

# Universities in an Age of Uncertainty

## 44 Propositions on the Future of Universities

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### INTRODUCTION

Higher education is known as one of the “*least digitised and most people-intensive economic sectors*” [1]. While many other industries have been disrupted in their dominant logic of value creation, [2] the education sector has experienced few changes. It continues to pursue its historical ideal of ‘educating autonomous individuals’ [3]. The world is changing rapidly: Recent geopolitical challenges, social polarization, pandemic-induced disruptions, the exponential growth of knowledge and simultaneously increasing scepticism towards science, as well as evolving work modes in a global economy are indicators of that change. At the same time, new digital technologies such as generative artificial intelligence (AI) highlight the necessity and opportunity for transformation of the entire higher education sector.

These opportunities should also be considered in light of universities’ longstanding resilience in the face of change, which may stem from their ability to flourish in a research environment of cooperative competition rather than pure market competition that goes beyond the individual university.

The push for change comes from a number of drivers, which are transforming various areas of learning, work, and life simultaneously. The most prominent include:

First, demand is changing radically from a traditional certification orientation during post-secondary education towards lifelong skill and competence development. Hundreds of millions of people will need to be reskilled soon due to technological change [4].

Second, science is opening up and accelerating knowledge creation and diffusion processes (e.g., open science and recent advances in quantum physics) [5, 6]. At the same time, science is becoming increasingly politicized, thereby placing new pressure on universities to demonstrate the societal value of research.

Third, starting in 2012, massive open online courses entered the education sector with low-cost, high-impact platforms.

Finally, universities play an important role in contributing to social and environmental development in the future, e.g., by delivering on the UN Sustainable Development Goals [7].

These trends and change drivers challenge and put pressure on established universities, leading to the question: **What does the future of universities look like?**

Universities engage in knowledge production through basic and applied research as well as knowledge development, which is a key

element for technology and knowledge transfer to companies, non-profit organizations, spin-offs, and the government, as well as the basis for society’s ability to reflect on itself and its environment. This is a resource for reputation and a unique selling point for universities.

Universities also provide basic and advanced education, which refers to training after high school graduation and includes undergraduate and graduate programs of study, targeting students preparing to enter the job market. Furthermore, they enable lifelong learning by offering continuing education programs to learn alongside and between jobs to acquire further skills to meet the changing demands of the job market and society at large.

Humboldt’s idea of educating autonomous individuals no longer suffices. Instead, it might be time to rethink the role of universities and higher education in view of the above. Higher education, as well as each university within its heritage and uniqueness, must find its specific answer, bridging science, the public, and fostering dialogue.

The derived 44 propositions on the future of universities can be found in the appendix of this paper. They take a broad perspective of higher education institutions, i.e., they are not limited to the context of business schools. Further, some of the propositions may be paradoxical; this is intentional and should be seen as fertile ground for careful and deliberate discussions. We developed these propositions over the past years using in-depth analyses of the literature on trends in higher education, interviews with leading experts, and several workshops. This summary is organized into five areas—we call them gardens—where we believe universities can co-cultivate their future.<sup>1</sup>

### CO-CULTIVATING THE FUTURE OF UNIVERSITIES

Our *co-cultivated garden* consists of five beds, each symbolizing the harmonious coexistence of multiple tasks, roles, challenges, and opportunities in the context of the future of universities and higher education.

- Empowering lifelong learners & thought leaders
- Facilitating adaptive learning processes
- Fostering community & responsible leadership
- University as a *Denkplatz* & knowledge exchange platform
- Promoting cutting-edge research & open ecosystems

Just as skilled cultivators tend to their plants, universities must adapt to navigate the challenges and opportunities of the modern era. The garden beds serve as metaphors for the intricate relationship between the legacy and the future of universities, where co-cultivation involves the active participation of various stakeholders, sharing ideas and knowledge. Together, they will grow a lush higher education garden.

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<sup>1</sup>Thanks to Martin Eppler for the metaphor of “co-cultivating gardens.”

## Empowering Lifelong Learners & Thought Leaders

The landscape of higher education is undergoing significant transformation. Ever-evolving job profiles drive the demand for lifelong learning. As automation continues to advance, the need for higher education is further amplified as more individuals transition into knowledge-based roles. However, the rapid pace of digitisation has surpassed human capabilities in keeping up with organisational changes. Consequently, lifelong learning is poised to play a pivotal role in future education, enabling individuals to continually update their skills and knowledge.

In this context, lifelong learning is not merely an opportunity but a necessity for active participation in a responsive society. It will be characterised by greater conciseness, flexibility, and part-time engagement. Learning will emphasise real-world impact. Traditional models of learning will be complemented by experiential approaches that prioritise learning through practice and collaboration. This includes opportunities such as working alongside experienced professionals, receiving counselling, mentoring, coaching engaging in team-based/peer-to-peer learning, and immersive experiences.

Moreover, linear academic work streams will slowly be replaced by project-based learning and teaching rhythms. This approach allows learners to apply their knowledge and skills in practical contexts, fostering a deeper understanding of the subject matter. Furthermore, the integration of AI and learning analytics will be central to the learning experience, enabling personalised learning journeys tailored to individual needs and preferences.

Critical thinking and self-reflection are essential for the next generation of thought leaders who are being educated in an era of increasingly commoditised access to knowledge. As a result, problem-centric learning approaches, such as case learning tackling real-world challenges, gain prominence. In the pursuit of nurturing well-rounded individuals poised for leadership roles, the focus shifts towards cultivating a mindset characterised by curiosity, adaptability, growth potential, and emotional intelligence. These are likely relatively more critical than technical skills and knowledge.

## Facilitating Adaptive Learning Processes

In the ever-changing landscape of higher education, it is crucial for universities to adapt and update teaching methods to keep up with dynamic changes and technological shifts. Traditional on-campus, degree-focused learning is gradually giving way to interactive and experimental approaches that prioritise practice-oriented, career-focused education with tangible outcomes at the core. Additionally, the need for lifelong learning has led to the emergence of shorter, skill-based programs that cater to the evolving demands of individuals seeking continuous personal and professional development.

Recognising the demands of industry, educational institutions are being urged to offer executive-type programs that focus on specific skills and can be pursued as part of a continuous learning journey rather than episodic interventions such as current certificates of advanced studies (CAS) or master's programs. However, it is crucial to strike a balance between the breadth and depth of learning experiences to ensure comprehensive skill development. It is important to acknowledge that most students entering the education system today will eventually pursue careers in fields that do not exist yet.

Consequently, the emphasis is shifting from knowledge acquisition to the cultivation of skills and competencies that will enable individuals to adapt and thrive in a rapidly evolving professional landscape. This includes embracing technology, developing higher cognitive abilities, and fostering strong social skills.

Despite garnering substantial attention, Massive Open Online Courses (MOOCs) have not yet disrupted traditional universities or truly democratised knowledge, particularly among lower-income students. Successful MOOC participants often possess prior educational qualifications, emphasising the importance of coaching and personalised interaction, especially for disadvantaged students, complementary to existing course content, to facilitate adaptive learning processes. As intelligent automation and AI continue to make an impact, digital skills are becoming essential in academic teaching and learning. The automation of teaching and learning analytics further enables the intensification of student-centred learning processes, allowing for tailored and individualised educational experiences. Note that EdTech extends beyond digital learning; it represents an opportunity to optimise the overall student and faculty experience through digital means.

## Fostering Community & Responsible Leadership

Universities have always functioned as centres of intellectual discourse and opportunities for individuals to connect and exchange ideas. They foster in-person interaction to create a cohesive community and serve as a breeding ground for socially and environmentally responsible leaders, addressing the pressing needs of society. The demand for such leaders is urgent, and fostering diversity, equity, and inclusion has become imperative. An entrepreneurial growth mindset is required to tackle grand challenges of global significance, such as healthcare, sustainability, and diversity. Universities, as role models in responsible leadership, play a vital role in shaping such leaders. To develop essential soft skills, student engagement is crucial, and these activities must be integrated into core programs rather than viewed as extracurriculars. Furthermore, the recent phase of online education has highlighted the importance of physical interactions within universities to create a common context, foster empathy, encourage serendipity, and inspire spontaneous ideation.

## University as a *Denkplatz* & Knowledge Exchange Platform

Universities serve as an agile platform for the exchange and accessibility of knowledge, catering to the growing demand for freely available information in society. The university campus is a dynamic space that fosters interaction and collaboration among students, professors, companies, NGOs, alumni, and citizens, enabling the development of skills and knowledge through interdisciplinary teamwork and shared learning experiences. By providing a common physical space, the university environment seems effective in breaking through echo chambers and facilitating meaningful interactions and diverse perspectives.

The role of academic teachers is undergoing a transformation, shifting from being mere knowledge dispensers to becoming facilitators of learning experiences. On an open platform professors, students, alumni, and practitioners contribute their existing knowledge and contextual insights, actively engaging in the learning

process. The university enables discussions and exchange, allowing its stakeholders to shape and influence society.

### Promoting Cutting-edge Research & Open Ecosystems

While individual creativity remains invaluable, the most significant research breakthroughs are achieved by collaborative teamwork. Diverse teams create an environment where novel ideas flourish and critical dialogue thrives, propelling true research culture forward and pushing the boundaries of cutting-edge research. Advancements in technology, particularly the rise of AI, open new frontiers for empirical research. AI's capacity for exploratory analyses and data processing empowers researchers to delve into uncharted territories, uncovering insights that were previously inaccessible. This infusion of new technological abilities invigorates the academic landscape, propelling research towards innovative breakthroughs.

Moreover, the scientific community emphasises the significance of interdisciplinary research in driving advancements. Disciplinary research, although still important, faces intensified competition on a global scale. Interdisciplinary collaboration fosters a diverse and vibrant research ecosystem, where ideas flow freely across boundaries. This open ecosystem approach is amplified by the principles of open science, which not only accelerates research and its dissemination but also challenges traditional publishing models. In this dynamic landscape, research assumes a more prominent role in the creation of start-ups and contributes to the development of economies. Empowered by an open ecosystem, young scholars find increased opportunities to establish their academic careers and make significant contributions to society.

Academic research, with its emphasis on rigorous methods, scientific integrity, and logical reasoning, plays an important role in counteracting the proliferation of misinformation and the erosion of trust in media. Academic research enables open dialogue and the exploration of novel ideas, providing the foundation for the pursuit of truth and knowledge.

