive wellbeing.

Wellness at Kedge Business School (Marseille)

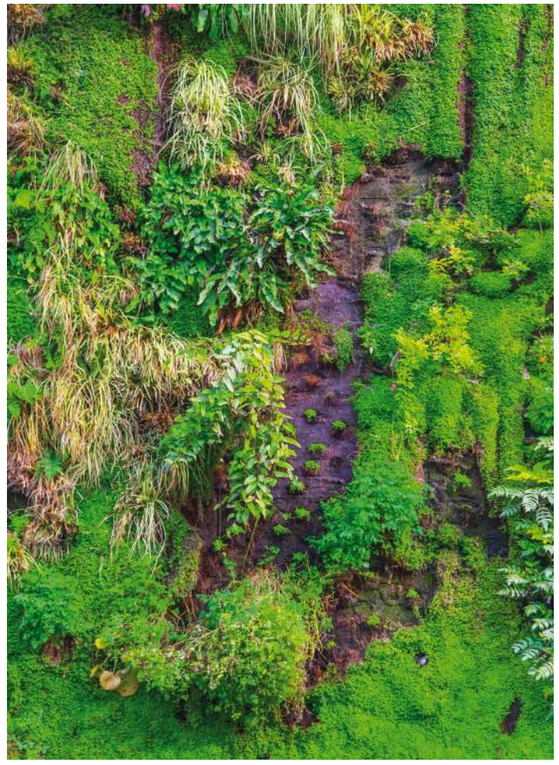
The Wellness service set up by Kedge Business School in Marseille adopts a comprehensive approach to promoting student wellbeing.

Preventive measures revolve around a "Well-being Fortnight" during which a host of events and activities are organized around themes such as diet, relaxation and health. Activities include stress management workshops, first aid training, yoga sessions, relaxation classes and natural medicine courses.

Active measures last throughout the year with assistance provided by five volunteers and a psychologist on campus to support students and give them counselling with regard to any difficulties they may encounter, such as financial troubles, family problems, stress, anxiety or addition.

Catching forty winks at Université Jean Monnet Saint-Etienne

The university's "1,001 Nights" nap room opened in January 2017 and has proven a big hit with students. The 40 sq. m space is equipped with six comfortable sleeping areas consisting of tents and mattresses where students can take a quick 30 minute nap, the benefits of which for memory, concentration, creativity and physical health are well documented. It is available for most of the school day and has taken on a life of its own while remaining peaceful and clean.



Reconnecting students with nature

Several studies agree on the benefits of greenery, sunshine and nature in general on mental and physical health. Today several firms are betting on the goodness of Mother Nature to enhance the wellbeing of their employees. A striking example of this is Amazon, the world's largest e-commerce firm, which is building three giant glass biodomes ("Spheres") in its campus in downtown Seattle that when complete will house no less than 40,000 plants of 400 different species with streams running through it—a living light shaft. Universities cannot help but sit up and take notice.

The University of Texas at Austin's Living Wall

The University of Texas at Austin boasts the world's first "Living Wall" on its campus. The university's School of Architecture and Lady Bird Johnson Wildflower Center collaborated on the Wall which houses a cross-selection of native plants and features a honeycomb-like structure composed of "cells" designed to reproduce the optimal habitat of several animal species such as lizards, butterflies and insects. It is a project that has helped to make students aware of the importance of biodiversity.