### CONCLUSION

In the ever-evolving landscape of higher education, universities need to embrace their role as co-cultivators, tending to the growth and development of a vibrant garden. The future of universities lies within these five metaphorical and distinct garden beds, each with its unique characteristics and purpose. Just as real gardens, the future of universities requires careful attention, nurturing, and collaboration among stakeholders, including learners, educators, industry partners, and the wider community. The five steps to a flourishing university garden are:

First, nurture lifelong learning, recognising the necessity of continuous skill and knowledge development in a rapidly changing world. Embrace experiential and project-based learning approaches. Integrate artificial intelligence and enable individuals to adapt to the demands of a knowledge-based workforce.

Second, adapt to changing circumstances and technological advancements. Emphasise the importance of skill development over mere knowledge acquisition. Universities must offer interactive and practice-oriented education that caters to evolving demands with tailored and individualised educational experiences.

Third, build thriving community hubs and breeding grounds for responsible leaders by emphasising the cultivation of a cohesive university community that fosters diversity, equity, and inclusion. Respond to the demand for socially and environmentally responsible leaders. Nurture student engagement and provide physical spaces for interaction and discussion.

Fourth, embody the spirit of intellectual exploration and knowledge exchange. Break through echo chambers, encourage diverse perspectives, and support critical thinking, creativity, and innovation. Establish the campus as an open platform for discussions, where stakeholders can shape and influence society.

Finally, foster the transformative power of academic research. Promote scientific integrity and rigorous methods. Embrace collaborative teamwork and interdisciplinary research. Promote open science, open access to publishing, and a research culture that empowers both established and young scholars.

To conclude, universities tend to the growth and development of the garden, shaping a future where knowledge flourishes, responsible leaders emerge, and society benefits, just as skilled gardeners tend to their plants with care and expertise. In doing so, they will shape higher education as a beacon of growth, innovation, and intellectual exploration. Through co-cultivation, universities can yield bountiful fruits by navigating the complexities of the modern era and ensuring their relevance and impact in shaping a better tomorrow.

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#### 44 PROPOSITIONS ON THE FUTURE OF UNIVERSITIES

- (1) Knowledge should be freely available to anyone.
- (2) We urgently need socially and environmentally responsible leaders.
- (3) Diversity, equity, and inclusion are imperative.
- (4) Universities should foster an entrepreneurial growth mindset to solve grand challenges with a global scope, e.g., health care, sustainability, and diversity.
- (5) Student engagement is paramount in developing soft skills. These activities must be actively integrated into core programs and not solely be seen as extracurriculars.
- (6) Campus will be an agile space where students meet and work together in groups and interdisciplinary teams with professors, companies, NGOs, alumni, citizens, and develop skills and knowledge in common exchange.
- (7) Interaction in a common physical space is more effective in breaking through echo chambers.
- (8) The role of teachers shifts toward facilitating an interactive learning process.
- (9) New competitors offer skill-based programs and challenge the role of universities as skills become the currency of a career.
- (10) Universities provide an open platform for discussions and exchange for shaping parts of society.
- (11) Universities are role models in responsible leadership.
- (12) Even dropouts use the epistemological and entrepreneurial foundation of universities to build their tech or knowledge ventures (e.g., Apple, Facebook, Microsoft).
- (13) Universities are increasingly evaluated on rankings and ratings in lieu of qualitative evaluation.
- (14) Universities continue to have the role of thought-leadership in society. They set cultural trends.
- (15) Automation will increase the need for higher education as more people will become knowledge workers.
- (16) Digitisation has multiplied the speed of change in organisations by factors, humans are not able to accelerate at the same speed. Continuous/lifelong learning will play a key role in education in the future.
- (17) Problem solving and critical thinking become a core component for responsible leaders.
- (18) On-campus, degree-focused learning, shifts towards interactive and experimental, practice-oriented, career-focused learning with specific outcome at the centre.
- (19) Life-long learning requires shorter, skill-based programs.
- (20) The increasing commoditisation of knowledge heightens the need for critical thinking and reflection.
- (21) Problem-centric learning gains in importance, e.g., case learning or learning by solving real challenges.
- (22) Lifelong learning is not an opportunity but a requirement to be part of a responsive society. Lifelong learning will be more concise and flexible, often part-time, and action-based that means learning with a real-world impact.
- (23) Industry needs shorter, skill-based executive-type programs from education. These should be organised as a continuous learning journey more so than an episodic intervention

via today's CAS or master programs. At the same time the breadth and depth of learning must be taken into consideration.

- (24) Most students entering the education system today will ultimately work in jobs that do not exist yet.
- (25) A mindset of curiosity, adaptability, growth potential, and emotional intelligence becomes relatively more important than technical skills and knowledge.
- (26) Problem-solving capabilities need even more focus on academic mindsets, e.g., curiosity, learning, experimenting.
- (27) Being able to work in teams is a core skill which should be more actively developed in universities.
- (28) Skills and competencies must be developed instead of knowledge, embracing technology, higher cognitive, and social skills.
- (29) Covid-19 forced rapid remote learning overnight. In future, universities should prioritise the right modalities in terms of online/offline/hybrid teaching to optimise the mixture of anytime/anywhere learning and personal interaction.
- (30) This phase of pure online education also showed that universities need to physically meet to create a common context and culture. Deep empathy, social serendipity, and spontaneous ideation require in-person interaction.
- (31) More learning happens by doing and working alongside accomplished practitioners, counselling, mentoring, coaching, teams, peer to peer, immersion experiences.
- (32) Massive open online courses have not disrupted universities yet, nor truly democratised knowledge. Successful MOOC students are often well-educated students, with an existing degree. Coaching and personalised interaction is especially important for disadvantaged students.
- (33) Shift from linear academic work streams to project-based learning and teaching rhythms.
- (34) With the impact of intelligent automation/AI, digital skills become the standard for academic teaching and learning.
- (35) AI and learning analytics become core of learning, allowing personalised learning journeys.
- (36) The automation of teaching and learning analytics allows intensification of fully student-centred learning processes.
- (37) EdTech is more than digital learning; it is a way to digitally optimise the entire student and faculty experience.
- (38) AI enables new exploratory empirical research settings.
- (39) Academic research must continue the search for truth in times of diminishing trust in science.
- (40) Interdisciplinary research is more strongly emphasised in the battle for funding; disciplinary research becomes more competitive globally.
- (41) While creativity can be a great strength of individuals, most great research nowadays is done in teams.
- (42) Open science further accelerates research and its diffusion. This goes beyond expropriating publishers' business models.
- (43) Teams work well in diverse settings with a high level of psychological safety. Free thought and speech are the hallmarks of true research culture.
- (44) Research takes on a larger role in the creation of start-ups and work.

### 1 Knowledge should be freely available to anyone.

There is an ongoing debate pertaining to whether knowledge is a private or public good. The increasing number of students in higher education clearly indicates a need for more tertiary education availability. In 2000, 100 million students were pursuing a tertiary degree worldwide. By 2015 this number climbed to 214 million. Last year 250 million students were pursuing such education and the number is expected to rise to 375 million by 2030. This development is accompanied by a significant shift:

“Up to 2002, for example, North America and Europe (together) enrolled more higher education students than any other world region. That changed in 2003 when East Asia took up the number one spot, driven in large part by the dramatic expansion of China’s higher education system.” [1]

As we expect global higher education enrolment to grow by nearly 200% through 2040, the discussion of whether knowledge should be freely available or paid by private consumers becomes increasingly relevant.

### 2 We urgently need socially and environmentally responsible leaders.

Education is first and foremost not only the transfer of knowledge, but also the transmission of skills. This implies developing socially responsible leaders. In a world in which all business activities should comply with the triple bottom line, the goal is to pay equal attention to environmental and social dimensions in addition to economic concerns. Responsible leadership can be defined as an “orientation or mind-set taken by people in executive-level positions toward meeting the needs of a firm’s stakeholder(s). As such, it deals with defining those stakeholder(s), assessing the legitimacy of their claims, and determining how those needs, expectations, or interests can and should best be served” [2].

John Hennessy, former president of Stanford University and chairman of Alphabet, summarises the essential qualities of responsible leadership as follows:

“Honesty, trust, service, authenticity, empathy, and purpose.” [3]

### 3 Diversity, equity, and inclusion are imperative.

Great research is part of the university mission in the future and great research is done with great teams. Great teams are diverse teams. Diverse teams include a balanced ratio of various genders, ages, nationalities, and socio-economic backgrounds.

One well-known issue in higher education is the lack of gender parity in the science, technology, engineering, and math (STEM) fields. To improve gender diversity and create inclusion, universities need to go beyond marketing and recruitment to increasing the number of diverse role models.

Real diversity and inclusion require more than measuring numerical targets like a gender ratio, although in many organisations it starts there [4]. Opinions diverge substantially on hard goal-setting for diversity and inclusion targets, but it does bring quick first results to those companies that choose this approach. Diversity

target-setting for any chosen parameter including gender seems to work best when it is paired with building inclusion and driving behavioural changes: awareness building, psychological safety, bias-free decision making.

In addition to a mixture of age, gender, and cultural backgrounds, leaders should strive for “cognitive” diversity, e.g., a range of thinking styles, habits, and perspectives [5]. Groupthink, of course, hinders performance. Having diversity of thought aims to avoid this phenomenon and allows the team to achieve better outcomes.

Technological development can also provide potential instruments to address biases. For instance, tools developed by software and consulting companies can assist in identifying biased data so that such biases can be addressed proactively [6].

### 4 Universities should foster an entrepreneurial growth mindset to solve grand challenges with a global scope, e.g., health care, sustainability, and diversity.

Another important prerequisite to meet the changing conditions in the economy and society and to be able to approach them as an active player is an “entrepreneurial growth mindset.” This entrepreneurial growth mindset can be understood as follows:

“A growth mindset is a belief that your efforts and those of other people will lead to success in business. [...] A growth mindset encourages you to overcome obstacles and view setbacks as opportunities.” [7]

A growth mindset differs from a “fixed mindset” in that it does not assume that one’s abilities and opportunities are given from birth and that one operates within the framework of these. On the contrary, a “growth mindset is the belief that someone’s ability and intelligence can be developed over time” [8].

This understanding includes an adequate, goal-oriented way of dealing with feedback to learn and improve from defeats and setbacks. Failure is accepted or even anticipated as part of the process and dealt with a certain resilience.