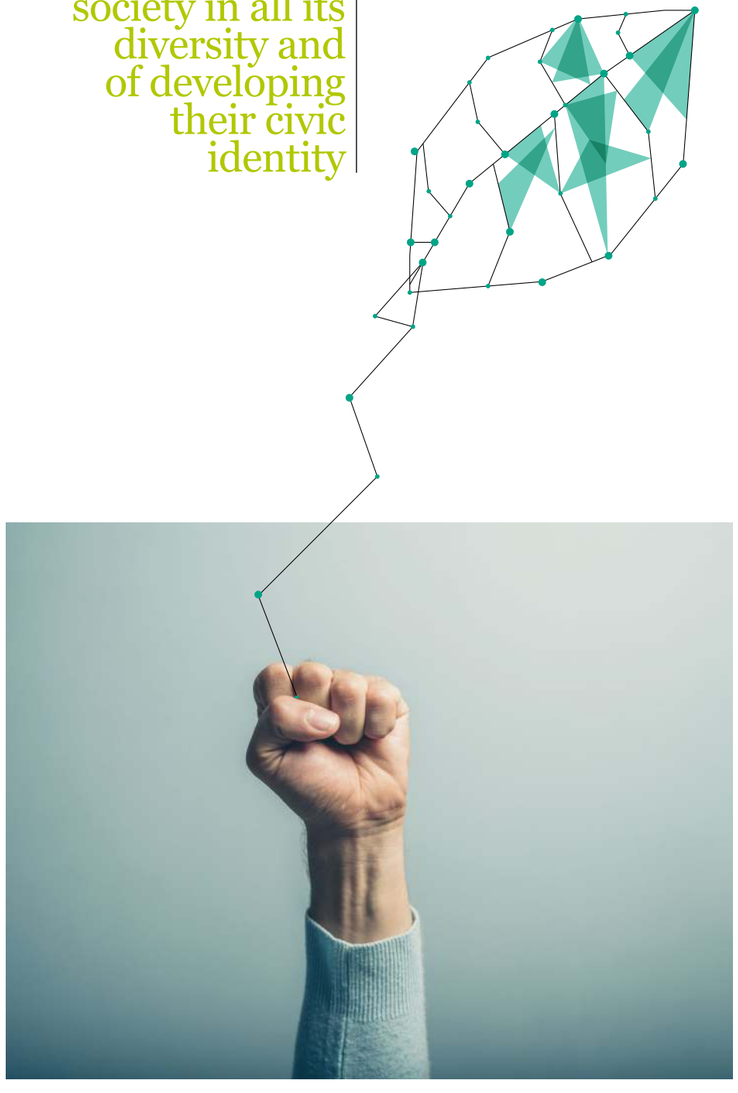
Watching sound at Université Pierre et Marie Curie

For several years researchers at the Institut Jean Le Rond d'Alembert of Université Pierre et Marie Curie (Jussieu campus, Paris) have been working on the "Mégamicros" project with the aim of establishing a network of multiple digital microphones throughout the campus to perform aerial ultrasonic imaging. The scientists are putting together noise (or hearing difficulty) maps in the first stage of their efforts to combat noise pollution. A fine example of the university as research lab!

The lightness of being Glasgow Caledonian University

The Saltire Centre at Glasgow Caledonian University is a learning facility that received the National Lighting Design award for its extraordinary light. With room for 1,800 users it is one of the UK's most visited university libraries.

A way of putting students in touch with civil society in all its diversity and of developing their civic identity



Bringing up engaged citizens

As the last rung on the education ladder, campuses bring up not only the workers but also the citizens of tomorrow. Apart from transmitting the knowledge, skills and know-how needed to compete in the labour market, higher education institutions are giving ever greater importance to opening the minds of their students and endowing them with a sense of responsibility. Conscious of their social role, some campuses are adding social, ethical and civic dimensions to their degree programmes. For instance they are making students aware of environmental issues by telling them about their carbon footprints and teaching environmentally friendly behaviour.

Student engagement in France gained increasing value in 2017 with the possibility of students earning university credits for their involvement in social, civic or work-related initiatives or causes (ranging from charity work to voluntary service in the fire brigade or army). A way of putting students in touch with civil society in all its diversity and of developing their civic identity.

Civic engagement at Tufts University

The Jonathan M. Tisch College of Civic Life at Tufts University near Boston prepares students for a life of active citizenship.
It offers curricular and extracurricular activities to develop the knowledge and abilities pertaining to civic engagement and helps faculty members create incentives for civic engagement in their lectures.
The college also supports research relating to civic life.
Its programmes are an integral part of the university's identity and can be converted by students into degree credits.

Teaching citizenship at the Burgundy School of Business

Over ten years ago the Burgundy School of Business introduced a common compulsory module giving all first- and second-year students the opportunity to devote 50 hours a year to working with one of several partner associations on various causes such as helping people with disabilities, tutoring schoolchildren and assisting the elderly. Each partner organization presents its community initiatives during a Civic Day at the beginning of the academic year and "hires" the students who will assist them over the course of that year.

Ensuring sustainable commutes

The daily commutes of students and faculty at Université Laval account for 21% of the campus' greenhouse gas emissions[22]. Figures like these reveal commuting to be a major factor in universities' carbon-neutral strategies. Carbon emissions are likely even higher at remote or enclosed campuses with limited access or American-style campuses extending over a huge area. Other than damaging the environment, campuses that are hard to reach or that force users to travel extensively within them lose their appeal and result in stress and tiredness on the part of students and staff.