And this mindset is essential to be able to take on the major challenges of society—be it healthcare during the Covid-19 pandemic, sustainability issues, or diversity—and manage them in all their complexity and with all their setbacks.

### 5 Student engagement is paramount in developing soft skills. These activities must be actively integrated into core programmes and not solely be seen as extracurriculars.

Over the years, students increasingly engage with various university organisations and actively work to support these institutions. As students have come to understand the relevance of practical activities as increasingly relevant to their own attractiveness on the job market, more and more students are getting involved outside the curriculum and gaining valuable experience. Student engagement is understood as follows:

“Constructivist approach to teaching and learning: less ‘sage on the stage’ and more learning by doing.” [9]

In learning by doing, skills are developed that go beyond mere knowledge by providing for different fields of application. However, these soft skills as a decisive profile component cannot only be acquired in extracurricular activities but should be anchored more deeply in the curriculum. On the one hand, students today are already striving for these skills as a matter of course, and on the other hand, they are becoming increasingly important in the job market. However, this means that, in addition to purely frontal knowledge transfer, fields of application must also be dealt with.

- 6 Campus will be an agile space where students meet and work together in groups and interdisciplinary teams with professors, companies, NGOs, alumni, citizens, and develop skills and knowledge in common exchange.

As teaching shifts to new formats, the role of campus must necessarily shift as well [10]: Universities will have to consider which physical aspects of campus will play the most essential roles in the future and upgrade campus accordingly. They should rethink both space and time, i.e., rethink capacity as teaching and learning may increasingly happen asynchronously. For those instances where the focus is interactive, in-person instruction and co-creation, the campus will play a vital role.

“[University] must retain its ability to bring together large numbers of young adults with extra-curricular time on their hands to structure for themselves. The physical university campus which survives and provides reputable and reliable non-formal learning experiences will be of increasing importance to students, recruiters and talent managers alike.” [11]

To take full advantage of the benefits of campus life, universities should also foster integrative and interdisciplinary learning across all levels of teaching in higher education from undergraduate to graduate and post-graduate levels [12].

“Universities should provide an environment with activity zones for spontaneous encounters as well as designed and organised interactions.” [13]

- 7 Interaction in a common physical space is more effective in breaking through echo chambers.

Echo chambers arise from a combination of (a) the choice of individuals to segregate with like-minded ones—the creation of chambers—and (b) behavioural biases that induce polarisation when individuals exchange beliefs in these chambers—the echo [14]. Segregation leading to the creation of chambers and behavioural biases leading to polarisation can and do occur both in in-person exchanges and, as has been frequently alluded to in the press, in online interaction [15]. Interestingly, physical, offline segregation has been on the rise in Western societies over the past decades [14].

Research has shown that intergroup contact, i.e., interactions among individuals, can be an important way to reduce stereotyping and prejudice [16–18]. Several important moderators of this relationship have been identified including how intense (the extent to which contact is perceived as positive or negative) and intimate (perceiving contact as close rather than superficial) the intergroup

contact is perceived to be [19, 20]. There is also a burgeoning literature that examines how indirect contact can be structured to support reducing prejudice and promoting interest in face-to-face intergroup contact [21]. Of course, if universities are to function as a space to disrupt echo chambers, they must bring together a variety of viewpoints and enable constructive intergroup contact.

- 8 The role of teachers shifts toward facilitating an interactive learning process.

Gen Z values personal engagement, especially with classmates, which is seen as an important factor for mental health. Other benefits of face-to-face learning that are important to students include networking opportunities, inspiration from other learners and faculty staff, the ability to learn skills like teamwork, foster creativity and problem solving by getting into “group flow” moments. Teaching will therefore likely involve ‘facilitating the learning experience’ rather than simply transmitting knowledge to students to cover both the need for flexible formats and the desire to learn a broad range of hard and soft skills in addition to domain knowledge. Importantly, instructors may require additional training in didactics so they can appropriately deliver content in such a format.

Further, as the business world becomes increasingly interconnected with industries converging in the future [22, 23], higher education will benefit from instituting new ways of collaborating with and integrating different stakeholders in the education ecosystem [24]. Specifically, it can be very beneficial to deliberately strengthen the relationship with alumni; they can support the university with time, expertise, and money. This makes them an extremely valuable resource for higher education institutions [25]. Practitioners should similarly benefit from actively collaborating with universities since they can help shape the skills students learn, foster interdisciplinarity, and establish a concrete value co-creation partnership through regular exchanges.

- 9 New competitors offer skill-based programmes and challenge the role of universities as skills become the currency of a career.

This great demand for new skills, based on automation and digitisation triggered by Covid-19, has led many different institutions to take up this topic and provide skill-based programmes (see Figure 1):

Examining what universities are doing, there is on the one hand the traditional “In-person 4 years institutions” (A), including Harvard or UCLA. At the same time, there are new providers entering the space. One trend are online-only universities (B), trying to be geographically agnostic. And maybe even going in someone’s expertise areas, the question arises of how to compete with these platforms, that are gaining scale, have lower prices, are very quick on degree innovation, and are actively training and partnering with employers. In the US, these players posed less of a threat to universities in the past, but they have been gaining in relevance over the last few years.

Attention should really be paid to alternative credential providers (C) like Udacity, as people have realised how valuable these companies have become (Coursera generated revenues of US\$300 million,

Provider type	Overview	Examples
<b>A</b> In-person 4Y institutions	<ul style="list-style-type: none"> <li>Offer professional skills education and training extension or professional/continuing studies platforms</li> <li>Primarily post-graduate focus (degrees) and experimenting with certificates, on-ramps to degrees and bootcamp offerings</li> </ul>	
<b>B</b> Online university providers	<ul style="list-style-type: none"> <li>Relatively geography agnostic</li> <li>Compete on pricing, degree innovation, direct employer partnerships</li> <li>Larger advertising and marketing spend</li> </ul>	
<b>C</b> Alternative credentials provider	<ul style="list-style-type: none"> <li>Newer companies and schools that have enjoyed boom in funding (\$1.6B to EdTech in 2019)</li> <li>Alternative credentials with innovative pricing</li> <li>Often operating with outcomes guarantees or direct job ties</li> </ul>	
<b>D</b> Tech companies	<ul style="list-style-type: none"> <li>Relatively new entrants to the space</li> <li>Offerings tied to in-demand skills and/or company platforms</li> <li>Experimenting with alternate credentials for hiring and job qualification</li> </ul>	
<b>E</b> Community colleges	<ul style="list-style-type: none"> <li>Traditional sub-baccalaureate providers that offer vocational training, certificates and can serve as pathways to 4Y degrees</li> <li>Often focused on affordability, technical skills, and access</li> </ul>	

Fig. 1. New players on the EdTech market[26]

Udemy generated US\$500 million, and Udacity US\$200 million in 2020). They are finding a way to monetise and get to scale around the world, reaching between 10 and 20 million learners. This begs the question of whether these firms would and could be suitable partners for the future or whether they present a new type of competitor?

Technology companies (D) are also increasingly entering this space. They are the need for practical skills rather than degrees. Even shorter programmes can be highly valuable if they are teaching the right skills to someone. These types of qualifications can be ideal for entry-level positions. Are these competitive threats or opportunities to partner with?

Community colleges (E) are relevant to consider in terms of whether they represent institutions to pair up with, for example on lower-level skills and can this create easy pathways to come to institutions for higher-level knowledge and understanding. We see universities that say there are a lot of things we never want to do but let them find partners that do that and let them create easy upward mobility pathways. That we can help students to get to their middle and higher ends of their careers but recognising that are not only the younger students but could also be 30- or 40-year-olds that need to rescale or upscale.

New EdTech players are globally active as evidenced by Figure 2. Are these mentioned types of organisations substitutes or complementary? Most universities have not been worried about the online alternatives, but increasingly pay attention to those providers. The alternative credential providers are faring the best in terms of partnering with leading institutions. However, collaborative efforts have remained modest so far. The aim is to get a sense of what does the

platform create, how is the value sharing. But it is essential to think about a way to extract economic value out of these partnerships and how to make sure your institution gets their fair share versus fall to a platform that entered aggregating a lot of content and commoditises some of the universities offering. Tech companies are mostly seen as any other player, and partner with them on research or employment, but do not see them as a real threat really entering the market but should be paid more attention to. However, as Figure 4 indicates, new entrants are operating globally and represent interesting opportunities for collaboration.

Alternative credential providers already started with other universities to offer large and complex degrees. Coursera for example works together with University of Sydney to offer an MBA. It is advisable to have a look where first-mover universities start to be at level of MBAs, offering 30 degrees or other business degrees. It is not necessary to be the first but being under the first 25% who partner with these platforms.

“When we talk about the future of work, a lot will be about continuing education, a lot will be about skills. Skills are becoming the currency for your career.”[26]

That’s not only because of how firms are reorganising. Unilever introduced two years ago a skill-based model to allocate jobs in the company. They want to create a more agile organisation, so they are going away from fixed positions to assign more jobs based on skills. Skills is becoming the currency for careers.



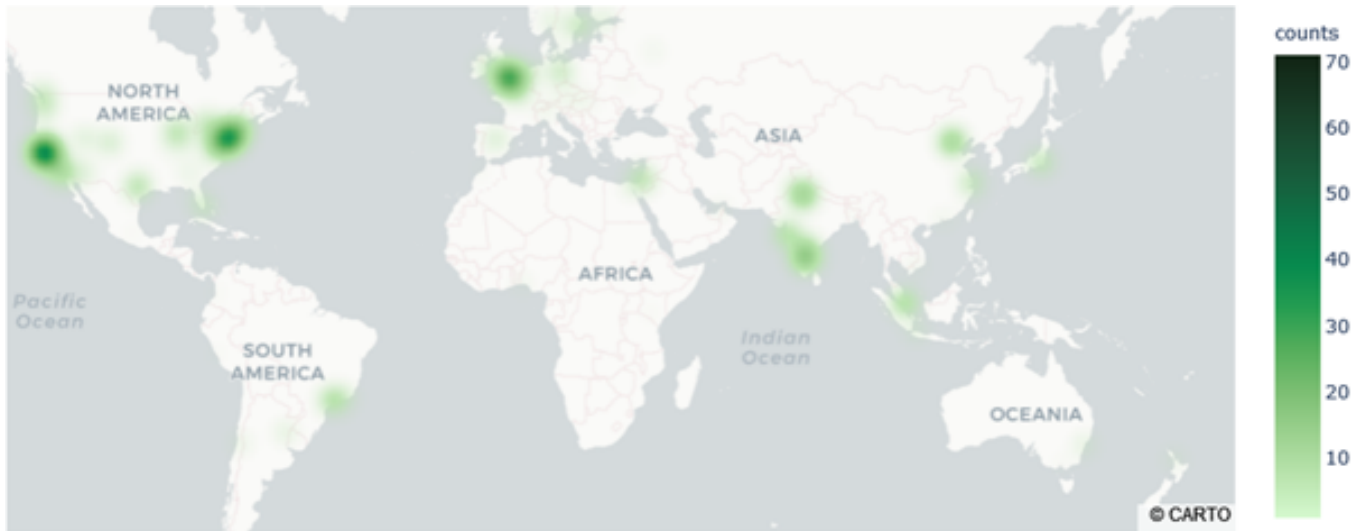


Fig. 2. Geographical spread of the top 1000 EdTech companies on Crunchbase

#### 10 Universities provide an open platform for discussions and exchange for shaping parts of society.

Universities have long had the role of furthering academic discourse and the diversity of ideas [27]. Since the importance of knowledge, research, and innovation are growing in our society, higher education is also increasingly seen as a crucial component in developing societies globally [28]. In our (politically) polarised era, higher education institutions should continue to be places where controversial ideas can be expressed and challenged [29]. Further, universities may also consider their role in preparing students to engage in such civil discourse as well as in ensuring free speech and just access [30].

“Universities should uphold strong principles and a moral compass by enabling discourse on causes that are currently discomfiting, unpopular, or contrary to the mainstream.” [31]

#### 11 Universities are role models in responsible leadership.

Graduates today demand purpose within organisations, meaning they desire to adequately develop their responsible leadership skills [32]. Meanwhile, there is an ongoing debate between corporations that expect graduates to be better prepared for the world of work and academia, which has traditionally seen itself as being in the key role of providing solid “classical” education. The shift is however evident with universities starting to play an active role in nurturing and developing students’ skills.

“Students need to “learn to think” – a university education should provide them with a broad and generic foundation, backed up by the right mix of theory and practice.” [33]

Arizona State University’s W. P. Carey School of Business present a recent example of a university playing a more active role in developing leadership skills. The school’s career services team innovated

by “shifting from a short-term ‘transactional’ career services model to an integrated approach that serves students throughout their careers” [34]. The structured career programmes span across the entire duration of study from Bachelor, to Master, to MBA programmes and offer continued support for university alumni. The approach involves running bootcamp-like training at the beginning of studies. In the bootcamps students define learning goals for their studies based on their understanding of personal traits, motivations, and strengths. The programmes are also supported by career planning courses, employer meet-and-greets, and specific industry information to provide the right level of role-modelling.

#### 12 Even dropouts use the epistemological and entrepreneurial foundation of universities to build their tech or knowledge ventures (e.g., Apple, Facebook, Microsoft).

There is a positive correlation between the level of education and an ability to spot opportunities, thus leading to higher lifetime earnings. Therefore, universities are the right place for growing and nurturing entrepreneurs, even if some of them choose not to bring their graduation to conclusion, including Facebook’s Marc Zuckerberg and Microsoft’s Bill Gates who both famously dropped out of Harvard or Michael Dell who left the University of Texas at Austin to found Dell Computers amongst many others.

Research suggests that across countries university graduates are more likely to start a new business than those without a university education [35]. Similarly, Forbes’ profiles of young innovators and entrepreneurs, also show that most individuals are university graduates [36]. Overall, a university degree is likely to improve outcomes substantially and dropouts remain the exception among the population of highly successful people [37].



### 13 Universities are increasingly evaluated on rankings and ratings in lieu of qualitative evaluation.

University stakeholders – students, sponsors and funding institutions, owners and society, research partners, faculty members – often want to know how their institution compares to others. Rankings, ratings, audits, impact factors, objectives, and performance mandates ('Leistungsaufträge') are increasingly replacing qualitative evaluations and discussions of universities. This has been important to fulfil requirements and allow for benchmarking. Such a performance orientation is in many ways a necessary condition for international reputation. But new questions arise: How free, autonomous, and creative are these performance-oriented institutions? What are the conditions for a culture of sustainable creativity [38]? Does the corporatisation as well as market- and efficiency-orientation at contemporary universities lead to blind spots and lack of real invention for society? Is it important to set counterweights to prevent over-engineering and speed as well as increase reflection capabilities at universities [39]?

There is no simple answer when institutions are striving towards excellence and global reputation. The right balance will remain critical.

### 14 Universities continue to have the role of thought-leadership in society. They set cultural trends.

When universities were first established, Humboldt offered "cultivation of the mind and character" and "well-informed beings" as an educational ideal [40]. Today, research and practice show that university graduates not only earn more but are also more likely to be politically and socially active members of societies [41].

"Universities' ability to continuously bring new perspectives from different and unforeseeable angles make them crucial partners in the search for trend-setting." [42]

Even within a university context, the topic of identity politics, e.g., conversations about race, class, sexuality, and other identities are often uncomfortable and difficult. Shifting student demographics necessitate mastering these conversations; increased enrolment of historically underrepresented students among other changes imply that faculty members must gain facility in discussing identity and that talking through contentious issues is a skill that should be fostered in students [43, 44].

To address the increasing polarisation of society in many areas, there is a need to maintain the core values of higher education institutions.

"Free speech and academic freedom are core values for our universities. Disagreement is a fundamental part of debate and has been key to advancing knowledge and gaining different perspectives on everything from ethics and history to genetics and theoretical physics." [45]

It is a core role of academia to stay critique, search for truth, irritate existing routines and institutions, promote free discourse and communicative rationality. In doing so it contributes essentially to the building of a reflective and learning society.

In Humboldt's time universities were elite institutions, today we have mass education. Since knowledge is freely available, universities could reprise their role as a think tank for society. Universities will be requested for more thought-leadership for regional, national, and global challenges.

Humboldt's education of autonomous individuals is no longer enough. Instead, it might be time to rethink the role of universities and higher education considering the above theses. As expected, more questions than answers arise. Higher education but also each university within its heritage and uniqueness must find its specific answer.

Thanks to their research and socio-pedagogical role, universities act as catalysts for ideas and problem-solving. The wider social role of universities can be realised through their contribution to the sustainable development goals as well as grand societal challenges like poverty and inequality, as well as climate and political tensions.

### 15 Automation will increase the need for higher education as more people will become knowledge workers.

Today, over 40% of all 25 to 34-year-olds in OECD countries are university graduates, which, on the one hand, decreases the value-added of a university degree. On the other hand, it also means that a university degree is becoming a must-have in finding a job in many sectors, indicating that it is crucial.

Due to the changing labour market, with more and more skilled trades being replaced by technology and automation, the resource of knowledge will become more and more essential for new job roles. Some estimates suggest that around 1.4 million people will lose their jobs in the US by 2026 due to automation [46]. Other sources even state that 30% of jobs (in 29 countries surveyed) will be threatened by automation by 2030 [47, 48]. However, there are also signs that these jobs will not be lost but instead be replaced by different jobs [49].

These changes indicate that employees are increasingly likely to become knowledge workers who will need access to knowledge. Especially areas where algorithms and artificial intelligence are limited in their ability to replace human work, such as in creativity and relationships, will likely be in increasingly high demand.

"Education has to be transformed so that higher education, which more people will need in an automated world, becomes more affordable and more accessible."

Recent research shows that university graduates score very highly across most skills considered to be particularly relevant for the future: cognitive, interpersonal, self-leadership, and digital skills. This means that today's university graduates are already better prepared than those without a degree to deal with the challenges of tomorrow. Nevertheless, more must and can be done by universities. For instance, expensive tuition fees should not be an exclusion criterion for denying people access to jobs.

"The Golden Age of universities in the developed world is passing and life is becoming tougher. Rising costs are no longer matched by a willingness of governments and students to pay for them. And yet the traditional operating model of a university cannot

produce sufficient productivity gains to cover the gap.”

For quite some time now, public funding for universities has been in decline. This has been accelerated by the pandemic, which is also causing students to reconsider the value of an education that is now conducted increasingly online or in hybrid models of teaching.

Simultaneously, competition among universities in international rankings is rising and is strongly driven by their research prowess. This indicates that universities should indeed value research highly. However, such investments may need to be weighed against investments into new technologies that could both create an additional competitive advantage and help to reduce costs while changing to online or hybrid learning models.

Swiss universities are primarily funded by the public sector. However, they are increasingly obtaining private financing as well. It is important to note that private financing of universities in Switzerland is still well below the average for OECD countries. This highlights the opportunity to further review Swiss universities’ funding strategies.

In this context the debate about whether knowledge should be freely available or paid for by private consumers becomes extremely prominent.

#### 16 Digitisation has multiplied the speed of change in organisations by factors, humans are not able to accelerate at the same speed. Continuous/lifelong learning will play a key role in education in the future.

The half-life of knowledge is decreasing as digitisation increases the knowledge intensity in all sectors. This non-linear growth of knowledge can be seen in the doubling of available knowledge every few years. While knowledge increases exponentially and its half-life decreases, there are major differences, especially between operational expertise and IT-related expertise. While business knowledge has a half-life of 4 years, this drops to 1.5 years for digital technologies [50]. These tendencies demand regular retraining:

“80% of CEOs now believe the need for new skills is their biggest business challenge.” [51]

Speedy reskilling is in many ways only possible thanks to virtual technologies. A human-centric adoption of new and existing technologies is a key enabler for efficient communication and knowledge transfer. By some estimates most students beginning their education today will ultimately work in jobs that don’t exist yet [46].

“A dual approach consisting of both practical experiences and academic research is fundamental for digitisation; digital knowledge must be matched with customer expectations and processes.” [52]

Further, digitisation is increasing the pace of work immensely. This is a result of many administrative tasks being automated away, thereby freeing up employees’ time for more content-related work. This also requires change on the part of employees, as Roshni Nadar, president of HCL technologies, explains:

“Digitisation has multiplied the speed of work by 20. But the speed of people did not catch up. We need

to develop our people to be ready for the new work.” [53]

#### 17 Problem solving and critical thinking become a core component for responsible leaders.

Responsible leadership is associated with value orientation and not advancing profit-oriented and personal goals at the expense of social and organisational goals such as stakeholder value creation and corporate social responsibility. Problem-solving in an academic setting aims to help students develop their ability to find socially responsible answers to grand societal challenges by applying value-based approaches. It uses pedagogical instruments like experimentation in a safe learning environment where individuals can make mistakes and adjust their behaviour to enable their development as responsible leaders.