Many campuses are putting sustainable commuting plans in place based on making services and facilities available, raising awareness and providing information and financial incentives to encourage active commuting (walking, cycling, jogging), bringing in electrical forms of mobility, using public transport and consolidating commutes.

Sustainable commuting shows the need to widen one's horizons by considering the relationship between campuses and their regions. Now more than ever campuses are working with a wide variety of stakeholders such as municipalities, companies and public transport operators.

As online learning takes off and usages and services on campus become more closely interlinked, debate on reducing the need for campus commutes should intensify.

[22] Les déplacements durables, Je suis DD, Université de Laval

Staggering lecture times and public transport peak hour at Rennes 2 University

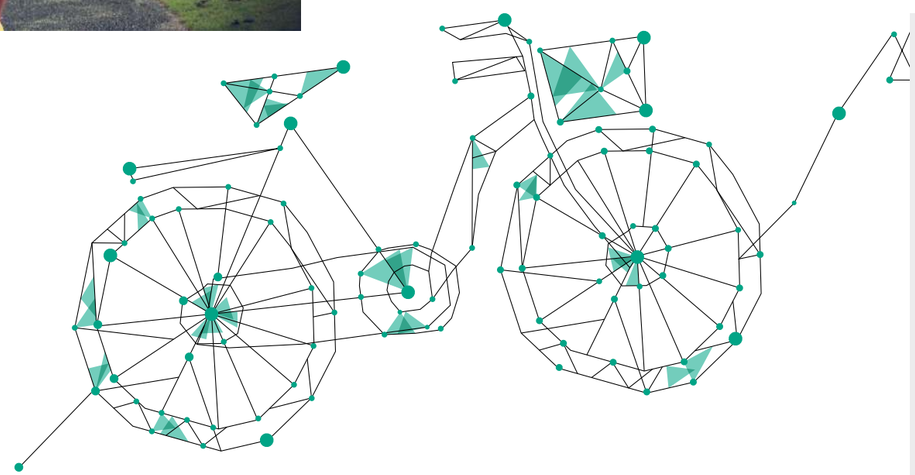
In 2012, faced with the risk of a clogged underground, Rennes 2 University reached an agreement with the subway operator and the Rennes city council to shift some of its morning lecture times by 15 minutes so as to ease congestion on the metro line. The measure reduced peak hour volumes by 10%.

Public transport and cycling incentives at the University of Namur (Belgium)

The University of Namur offers to pay the full cost of bus and train commutes to its faculty and staff as well as an allowance to cycle to work.

Active commuting at Université de Sherbrooke (Canada)

Université de Sherbrooke in Quebec encourages its campus community to embrace active means of commuting through incentives (walking/cycling/running challenges), dedicated facilities and services (bike sharing, bike sheds, showers, bike repair stations, bike repair training) and new ways of linking the campus to the surrounding region (linking the campus to urban cycling lanes).



EcoSynergies between campus and region

For campuses to be firmly established in their regions, both must develop ever closer synergies, with campuses drawing on regional characteristics in shaping their strategies while contributing to the economic, social, environmental and cultural lives of their surrounding regions.

Assessing campus EcoMobility potential with Ecomobilité by Effinergie

The Ecomobilité tool was developed by Effinergie, a collective, and set up in partnership with CSTB, the national construction regulator, Qualitel, a nonprofit housing information and certification association, and Groupe Caisse des Dépôts. It enables the "EcoMobility potential" of a building to be measured and aims to increase awareness of the amount of energy consumed when a building's users travel. This EcoMobility potential is assessed based on distances travelled, the percentage of use of each mode of transport (e.g. walking, cycling, driving, public transport) and amount of energy consumed.

Electric carpooling and carsharing at Ecole Polytechnique Fédérale de Lausanne (Switzerland)

ElectricEasy is an electric carsharing service for the students, faculty and staff of EPFL. It is available at any time of the day and works on a pay-as-you-go basis (no subscription required). EPFL also teamed up with the University of Lausanne to provide a common carpooling platform for use by their community.

[23] Étude d'impact socio-économique et environnemental des campus français

Synergies between the Lyon Ouest-Ecully EcoCampus (ECLOE) and local producers

ECLOE and the Ferme de l'Abbé Rozier, an association specializing in social integration and rehabilitation through organic market gardens, set up a market for local and organic produce serving the five schools that make up the EcoCampus, namely, CESI Lyon, Ecole Centrale de Lyon, EM Lyon Business School, ITECH and ISOsteo Lyon. Other than an opportunity to make shoppers aware of the benefits of a healthy diet and short distribution channels, the collaboration initiative with the farm and other local producers helps to support regional agriculture.