Responsible leadership can be a specific learning outcome: Value-based decision-making can be learned in a classroom setting, which then hopefully leads to value-based actions [54, 55].

Regarding critical thinking, “a plea is made for a social constructivist approach of critical thinking as an educational aim.” Here democratic citizenship is defined as the ability to actively participate “in a pluralistic society in a critical and aware manner.” Above critical thinking per se, democratic citizenship requires caring, empathy, and commitment. Therefore, instead of learning the “tricks of arguing” or focusing on the “cognitive activity of analysing,” there is a need for instructional tools increasing student participation in real social practices and activities as well as critically reflecting on those experiences [56].

#### 18 On-campus, degree-focused learning, shifts towards interactive and experimental, practice-oriented, career-focused learning with specific outcome at the centre.

Universities have played an important role as centres of knowledge exchange. They are known to be places where diverse organisations and businesses come together to cooperate as well as challenge each other to devise new and innovative as well as creative solutions to the grand challenges facing society. Universities will be able to continue in this tradition if they actively foster collaboration and close interaction with real world challenges.

“There will be more cross-disciplinary courses and projects that will bring students studying diverse subjects together, like healthcare and engineering. This aims to empower students to respond to major societal challenges such as aging populations.” [57]

Such active engagement with real world challenges will also be instrumental in creating new centres of knowledge for highly salient interdisciplinary intersections. On the one hand, this might be accomplished by focusing education around deep-tech ecosystems where multiple technologies including advanced materials, artificial intelligence, biotechnology, photonics, robotics, advanced manufacturing, embedded software, and mechatronics are combined [58]. On the other hand, fostering learning around real world challenges as

outlined in the UN's sustainable development goals or other important issues like migration will also become increasingly important in the future [59, 60].

Looking at the structure of higher education formats over the past decades, which is characterised by an average of 4-year on-campus programmes, a clear degree-focused learning profile is prevalent. There is however a clear shift towards career-focused learning, which also goes hand in hand with new models of recent years, such as massive open online courses (MOOCs), industry-driven certification programmes, action-based inhouse learning programmes, and coding bootcamps. Today, you can already find more than 50 MOOC-based degrees, all focused on individual skills rather than entire degree curricula. EdX and Coursera for example currently offer 4800 courses as of Q2 2020 [61]. Central to this is the "unbundling" of degrees into shorter micro-credentials. The goal is no longer to have completed a certain curriculum, but to possess specific skills that can also be acquired individually [62].

Additionally, micro-credentials introduced by universities jointly with Coursera or individually offer the students opportunities to stock up the individual courses to a degree (CAS equivalent within Swiss higher education system).

Some thinkers suggest that micro-credentials or "nanodegrees" (a project and skills based educational credential) is likely to replace big part of degree and diploma programmes in the future. They argue that the aspiration to obtain a certain profession would be replaced by looking to build first skills for the right career start, followed by taking various skill-building programmes which would lead to quite diverse profiles, able to adopt for the changing labour market. Some companies like Google, Netflix, and Apple do not already require a tertiary education but look for a specific skill sets, meaning more employers might join in as they need less generalist profiles and more specific skills. The same report also suggests however that current demand for degrees is growing worldwide and thanks to its reputation to give a certain quality of education, traditional universities will not die away but rather adopt offering programmes equipped by technologies of the future [63].

## 19 Life-long learning requires shorter, skill-based programmes.

Looking at upcoming new job profiles and some of the current jobs' ability to be automated, based on new technology, asks for the expectation where future technology will go. It is relevant to ask what that means for what skills will be required.

Switzerland, like many developed economies, believes that "between 20 and 30% of all tasks may be automated by 2030, but a roughly equal number of new tasks may be created. Most displacement of activities could be seen in the retail and wholesale trade, manufacturing, finance, and public sector. These sectors account for about 50% of all salaried employees and around 60% of the GDP. Most jobs could be created in healthcare and technical and professional services" [64]. These numbers can be understood as a clear wake-up call, that a big set of job roles dramatically needs to change. The companies involved with the WEF declare that they intend to internally redeploy nearly 50% of workers displaced by automation.

Therefore, a reskilling revolution is going to take place within the next five years.

A lot of help is needed in terms of upscaling and moving into new industries and roles that are significantly more digital in nature. This speaks for a strong need for transformation of skills to match the rising demand for technological, social and emotional skills triggered by automation [64]. According to forecasts, health professionals (+48% predicted) and STEM professionals (+37% predicted) will see the greatest growth over the next ten years [64]. Now that increasing automation is demanding an increasing need for technological, socio-emotional and cognitive skills, Covid-19 is demanding for additional skills triggered by digitisation [65].

## 20 The increasing commoditisation of knowledge heightens the need for critical thinking and reflection.

"Proliferating information and viewpoints in the 21st century require an educated citizenry with the ability to think critically about complex, controversial issues. Critical thinking requires epistemic cognition: the ability to construct, evaluate, and use knowledge." [66]

In view of the volume of data and information, it is becoming increasingly important to critically scrutinise it and to use it in a targeted and value-added manner.

The demand for critical thinking and reflection can especially be seen through the rising demand for technical (e.g., data related) jobs. According to the WEF, technical skills needed in the future, will be: Technology use, monitoring and control, as well as technology design and programming. The skills critical for the emerging professions that will substitute the roles taken away by the automation predicted by WEF are data science, data storage technologies, development tools, artificial intelligence, and software development lifecycle (SDLC).

According to the OECD Skills Outlook 2021, in healthcare sector the demand will grow for nurses, home health and personal care helpers, physical therapists, medical and health services managers. In tech and data analysis the demand will be for statisticians, information security analysts, data scientists and mathematicians, software developers and software quality-assurance analysts and testers. Additionally, the report highlights the importance of transversal skills and amongst them, calls out the digital skills, e.g., being able to perform the jobs virtually [67].

## 21 Problem-centric learning gains in importance, e.g., case learning or learning by solving real challenges.

There is a trend of 'phenomenon-based learning' with students working on projects, either alone or as a team, to address complex challenges as a part of guided learning. Such interventions are not easily scalable and call for a different role of a teacher, as a facilitator who is able to help students structure such projects, learn certain material to support their project work and learning from possible experiments or mistakes, yet achieve project and learning objectives.

There is some experimentation going on already and "CODE University" could be mentioned as an example. It is a private University in Berlin with an offer of three technical Bachelor programmes

where the professors act as coaches and support student project work.

“The students work in groups to resolve challenges provided by partner organisations. Professors offer the content learning (lectures, workshops or alike) only on student-request. The students don’t have grades, they strive to develop their target competencies instead.” [68]

22 Lifelong learning is not an opportunity but a requirement to be part of a responsive society. Lifelong learning will be more concise and flexible, often part-time, and action-based that means learning with a real-world impact.

Lifelong learning is a topic that received heightened attention already over 25 years ago. In 1996 the European Union designated the year as the “year of lifelong learning” [69]:

“Lifelong learning is more than adult education and/or training—it is a mindset and a habit for people to acquire. Lifelong learning creates the challenge to understand, explore, and support new essential dimensions of learning.” [70]

The rise in demand for further education is accompanied by increased demand by employers for continuing education for their employees to cope with ever-changing work environments. Increased pressure on employees to always stay informed and properly trained, can be observed through the increase in non-formal education across the European Union over the last decade. The EU observed that in 2007 31.4% of the adult population received an upper-secondary or post-secondary non-tertiary education as compared to 40.3% in 2016, which equals an increase by 33% [71].

Lifelong learning needs to move from sterile classroom environments to practical applications for learners to see immediate impact in their day to day lives. This goes hand in hand with the smaller, but more frequent learning exposures through micro or nano degrees. This can be observed on one hand from the students’ behaviour. Less students would be ready to invest in full-time degrees but rather would look for “micro-credentialing, competency-based education, nano-degrees and curated degrees” [71]. On the other hand, this also offers the advantage to adapt individual life situations and learning paces:

“Self-directed and flexible digital learning tools such as micro-credentials, tutorials, and web-based courses, allow individuals to learn at their own speed and become involved in topics of their choosing where they see real-life implications.” [67]

The described practical learning can take different forms, which offer different advantages for students, institutions, and partners alike. For example, real life examples could be used, to solve pressing issues for partners, while offering students real life exposure to actual business or scientific challenges. This has adapted to different forms of learning experiences:

“Modern learning experience designs include inquiry-based learning, project-based learning, challenge-based learning, phenomenon-based learning, and personalised learning.” [72]

23 Industry needs shorter, skill-based executive-type programmes from education. These should be organised as a continuous learning journey more so than an episodic intervention via today’s CAS or master programmes. At the same time the breadth and depth of learning must be taken into consideration.

Lifelong learning does not just affect the point in time or career of learning, but also the type and exposure to the learning objective. Nowadays, intervals of learning such as CAS or master programmes extend the learning journey. In the long run, it is not enough to have intense, but short intervals of learning, but more of a continuous learning experience. This is especially true for skills which require a longer but less extensive exposure to be adapted (e.g., leadership skills) or skills which must continuously be updated to changing technical requirements.

Some universities may offer a subscription model, when students would get lifelong access to various programmes included into initial tuition fee or offered at study completion at a discount [73].

Others will increasingly collaborate with public and private sectors to ensure retraining before job dislocation is taking place or support the individuals in the key moments of their employee experience, like on-boarding with a new employer or changing a role with current employer.

24 Most students entering the education system today will ultimately work in jobs that do not exist yet.

As technology advances it also enables the creation of entirely new jobs. We do not currently know what precisely the jobs of the future will look like [74]. While this has been true for many years now, current advances in artificial intelligence and machine learning are having a substantial impact on the kinds of skills and competencies that will be required in future jobs. Indeed, these advances mark an acceleration of these shifts in skills [75]. Further, it has often been discussed that automation will lead to the elimination of many tasks or even jobs, but of course these technologies will also create many new jobs.

“Countries that leverage education to create attractive locations for companies will gain a competitive edge over their static neighbours.” [76]

Universities can play a crucial role in preparing students for the jobs of the future. They can be instrumental in helping employers to redeploy, upskill, or reskill people. Universities may support these endeavours by fostering the most needed skills including technological and digital skills, which will be essential for developing and managing these new technologies. Importantly, they may also be helpful in advancing uniquely human abilities, e.g., empathy, imagination, creativity, and emotional intelligence [76].

- 25 A mindset of curiosity, adaptability, growth potential, and emotional intelligence becomes relatively more important than technical skills and knowledge.

The following top global skills are identified by World Economic Forum for 2025 [77]:

- Analytical thinking and innovation
- Active learning and learning strategies
- Complex problem-solving
- Critical thinking and analysis
- Creativity, original thinking

The employers look for such attributes in candidates as emotional intelligence, resilience, and integrity, those are however hardly the characteristics that universities select prospective students for or help the existing ones to develop [78]. The ability to adapt, future growth potential, and cultural fit are more important for many corporations than hard technical skills (e.g., programming or analytics). Companies like Google, Amazon, and Microsoft all emphasise mindset at least as highly as technical skills. But do universities prepare students well enough regarding this mindset?

“Data is to inform, but it cannot answer any question. You have to take the data and make a story out of it.” [3]

One side of the coin is to have the ability to understand the amount of data you gain, but the other is to have the critical mindset and skills to act responsibly based on the data. To have data alone is not enough.

According to their CEO Roshni Nadar, HCL Technologies hire the brightest pupils in rural areas of India directly from school and put them on the job to survive. These so-called ‘tech bees’ are highly productive, often better than their peers with degrees. During the next 10 years most of these students are promoted to conduct a part-time bachelor’s degree.

Overall, we can therefore note that the abundance and ever-increasing volume of data due to the impact of AI and automation means that it is not knowledge that is the differentiating factor on the job market, but rather that it is becoming increasingly important to handle data and information responsibly and in a way that adds value, and to use them correctly. Soft skills are needed for this:

“Environment where access to information is immediate and free, shifting the focus toward active learning pedagogies that place a premium on collaboration within diverse teams in a project-based and peer learning environment.” [79]

Universities must contribute to students acquiring these soft skills. Stanford University provides a very good example of a modified, updated curriculum to integrate soft skills and problem-solving skills in a new course on Problem Solving in Biology that “has students design experiments to develop cures to real- world pathogens such as Lyme disease and HIV, using authentic data from scientific literature” [79].

- 26 Problem-solving capabilities need even more focus on academic mindsets, e.g., curiosity, learning, experimenting.

Due to the ongoing and accelerating change driven by technology and digitisation, new problems and issues are constantly arising. The paradigms under which we work are changing so rapidly that it is necessary to constantly solve new challenges for which there is as of now no answer and no existing knowledge to fall back on. Instead, a “scientific” mindset is even more important to be flexible and with a mindset willing to discover and learn new things and to develop a creative solution in iterative steps.

“More than any particular content area, curriculum needs to help students develop the capacity for ethical reasoning, for awareness of societal and human impacts, and to be able to comprehend the impacts of the fourth industrial revolution technologies on people, so they are trained to not only increase our material prosperity but also to improve our social and cultural fabric.” [79]

- 27 Being able to work in teams is a core skill which should be more actively developed in universities.

Not only is great research done in teams, as already mentioned, but also in many other industries working in a team is the way to go. In addition to teams within a department, this can include collaboration in interdisciplinary, agile teams or across departments and industry boundaries.

“No matter how brilliant your mind or strategy, if you’re playing a solo game, you’ll always lose out to a team.” [80]

Teamwork is understood as the process “where two or more employees interact interdependently toward a common and valued goal or objective, and who have each been assigned specific roles or functions to perform” [81].

However, being able to work effectively and efficiently in teams needs to be learned and developed, and higher education is an important place for this. It is helpful for students to move from the passive role of listener to an active role. Because the right composition of teams, the dynamics, the organisation or, leading of teams can be learned over time. At the same time, project work in teams together with partners from practice, for example, can also create added value for them and with them.

To work most effectively in teams, it is important to create inclusive teams and a psychological safety, i.e., a setting in which everyone can develop and contribute their best [80].

- 28 Skills and competencies must be developed instead of knowledge, embracing technology, higher cognitive, and social skills.

The needs have a lot to do with the skill profile of the future versus past students. Thinking about a university the other days was primarily just knowledge. But that will shift.

“Knowledge will become relatively less important, skills and mindset will become more important, especially if we think of the social responsibility of students, someone who is a critical thinker.” [26]

These are aspects students do not learn with knowledge or in traditional lectures. Instead, these skills are trained in peer-to-peer interactions and with mentoring. There will be fewer professors teaching, but more professors acting as counsellors and mentors focusing on skills and mindset rather than transmitting knowledge. Much of the knowledge may in future be acquired through online courses. Students from the leading universities should develop a critical mindset, scientific thinking, an ability for reflection, but also social and leadership skills. Those skillsets are not acquired through online teaching, but through peer-to-peer interactions moderated and coached by an instructor or professor. Classroom interaction will continue to be instrumental here and in-person interaction will be highly relevant.

Interestingly, student preferences regarding the mix of teacher-led instruction versus online learning appear to change as they progress in their academic careers. Early on, students often prefer teacher led instruction. As they strengthen their academic experience and performance, they become increasingly inclined to take control of their learning journey and move towards online teaching formats and blended learning environments. According to Fiona Godsman, the Chief Executive of the Scottish Institute of Enterprise:

“Students will still need to gain the fundamental knowledge of their chosen discipline, just as everyone needs numeracy and literacy skills. The acquisition of knowledge will not be the main purpose. Universities will provide an environment where students learn to be collaborative, creative and flexible, and to apply their knowledge in diverse ways.” [82]

- 29 Covid-19 forced rapid remote learning overnight. In future, universities should prioritise the right modalities in terms of online/offline/hybrid teaching to optimise the mixture of anytime/anywhere learning and personal interaction.

The Covid-19 pandemic precipitated a crisis resulting in high unemployment, decreasing funding for higher education, and rising socioeconomic inequity [83]. Many organisations froze their budgets, introduced hiring freezes, and began cutting costs in various ways including with layoffs. Uncertainty has soared and remains high, world economies have been destabilised, and many have fallen into the deepest recession since the Great Depression. Simultaneously, many new opportunities have arisen, especially for start-ups, resulting from the exponential growth in digitisation of working life and learning.

The pandemic together with protectionist political interventions has led to a slowdown in the free flow of goods, services, and people. That rollback is estimated to be temporary and does not mean an end of globalisation. On the contrary, Covid-19 has accelerated ongoing technological shifts such as the adoption of e-commerce, videoconferencing, and robotics in various economic sectors [84]. There has also been an increase in the usage of various technologies

including team-based platforms, AI, robotics, augmented reality, and others. These shifts are believed to strengthen globalisation further [85].

Looking at Switzerland, the use of the internet for learning has tripled over the last 10 years. The internet is mostly used to access learning material or communicate with teachers or students on internet portals rather than taking full classes online [86]. For the first time, every student and every professor is now experienced in teaching and learning online [87]. Indeed 87% of teachers reported their ability to use education technology has improved in these Covid-19 induced lockdown months [88].

The Covid-19 induced version of remote learning was by no means best in class and was characterised by a rush to create courses and transition to online teaching at breakneck speed. The question of how to use experiences gained during the Covid-19 lockdown in a more strategic and sustainable way remains [89]. How can universities bring more digital elements into residential education and how should universities think more intentionally about hybrid or online offerings? It will be essential to not simply follow others' examples, but to clearly position these offerings and combine them with the university's core competencies to create a unique value proposition that allows differentiation [90]. This is important since the expectation is that online education will quickly become commoditised. In turn, it is unclear whether students will choose to learn from a select number of well-known institutions or whether there are opportunities for regional excellence and domain expertise, in the same way that the university market has had regional domain excellence in in-person residential education.

Looking at the US education landscape, universities are increasingly investing in digital learning. For example, Georgia Tech introduced an online master's in computer science, that costs only one sixth of the campus price. As a university, it is suggested to focus on two to three core fields, put all energy in those and try to scale. Another example includes leading UK Universities (LSE, UCL, Berkley and others), introducing fully online master's degrees starting from Spring 2021.

Competitors will likely offer programmes drawing some potential students away from traditional universities. There is, of course, an opportunity to do the same. It is also potentially possible to double down on this trend of online teaching. For instance, it might be possible to create a European platform for premium business education with a consortium of top universities. This could serve not just the region but become an important player globally. Individual universities would own a portion of the platform and at the same time be able to offer a more holistic programme to potential students.

While learning has become increasingly available online and enabled some students to attend courses that they wouldn't be able to attend otherwise, the digital divide remains a problem. It makes higher education inaccessible for some students with limited internet or technology access. It is believed to have caused a decline in US undergraduate enrolment of 3.9% in the fall 2020 semester. Some solutions recommended to universities include surveying the students or even prospective graduates about the technology available to them, and in special cases providing support with desktop, tablet, or internet access [91, 92].

Regardless of these trends, education will remain highly important to Gen Z as it will continue to be an important path toward a stable life and good career. Gen Z will want jobs with purpose and meaning, intensifying a trend already started with the Millennials. It is interesting to see how technology can support the various points along the learning journey, as Gen Z increasingly enjoys personalisation and is more likely to adapt non-traditional learning methods. This personalisation does not stop with learning, but also includes support services and guidance on the way. The decision is not simply about completely digital or completely in-person, it is about the classroom experience and what characterises true engagement with peers and faculty [93].

Gen Z learners expect in-person activity and teacher-led learning; they also value it higher than millennials. Yet Gen Z is not homogeneous: Some Gen Z learners are entirely open to fully digital learning, whereas others still value in-person learning. Interestingly, this trend of both digital and in-person interactions gaining in relevance predates forced moves to online teaching during the pandemic. For instance, at one large public university in the US, even before the pandemic, most students lived on campus but many followed classes exclusively online. These students lived on campus for the residential experience only and chose to learn online [94].

Overall, the digital divide will be an important consideration not only for current but also for potential students, and especially in the context of possible offers of online/hybrid programmes.