Campus Footprint®, an economic, social and environmental impact study of French campuses

In 2016 the Campus Responsables network conducted CAMPUS FOOTPRINT®, a national study of seven pilot campuses[23] carried out with the support of Groupe Caisse des Dépôts, the CPU (association of the heads of French higher education institutions), the CGE (association of grandes écoles) and AVUF (national association of university towns). The study measured indicators such as the number of jobs created as a direct, indirect or implicit result of campuses' presence, the volume of sales in the region and the carbon emissions related to campuses' supply chains.

SUGGESTIONS

OPTIMIZE NATURAL RESOURCES ON CAMPUS

Designing energy-plus campuses

Campus buildings and facilities, whether raised from scratch or renovated, must be designed with minimal energy consumption in mind, for instance by means of bioclimatic architecture or energy efficient building envelopes. Construction equipment and technology must also be highly energy efficient and favour energy recovery.

By using various renewable sources of energy, electricity production can be evened out. For example, solar and wind energy complement each other depending on the weather and tidal cycles. Energy storage facilities are one way of offsetting the irregular supply of renewable energy and of managing peak demand on campus. Systems to monitor and predict energy use can also adjust the configurations of buildings in real time so as to constantly keep energy consumption to a minimum. For their part smart grids, which allow energy to be bought and sold as needed, can make campuses increasingly self-sufficient in terms of energy and ultimately result in an energy surplus on campus.

Alongside all these measures, user involvement is crucial; consumers need information and training on the technologies that are out there and what they can do to help.

Optimizing water management

Reducing water consumption

Using materials that require little water maintenance, installing plumbing equipment and systems that use up little water or that recover water, and planting indigenous species that need little watering in green spaces are all ways of reducing water consumption.

Tips and tricks to save water, education about environmentally-friendly behaviour and water saving challenges can also involve the campus community in efforts to reduce water consumption.

Recovering, purifying and storing rainwater

Drainage ditches, retention basins and basement tanks can be used to collect and recover rainwater. Water purification and storage enables rainwater to be put to use where drinking water is not necessary such as in bathrooms, laundries and green spaces.

Putting greywater and/or sewage treatment systems in place on campus

By virtue of their size, campuses can house their own greywater and sewage treatment systems on site. On-campus purification systems take the load off municipal or collective networks and can incorporate nonchemical wastewater purification methods.

Best practice

- Landscaped drainage ditches enable rainwater to be collected and pretreated with plants while helping to develop a site's biodiversity.
- The Drink Local campaign launched by Université Laval seeks to ban the sale of bottled water on campus.

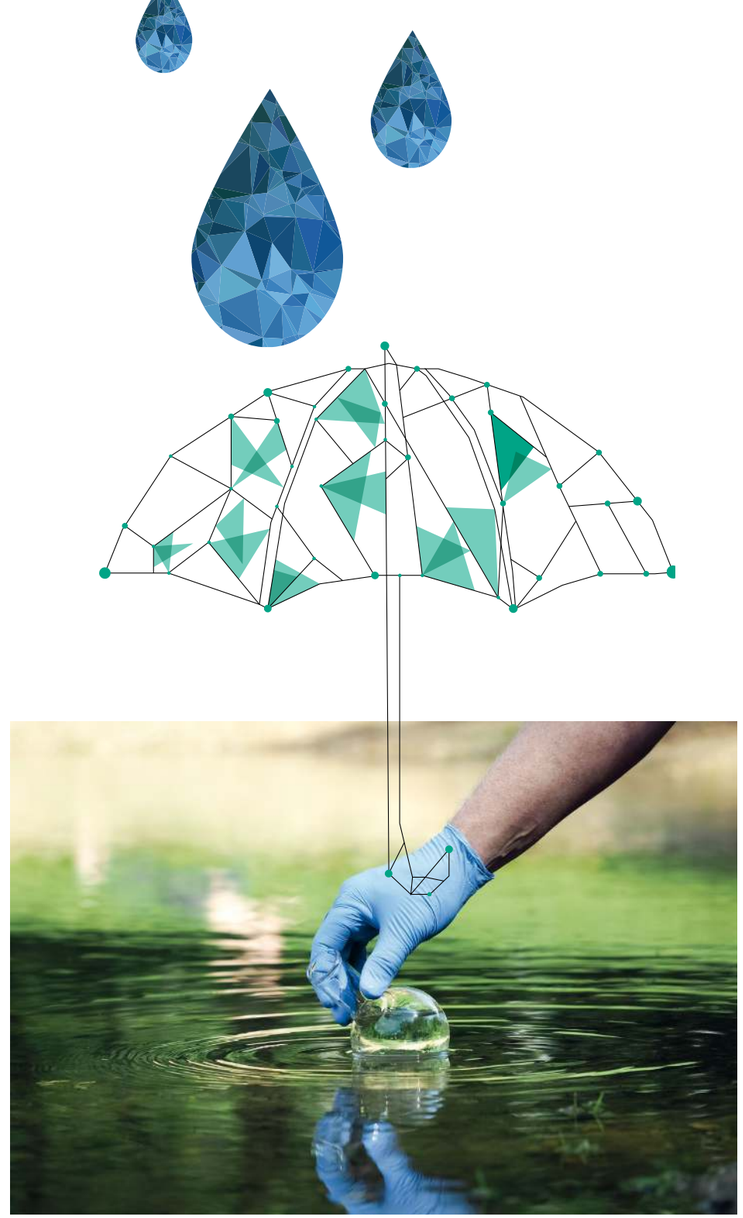
Designing, building and running virtuous circle campuses

Making campuses upgradeable and alterable

Endowing campuses with the ability to evolve by making facilities more flexible so as to easily adjust the number of work rooms and organize space and by configuring premises to give buildings multiple uses (e.g. turning classrooms into laboratories) entails thinking ahead of the need or possibility to alter buildings by anticipating regulatory and public safety standards, designing proportional spaces accordingly, and making partitions, electrical fittings and fluid distribution systems modular. Flexibility and modularity are the keys to optimizing the use of campus facilities and ensuring they can adapt to usages over the long term.

Restore more

Higher education institutions constitute the most precious publicly-held property assets in the West and are poised to become so in emerging economies as well. Restoring university buildings rather than knocking them down or raising new ones enhances the overall life cycle of a campus. It also avoids the major environmental impact of constructing a new building shell.



Aiming for zero waste

Responsible food services

Food services are the leading generators of waste on campus. Recycled organic waste from kitchens and meal distribution areas can be used to make compost or as fuel in methanation plants that turn organic matter into biogas. Compost can also be used as fertilizer for market gardens which supply short distribution vegetables to on-campus kitchens and offer a fun and fulfilling campus activity.

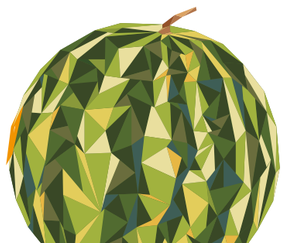
Waste prevention measures are facilitated by process rationalization systems such as apps connected to the Digital Work Environment allowing users to indicate ahead of time whether or not they will eat a meal. These types of data are essential for improving menus and purchasing plans.

Promoting the circular economy on campus

By virtue of their size and diversity of needs, uses and waste products, campuses are well suited to an industrial ecology model. Analysing waste production at the campus level is the first step to determining whether to reuse waste on site or pass it on to the surrounding region. Places such as repair cafés can serve to encourage members of the campus community to fix and reuse whatever they can. Different campus entities can also optimize and preserve resources by sharing and exchanging equipment, liquids and gas, and materials.

Best practice

- The INSA Lyon recycling centre recovers reusable objects, such as small furniture items, coat hangers, curtains and crockery, and sells them back to students at very low prices at the start of the academic year or gives away what it cannot sell to charities.
- The Université de Saint-Quentin-en-Yvelines's food services sort their food and organic waste into composts which are then used as fertilizer on campus.



Promoting biodiversity on campus

The potential for biodiversity

Often extensive in scope, university campuses are ideal places to foster biodiversity.
The first step is to identify a site's biodiversity potential (defined in terms of local characteristics and blue-green infrastructure) with the help of an ecologist. Depending on the plant and/or animal species that need to be protected, reintroduced or developed, various measures are possible such as creating habitats (e.g. birdhouses, bug hotels and meadows) for certain species, developing wetlands and building blue-green infrastructure.

The value of biodiversity

Biodiversity is also about users and smallholders taking responsibility for the land and understanding practices such as mowing late or stopping the use of insecticides.
It is therefore important to explain the benefits of biodiversity projects and more generally to motivate users to join them.
Setting up pick-your-own (PYO) farms, cultivating bees and selling their honey, and including biodiversity observation spots in relevant degree courses are some examples of possible initiatives.