- 30 This phase of pure online education also showed that universities need to physically meet to create a common context and culture. Deep empathy, social serendipity, and spontaneous ideation require in-person interaction.

Many educators had important positive experiences teaching online during the pandemic. These formats allow for increased flexibility and enable independent learning with students being able to adjust the pace of learning especially with asynchronous lecture-style content delivery.

However, educators' experiences during the Covid-19 pandemic also highlighted various shortcomings of teaching exclusively online [95]. For instance, teachers encountered issues because students are not familiar with learning online. To thrive in such environments students often need to be more proactive about asking for support and feedback throughout their courses. More broadly, online teaching can be a challenge for student engagement, which manifests in different interdependent domains including social, cognitive, collaborative, emotional, and behavioural [96]. Specifically, both cognitive and collaborative engagement suffer because interaction with both the educator and other classmates is much more limited than in in-person sessions. Similarly, social and emotional engagement also deteriorate with online only learning since students have a harder time connecting on a more personal level, which would normally positively affect learning attitudes and increase interest in learning. Further, online teaching also makes it harder for educators to cater to students' individual needs and to foster holistic learning because students miss out on more practical and applied learning experiences that usually take place during in-person sessions.

In terms of designing the physical space where such holistic learning can take place, universities will want to create conducive workspaces that foster higher cognitive performance and design spaces that can cater to different learning and working styles as well as foster safe interactions, well-being, creativity, productivity, and inclusion [97].

- 31 More learning happens by doing and working alongside accomplished practitioners, counselling, mentoring, coaching, teams, peer to peer, immersion experiences.

Interactive and in-person teaching will continue to be highly valued in the future. This is especially true for the next generation of learners who value personal contact very highly [98]. Additionally, the Covid-19 pandemic has accelerated the movement toward providing one-way instruction, i.e., lectures as learning videos that make learning more flexible. This means that in-person sessions can and should be structured differently now. Sanjay Sarma, MIT's vice-president for open learning, notes:

"We don't want to waste our proximity on one-way stuff," he says. "It has to be two-way learning." [99]

Interactively teaching with practitioners may also require structuring learning differently. Practitioners often lack explicit didactic frameworks to deliver content to students. Academics may be able to offer support here by (co-)developing suitable didactic frameworks that allow for optimal learning using practical input.

Interestingly, such close interactive education may also limit the scaling of teaching. For instance, MOOCs—intended to teach wholly online—have found that learning success hinges on interactive student support. However, such support is not inexpensive and online teaching costs, especially when geared toward effectively teaching diverse student populations, may indeed be about equal to the costs of effective residential learning [100].

- 32 Massive open online courses have not disrupt universities yet, nor truly democratised knowledge. Successful MOOC students are often well-educated students, with an existing degree. Coaching and personalised interaction is especially important for disadvantaged students.

One of the main reasons that MOOCs have so far failed to truly disrupt universities is that they are not yet able to attract students from diverse enough backgrounds. Specifically, past research has shown that the vast majority of MOOC learners are college degree holders and employed with an early study reporting that almost four in five students had a Bachelor's degree or higher and around two in five students had a level of education beyond a Bachelor degree [101, 102]. Some of the key reasons why students fail to complete their MOOC courses include lack of time, lack of motivation of learners, lack of interactivity in MOOCs, lack of knowledge and skills [103].

Most students generally fare less well in online courses than in on-campus courses. Further online learning has been shown to be especially challenging for comparatively disadvantages students such as those who are first-generation college students, students



from low-income families, and underrepresented minorities [104]. To recruit an inclusive student body to MOOCs and to successfully offer online courses in general, it will be essential to provide excellent student support [105]. In particular, while some online interventions may be helpful, research has indicated that in-person interactions with advisers, tutors, and peer groups are the most effective student supports [106].

### 33 Shift from linear academic work streams to project-based learning and teaching rhythms.

Younger digitally savvy learners and older learners interested in continuing education will likely meet in one classroom in the future. Fluid careers especially in the corporate world and the consideration of universal income might lead to older learners returning to the universities at later stages. With these different learners converging in classrooms, the teaching format will likely have to adapt. Figure 3 below provides an overview of some key characteristics of Gen Z learners and their implications for learning.

An important change will likely be that Gen Z students prefer more non-traditional classroom experiences. This means that there should be less rote memorisation and fewer lectures held by instructors with limited interaction. Instead, these students will demand problem-based learning, peer-teaching, inclusive classrooms with differentiated instruction. Consequently, teaching will have to provide personalised learning modules with project-based learning that is also able to take advantage of new delivery modes.

### 34 With the impact of intelligent automation/AI, digital skills become the standard for academic teaching and learning.

As artificial intelligence and intelligent automation become more commonplace in our world, we will see an acceleration in the shift in skills needed by our workforce more generally. McKinsey estimates that higher cognitive skills, social and emotional skills, and especially technological and digital skills will gain in relevance vis-à-vis physical and manual skills as well as basic cognitive skills [75].

Digital and technical skills are also going to continue to gain in relevance in the higher education sector [111]. Specifically, the European Union has already implemented the Digital Competence Framework for Citizens (DigComp), which intends to provide advice on how to support digital competence building, especially through education [112]. DigComp is currently being updated to address emerging topics and themes in the digital world including the effect of artificial intelligence [113].

### 35 AI and learning analytics become core of learning, allowing personalised learning journeys.

AI in education is an increasingly relevant topic and research interest has been growing dramatically in this area over the last several years. Seventy percent of all papers on “AI” and “Education” in Web of Science and Google Scholar have been published since 2015 [114]. Furthermore, AI is increasingly being applied within education. For instance, in the US education sector, AI is expected to grow almost 48% from 2018 to 2022 [115].

We understand AI as “the science and engineering of intelligent machines” or “a machine that behaves in a way that could be considered intelligent if it were a human being” [116]. This goes beyond learning analytics, which refers to the “measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environment in which it occurs” [117, 118].

Having this in mind, one can imagine AI in different functions in education. First is the automation of administrative tasks. This could be the case in admission of new students or in the grading and assessing process of exams and homework or providing feedback [114].

Second is instruction and intelligent tutoring. This covers the compilation of the syllabus and simultaneous analysis of the content to propose customised content. This means personalised learning, understanding what students want to know and how they learn best and thus offering the materials in different formats and teaching methods [119]. This also includes chatbots that can answer questions directly or online computer-based robots with conversational and dialogue abilities. Thus, one-on-one human instruction can be reproduced, with personalised real-time feedback [120]. This allows for more effectiveness, efficiency, and relieves teachers in that it allows them to focus on relevant, implementation-related areas. At the same time, these learner-centred programmes increase effectiveness because content is in line with learner capability needs.

Third, AI has important functions in learning. AI makes it possible to detect shortcomings in the learning process and to address them individually at an early stage. In this way, the learning status is permanently monitored, and adaptive interventions can be made. It allows to gather data from learners and, on this basis, to estimate and adjust the learning progress. Studies such as Wang et al. (2020) show that this type of adaptive learning allows students to perform better than with purely teacher-led instruction [121].

These potentials do not necessarily imply that teachers will be entirely superfluous and can be replaced by AI. On the contrary, these changes indicate that teachers will be able to take on new roles that are especially important for providing guidance and explanations:

“The professor’s role would be to guide, support, and mentor students, helping them to understand what they have learned, why it’s important, and how it can be applied in the real world.” [122]

This enables a shift from a “one-size-fits-all approach to personalised learning in terms of both content and methodology” [123].

### 36 The automation of teaching and learning analytics allows intensification of fully student-centred learning processes.

Customer-centricity can be seen as state of the art, when looking at the leading marketing and product innovation literature. Where customer centricity was introduced into the economy decades ago to sustainably compete, the student focus is now also becoming increasingly important in the education sector. Thanks to new technologies and specifically AI, it is possible to put the student at the centre of the learning journey. This makes it possible, on the one hand, to improve the content of the curriculum and the way in

What characterizes Gen Z's perspective on learning and employment		Implications for learning
Gen Z is individualistic	<ul style="list-style-type: none"> <li>• Gen Z does not like conformity but rather appreciates individualistic approaches</li> <li>• Values personalization in every aspect of life</li> </ul>	Learning as well as career paths need to be personalized and allow for individualism
Educational experiences powered by technology	<ul style="list-style-type: none"> <li>• 59% believe technology can transform the way college students learn in the future</li> <li>• 54% say that technology can greatly enhance the college learning experience</li> <li>• 49% like to use interactive learning apps or games to learn</li> <li>• 55% say YouTube has contributed to their education</li> </ul>	Delivery needs to be enabled by technology (e.g., mobile, VR, gamification)
Plan to seek higher education	<ul style="list-style-type: none"> <li>• 1 in 2 Gen Zs will be university educated compared to 1 in 3 Millennials</li> <li>• Believe education is key to finding a good paying job</li> </ul>	Need to offer continuous learning which also has signaling value
Non-traditional classroom experiences	<ul style="list-style-type: none"> <li>• Less rote memorization</li> <li>• Lecture and the infallible teacher replaced by problem-based learning, peer-teaching, inclusive classroom, and differentiated instruction</li> </ul>	Personalized learning modules with new delivery models
Hybrid and teacher-led experiences	<ul style="list-style-type: none"> <li>• 57% prefer in-person activities with classmates (against 47% of Millennials)</li> <li>• 39% prefer learning with a teacher leading the instruction (against 25% of Millennials)</li> </ul>	Delivery models need to allow for in-person activities (e.g., hybrid) and teacher-led instruction
Aspire to high impact employment	<ul style="list-style-type: none"> <li>• In a first job, Gen Z seeks career growth and fulfilling work</li> <li>• 51% of Gen Z economics students in Switzerland report that their main career goal is to reach a management position</li> <li>• 2x as likely as current workers to define success as making an impact on the world</li> <li>• Would like fewer job changes than Millennials</li> </ul>	Continuous learning and leadership development become increasingly important

Fig. 3. Characterisation of Gen Z's perspective on learning and employment [98, 107–110]

which the content is delivered, as well as the assessment and the corresponding individual focus on identified weaknesses and their countermeasures [121]. The times when the professor was at the centre of attention as a mediator of knowledge are changing to the extent that it is now possible to record in a way that is tailored to the needs of the students. This also includes chatbots that can answer questions directly or online computer-based robots with conversational and dialogue abilities. Thus, one-on-one human instruction can be reproduced, with personalised real-time feedback [120].