Best practice

- Indigenous fruit tree-lined avenues which people are free to pick at Université Laval;
- An information campaign to help get rid of alien species, volunteer initiatives at local nature protection associations and awareness-raising among students and faculty through the Give Nature a Home guide—all at Queen's University Belfast.

DEVELOP AND ENCOURAGE LOW CARBON **PRACTICES AND BEHAVIOUR**

Favouring alternative mobility solutions

Determining EcoMobility potential

Campuses are ripe for the growth of alternative mobility solutions on account of their size, the frequency of campus shuttle services and the awareness of students of new forms of getting around.
The EcoMobility potential of campuses can be assessed by surveying all the alternative mobility solutions available within campus grounds and between campus and town, examining their use by the campus community and identifying potential and unmet needs.

Moving towards alternative mobility

Various solutions are possible depending on the context, including setting up a logistical grid across campus; developing carsharing apps for the campus community; setting up carpooling and bike-sharing schemes; making pedestrian ways and cycling lanes; setting up mobility spaces with bike repair stations and electric vehicle charging points; and selling or renting out alternative modes of transport.

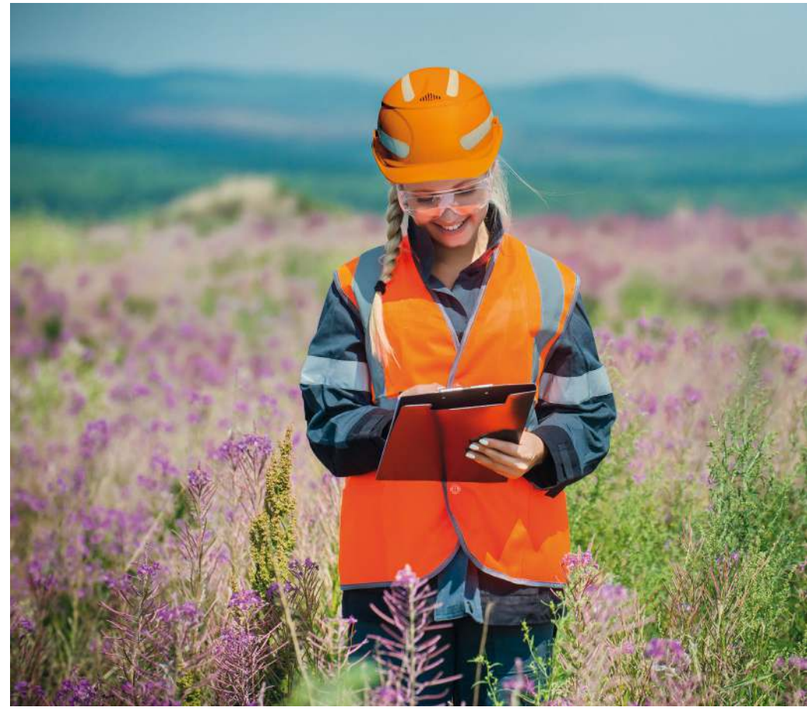
Designing campuses to teach, inform and challenge users

At the same time as enhancing the energy performance of buildings, campuses must find ways to motivate their users (students, service staff, administrative staff and faculty) to reduce their combined environmental footprint.
As campus populations keep changing due to turnover, sustainable behaviour must be so intuitive as to facilitate rapid adoption.

A first step to encouraging users to adopt sound practices would be to communicate information about carbon footprints and how campuses are doing in a clear and engaging manner through environmental ambassadors and/or digital displays. Campus members could then be given tools (such as an app) that measure their own carbon footprint and suggest personalized tips to adjust their behaviour accordingly. Students always up for a challenge could be motivated through themed games or competitions. To achieve all this, mechanisms that measure and compare the carbon footprints of individual and groups of users and that offer them avenues for improvement must be integrated into campuses at the design stage.

Best practice

- The Ecolympics held by Oberlin College in Ohio pit campus dormitories against one another in competitions to reduce their water and energy consumption.
- The student volunteer ambassador programme at the University of Calgary seeks to inspire exemplary behaviour among students and their peers in terms of reducing greenhouse gas emissions and water and energy consumption.