This brings along a change in the role of a professor as they will now have more focus wherever guidance and explanations are needed:

“It is not about teaching. It is about learning and the transformation of participants.” [26]

This shift asks for a focus on the engagement of participants. Since it is no longer a matter of habit for learners to gather around a professor to absorb knowledge, the question of what drives student engagement is increasingly being asked.

According to KPMG Survey, conducted in 2020 “most institutions said they could design student journeys (73 percent) and were co-designing learning pathways with students (69 percent), but some have more work to do to better integrate their ecosystems for education, research, and knowledge exchange, with just 60 percent reporting good or excellent execution in this area” [73].

37 EdTech is more than digital learning; it is a way to digitally optimise the entire student and faculty experience.

Due to Covid-19, many have jumped on digitisation related to digital learning, yet it is important to remember what digitisation means across the entire student or faculty journey. For example, in any other industry digitisation will start with a complete value chain map of every component that can be digitised. In the education sector, productivity gains should, therefore, also be possible far beyond the lowest hanging fruit like online degrees. Aside from new credentials and shorter courses, the student journey supported by university processes including enrolment management, success monitoring, and achievement assessment (e.g., automated grading), as well as many administrative functions such as IT and HR can be improved with increased digitisation. As result, the critical question arises of how to make sure, that those parts of the organisation are as advanced and productive as the same functions in the private sector.

“Take a much broader view when you think of your future digital university than just your online course.” [26]

Most universities get excited about marketing and student acquisition. For instance, universities that are online for some time have very sophisticated recruitment, digital marketing, and student acquisition algorithms. They get more sophisticated on who their

students are, whom they need to target and how to get a lot more ambition on front-end funnel of marketing spend. A lot of analytics spent can also be seen in student success, especially in the US. There is a shift towards student success and completion with better support of coaches and student counselling, beyond enrolment. Many universities increasingly invest in processes to use AI to drive better innovation of coaches and even giving nudges to people. Further, central administration tasks are increasingly digitised. The logic here is to:

“Always think to invest where your ROI is high.” [26]

Outsourcing should be common in this area, as it makes sense for traditional universities to specialise in their core activities, supported by customisable online platforms.

- Teaching
- Research
- Faculty training
- Libraries
- Turning alumni-networks into lifelong learner communities
- Student services (attraction, admission, exams evaluation like remote proctoring)
- Infrastructure, operations, management technologies (HR, IT, Finance)

### 38 AI enables new exploratory empirical research settings.

AI is also poised to have a significant influence on how empirical research is conducted in the university setting more generally. In many situations, including in universities, most data about products and processes are unstructured in nature. Estimates of the amount of unstructured data in most organisations range from roughly 80% to 90% of all organisational data [124]. Modern AI techniques based on machine learning methods in natural language processing, named entity recognition, as well as image and voice recognition are enabling entirely new ways to derive meaning from business documents, e-mails, images, audio recordings, journal articles, and social media posts. These methods are enabling both businesses and, importantly, researchers to conduct research using these newly accessible unstructured data sources, thus setting the stage for new research opportunities [125, 126].

### 39 Academic research must continue the search for truth in times of diminishing trust in science.

Universities have the potential to play a significant role in reducing social tensions and helping society to navigate the world of fake news and contradictory information [127]. In this journey, it is key that students develop critical thinking skills and an ability to reflect on information in a nuanced manner:

“I think the key to solving it is education. We should rely on the school system to help educate people to identify reliable sources of information and give them enough historical perspectives and understanding of the world and science for them to be able to have their own informed opinion rather than relying on social media.” [128]

The Covid-19 pandemic has intensified public mistrust of governments and institutions. Increasingly contradictory or misleading information plays a significant role in growing mistrust. Today, information is growing exponentially. This means that the need for the information to be qualified as a fact must speed up. Similarly, our definition of what the right expertise is to provide answers to the pressing challenges of our time is also changing [129]. Universities have the potential to take on the role of experts who can build trust and simplify public access to qualified information. The extent to which universities can fulfil this role depends on their capacity to conduct research on the most pressing social challenges, make this research available to the public, and provide context to possible implications. “Knowledge Bank” from the University of St.Gallen is an example of such an initiative, which may be built upon in the future [130].

At the same time academia is also under pressure of public value strategies and need to react to the increasing distrust of parts of the society in science.

Communicating knowledge to the public could potentially be channelled directly from universities, especially if communication is established through social media and partnerships with various leading media.

### 40 Interdisciplinary research is more strongly emphasised in the battle for funding; disciplinary research becomes more competitive globally.

Switzerland is ranked first globally in public and private research investment. Almost 30% of the R&D investments in universities are focused on exact and natural sciences [131]. But there is a re-organisation in how to compete for research funding: Funding is becoming ever more competitive and increasingly, interdisciplinary research approaches are gaining in relevance—although acquiring funding for the latter type of research remains a challenge [132, 133]. Business funding for Switzerland is growing fast. But having a differentiated look at where funding is going, things like engineering and technology continue to get greater share of the pie.

This growing interdisciplinarity can also be seen in how institutions are reorganising to compete in interdisciplinary types of schools: The MIT College of Computing, for example, has been outsourced as a new school with an interdisciplinary focus but is not a separate school [134]. It works together with the other MIT schools. Another approach is to launch grand challenges to answer societal questions through interdisciplinary approaches. This implies engaging the private sector—not on specific research projects—but to address societal grand challenges. The University of Michigan, for example, created a public private partnership that helps drive research and innovation [135]. It has a city to research on automotive connected vehicles. They engaged the regulatory environment to think about infrastructure etc. And they engaged around 60 industry partners like GM or Toyota, which is also money coming in from multinationals. Interdisciplinarity can also evolve by more collaborations.

41 While creativity can be a great strength of individuals, most great research nowadays is done in teams.

Historically, breakthrough inventions were seen to be the result of exceptional work done by lone ‘genius’ inventors. However, research has shown that teams generally outperform individuals when creating breakthrough innovations including highly cited scientific publications in science and engineering, the social sciences, and the arts and humanities as well as in technological patents [136]. Many fields such as biomedicine and high-energy physics already heavily rely on large teams. The importance of including all relevant stakeholders has also been highlighted for novel machine learning-based innovations in healthcare, where including knowledge experts, decision-makers, and users is especially important [137].

Of course, individuals can and do still play an important role. For instance, when inventions cannot easily be broken down into separate components or modules, individuals can indeed be highly successful innovators. This is the case in design patents where the invention relies on understanding and solving the underlying challenges holistically [138]. Further, research has also shown that individual creativity is an important precursor for team creativity [139].

42 Open science further accelerates research and its diffusion. This goes beyond expropriating publishers’ business models.

There are multiple schools of thought about open science in the academic literature: the infrastructure school (which is concerned with the technological architecture), the public school (which is concerned with the accessibility of knowledge creation), the measurement school (which is concerned with alternative impact measurement), the democratic school (which is concerned with access to knowledge), and the pragmatic school (which is concerned with collaborative research) [140]. Nevertheless, open science at its core is about the acceleration of research by sharing knowledge [141]. Open science has also been emphasised as an extremely important lever in accelerating research to address the Covid-19 pandemic [142]. Open science is intended to have a broad impact on society:

“Intergovernmental organisations across the world such as the European Commission, the European Parliament, the European Council, the Organisation for Economic Cooperation and Development (OECD), the United Nations, and the World Bank recognise the importance of Open Science to address the big societal challenges that humanity faces in the 21st century, such as climate change, public health emergencies, sustainable food production, efficient energy, or smart transport, among others.” [143]

43 Teams work well in diverse settings with a high level of psychological safety. Free thought and speech are the hallmarks of true research culture.

The vision of future of universities has two legs, one is research, one is education. On the research side, one should not mix up stress

with ambition. All big papers and research are done nowadays by teams. Teams work well when there is diversity, but also trust and collaboration. These facts reduce stress, but not the workload. This brings up the question how to create high performing environments that are less stressful, not leading to burnout or dysfunction in teams. These two things are not in conflict with each other.

“You could see a world where research is dominated by diverse teams, but where there is a high level of psychological safety.” [26]

The challenge we are facing is how to create this trust and team spirit someone wants to have to be a winning organisation at the end, in an environment that has much more personal interactions, also more natural disruptions as consequence. In a virtual environment without paying attention and being very thoughtful and deliberate about it, it can happen that these problems are increasing. It is not the digital world itself, it is the breaks and the little things in between that create the problem if they fall away.

“Regardless of digital or in person it is one of the moments that matter in terms of experience and wellbeing.” [26]

These are moments like for example the onboarding of a new researcher, the orientation of new students, the graduation moments, the feedback instructors are giving. Thinking about those important moments that provide a lot of value and how to do this irrespective of modality. There is some baseline that every leading institution needs to do, but the question is if this is enough or even needs to be differentiated. That should be prioritised amongst any other thing.

“But you will have a higher bar, if your goal is to be more diverse and inclusive and more digital.” [26]

From a bird’s eye view, it is about creating a positive, noncorrosive environment. McKinsey started a decade ago to move to a more positive, constructive feedback culture with the strengths-based feedback procedure. To create a more positive environment, that develops people as they are then more creative and productive in the end. The environment is becoming more demanding also in terms of innovation and therefore it needs thought how to create environments where people can innovate.

44 Research takes on a larger role in the creation of start-ups and work.

Universities represent a profound force for driving start-up creation and support [144]. The research conducted at higher education institutions has proven to be fertile ground for the establishment of new companies and jobs due to their unique ability to bring together highly qualified people from varied backgrounds in an area where experimentation and risk-taking are encouraged [36]. Academic research and knowledge spillovers, particularly start-ups and spin-offs of large research universities, empower the diffusion of innovation [145]. Supporting such entrepreneurial endeavours usually also generates returns for universities through one-off payments for research support, the establishment of a strong entrepreneurial alumni network, and building an elite reputation.

“If academic leaders realise that successful spinouts can be a powerful lever to reinvent their university

and make it better, then Europe will have an opportunity to [...] give birth to its own version of Silicon Valley.” [146]

Currently, US universities including Stanford, UC Berkeley, and MIT are uniquely positioned to produce the best platforms to support start-ups. They have achieved this through research support for product prototype development and by providing venues close to campus for newly established companies, thus keeping them close and supporting them along the way with further resources like access to talent, consulting, and further research [147].

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