UNIVERSITY OF HERTFORDSHIRE:
A SUSTAINABLE CAMPUS THAT IS ENVIRONMENTALLY FRIENDLY, GEARED TO USERS AND INCLUSIVE

In 2011 the University of Hertfordshire, situated in the north of Greater London, decided to redraw the master plan of its campus built in the mid-20th century.

Crédits photo : Université de Hertfordshire

A special concern was to make the refurbished premises conducive to student wellbeing by establishing communal areas and putting up a sports building and in particular by building 2,500 new student rooms and renovating 500 existing ones.

In 2013 Linkcity, a Bouygues Construction subsidiary, won via its dedicated subsidiary Uliving the contract to design, build and run these new premises in partnership with Derwent Living (a British "profit for social purpose" property manager, shareholder in the venture and operator of the premises), Meridiam (majority shareholder in the venture) and Legal&General (creditor).

The University of Hertfordshire wished to emphasize the environmental and social aspects of the project. Its concern paid off when the project obtained the highest BREEAM rating (Building Research Establishment Environmental Assessment Method) and one of the highest scores ever achieved in its category as a result of building with wood, keeping energy consumption low, recycling on the work site, making creative use of lighting in student rooms and offering students various recycling options.

Yet environmental excellence only came at the price of trial and error. In order to let in as much natural light as possible into student residences, the buildings were fitted with very large windows in the style of picture windows. A fine idea that nonetheless proved impractical as students struggled to open and close the big, unwieldy contraptions. Off the team went and found a way to rectify the situation without losing sight of its objective.

Energy generation also had to be revisited with the final project incorporating a plant big enough to supply not only the residences but also part of the university buildings.

The works were thus characterized by the continual adaptation and improvement of the buildings delivered in three stages as the consortium raised its game on the strength of user feedback.

Since the last rooms were delivered in September 2016, the running of the buildings has come up against the social hurdles faced by students in the UK as they find it increasingly hard to afford the country's very high rents. How might rents be brought down to more affordable levels? Increasing the occupancy rate of rooms throughout the year is one possible solution. Renting out student accommodation during conferences or summer schools would generate additional revenue which could be used to offset reductions in the monthly rents paid by students during the academic year.

An option worth looking at to develop a sustainable model that is environmentally friendly, geared to users and inclusive.

RENOVATING THE UNIVERSITY OF BORDEAUX: TECHNOLOGICAL INNOVATION, CULTURAL HERITAGE AND USER EDUCATION

In 2008 Operation Campus was launched in France in response to the dire state of university premises with almost one-third of grounds in a state of disrepair and some not having been renovated for 30 years.

The University of Bordeaux was one of the institutions selected under the plan by the French government and obtained funding to renovate and revitalize its premises which were plagued by a multitude of problems such as very poor energy performance, the use of asbestos, and facilities unsuited to the changing needs of the academic community.

The university entrusted the first phase of the project to a consortium represented by Bouygues Bâtiment Centre Sud-Ouest. It was no mean challenge: the grounds had to be renovated while preserving the university's cultural heritage, and the campus community's living and work facilities had to be redesigned while deepening the links between the university and its city.

The university was especially concerned with reducing the energy use of its buildings, one of the project's main objectives.
A comprehensive solution was put forward based on technological innovation—the bioclimatic facade—and on educating users.

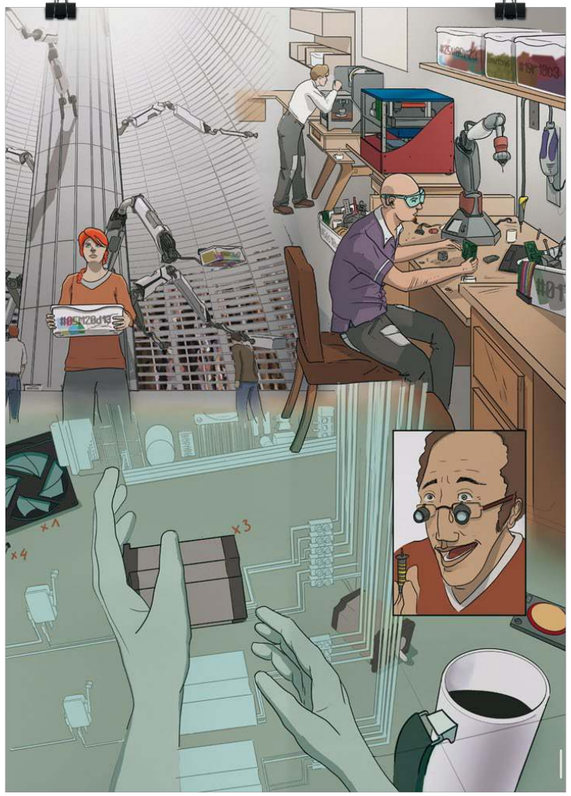
Consisting of a double layer of glass windows placed in front of a building's original frontage, the bioclimatic facade insulates the building from the outside and regulates its indoor temperature while preserving, modernizing and showcasing its historical features.
In winter the double layer is closed so as to keep the air warm through a greenhouse effect generated by the sun shining on the glass. In summer the double layer is opened so as to fully ventilate the building and lower the indoor temperature. In total, 20,000 sq. m of facades were installed on the campus' 16 renovated buildings.

Needless to say, students and staff were eager to know all about the innovation down to the last detail. More generally, all campus members and users are explained the basics of the system by means of an open-access course.

The project was delivered in September 2016 after one year of study and two years of works which took place while the premises were in use without interrupting any campus services thanks to coordination with the academic community.

THE RESILIENT CAMPUS
IN THE FACE OF GEOPOLITICAL AND CLIMATE CRISIS

It is 2030 and limited resources coupled with climate change are forcing humankind to live in harmony with nature and move about less often. People are having to learn to make the best use of local resources to survive. In this context the effective transmission of knowledge and skills has become vital.



On campus the watchwords are resilience and resourcefulness. Every part of town has become a potential learning place. For example disused factories are often renovated, their huge spaces converted into massive learning environments. In fact, selective admission to higher education has fallen away and all citizens are now obliged to learn and teach together and thus help sustain the community.

Research has become transdisciplinary and focused on experimentation. Dedicated facilities and equipment are at researchers' disposal. Raw materials are stored and classified in smart systems by "materialbases" which use them to carry out their own research. The circular economy has been taken to its logical extreme as every used resource is recycled to be reused in workshops equipped with 3D printers and other cutting edge equipment.

Campuses have become mobile, flexible and oriented towards local needs. When a bridge is destroyed by a hurricane, a temporary microcampus is immediately set up on the affected site and only taken down once the problem is fixed. Training sessions that switch between theory and practice are held in light facilities such as tents and modules. Digital technology connects everyone to the WorldWiki, a system linking all the world's local communities together and indexing their environmental and climate profiles, resources, knowledge and know-how. Local WorldWiki administrators use artificial intelligence to identify the communities best positioned to help resolve a given problem and contact them to begin a collaborative work session.

CONCLUSION

In a world where information is available at any time and any place and where artificial intelligence can process unimaginable quantities of data to learn, create and predict, the landscape is shifting. Just as the knowledge economy replaced the industrial economy, the “human economy” is gaining ground by putting forward human-centred values such as collaboration, creativity, engagement, ethics and responsibility. Tomorrow’s campuses face the challenge of educating citizens capable of thinking up new ways of organizing society, of considering the proper place of humans and machines, of finding answers to social inequality and of imagining ways to combat impending climate change.

In a learning society campuses will educate lifelong learners, open their doors to an increasingly diversified student body and position themselves as the indispensable partners of socioeconomic stakeholders. This requires a shift in scale. Campuses will become more accessible and open to cities to the point of becoming deeply interlinked and sharing facilities and services with them. At the same time they will lose their monopoly over education as the rise of MOOCs and distance learning and recent experiments in remote examinations show. Campuses will be both physical places—powerful drawcards to their surrounding regions—and virtual entities coordinating learners, lecturers, researchers, educational spaces, content, resources and teaching aids.

Endowed with a social mission, campuses will have to be role models and sources of inspiration by making a point of optimizing the use of natural resources, nurturing student wellbeing and driving the energy transition. They will also be breeding grounds for innovation by virtue of dedicated facilities such as fab labs, incubators and learning centres, their ability to bring about meetings and interactions, and their scale—making them ideal experimental sites.

The rise of EcoCampuses, innovation platforms and residential business centres oriented towards a diversified market shows that higher education models are changing fast. Yet balance remains fragile and problems abound as evidenced by the stream of news telling of saturated degree courses in France and exploding tuition fees in Britain and the United States, to name but two challenges.

This collective and collaborative thought exercise conducted with transdisciplinary representatives of the higher education, research, student and business spheres has pointed to new social expectations, noted the different visions of stakeholders while highlighting their synergies, and emphasized inspiring initiatives in order to help all parties take up the challenge of creating new campus models together and to imagine today the campus of tomorrow.

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