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Universities 4.0: New powerhouses for regional innovation and global impact?

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About this report

The role of universities is changing rapidly as the world is faced with a long list of complex, interconnected macro trends and challenges. As policymakers seek ways to create more sustainable economies and societies, they frequently look to the worlds of research and innovation (R&I) for the human creativity, disruptive ideas and novel technologies to deliver solutions.

As global issues translate into local contexts –a more tailored, focused approach to generate real-world impact is both fruitful and needed. In recent years, the concept of regional innovation ecosystems (RIE) has come to the fore as a means to achieve this. Driven by policy initiatives, such as the EU's smart specialisation strategy, and supported by various funding instruments, RIEs bring together diverse public and private sector actors around a common agenda and objectives, seeking to translate research knowledge into innovation that improves citizens' lives, boosts competitiveness and inspires growth.

Historically, universities have made valuable contributions to these ecosystems through knowledge creation and skills development across different scientific and technological domains – the core attributes of the so-called "3rd generation university". Yet as the scale of challenge for policymakers shifts from problem resolution to systems-level transformation and co-creation, there is pressure on universities to evolve in parallel, moving towards what some are already calling the "4th generation university".

In this context, it is an ideal time to rethink RIE models and the roles of different actors within them. Given the breadth and scope of their activities, universities are uniquely equipped to be in the vanguard – not only as knowledge partners for governments, industry and other stakeholders, but also as diffusers of innovation and talent into global research systems and value chains.

The EU will soon begin deliberations for its next multi-year budget and strategy (2028-2035). Against this backdrop, could the 4th generation university concept inspire new approaches within the successors to Horizon Europe, Erasmus+ and Regional Development Fund, among others? And at the macro level, what role for RIEs and universities in boosting Europe's longer-term interests around industrial competitiveness, the green and digital transitions, quality of life and jobs, and regional sustainability?

On June 5th, 2024, Science|Business, in partnership with Elsevier and TU Eindhoven, convened a select group of senior figures and experts from across the R&I spectrum and university community to address these topics. Participants discussed the distinctive characteristics of a 4th generation university and how transitioning to this status impacts partnerships within the RIE system. They also delved into the challenges of defining and measuring value creation across borders and striking a balance between universities' local impact and their contributions beyond the scientific community.

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Conclusions and recommendations

The roundtable gave rise to the following conclusions and recommendations:

Characteristics of 4th generation universities

- The concept of a 4th generation university resonated well with participants, who recognised the need to better articulate the societal contribution and impact of universities working in close partnership with industry and the public sector.
- > 4th generation universities put a strong focus on impact through regional partnerships, enabled by their connection and contribution to the global scientific community.
- > Research excellence should drive collaboration. Universities should maintain their independence while collaborating with industry. Instead of simply following industry demands, they should lead the way, balancing challenge-based research with open academic inquiry.
- The new generation universities should go beyond the technological aspects of innovation and embrace the bigger picture, focusing on broader societal impact.
- > 4th generation universities may have different characteristics due to differences in their regional innovation ecosystems, such as their size, research infrastructure development and strategic objectives.
- > Both qualitative and quantities indicators should be combined to monitor and evaluate a university's performance, considering that the driving role of the university is often not immediately quantifiable.

Considerations for policymakers

- > Regional innovation ecosystems (RIEs) are undoubtedly core to Europe's competitiveness and nearly all successful RIEs have a research university at its core.
- > As well as boosting RIEs throughout Europe, cross-country collaborations are required to boost Europe's global competitiveness, with higher education institutions playing a key role in connecting innovation ecosystems.
- > Universities are well positioned to become central hubs for innovation due to their research capabilities and their role as portals for human capital. These hubs can help address the innovation divide between different parts of Europe.
- The public and non-partisan nature of universities enables them to be a driving force behind regional strategy development and a platform to convene both private and public partners based on shared challenges and strategic goals.
- > Beyond individual initiatives, a systemic transformation involving all stakeholders—regions, cities, industry, universities, and society—is needed. However, coordinating these efforts remains a challenge due to the large number of actors involved. Policymakers should engage with universities to foster collaboration between stakeholders.
- Incentives for academic spin-offs and start-ups to scale-up are crucial to overcoming fragmentation and underutilisation of Europe's innovative capacities.
- Innovation ecosystems should be well networked to facilitate knowledge transfer and reduce the innovation gaps between regions.

The role of regional innovation ecosystems should not be underestimated as Europe strives to boost growth and global competitiveness. Policymakers must address fragmentation, foster technological development, and lay the foundations for sustainable growth. Higher education is undoubtedly one of the pillars of prosperity. However, as the role of universities evolves, the question arises: what changes should they undergo to effectively respond to modern challenges, such as the green and digital transformations?

The concept of the 4th generation university defines a new approach to higher education, based on driving societal value creation in the ecosystem, partnerships between universities and industry, the integration of new technologies into education, and regional impact combined with global reach.

What is a 4th generation university?

The report "Towards the 4th generation university" by Elsevier and TU Eindhoven, which served as conversation starter for the roundtable's discussion - defines a 4th generation university as one that emphasises societal value creation within the regional innovation ecosystem. It drives regional development strategy, fosters partnerships with industries, strategically focuses on key enabling technologies essential for the ecosystem, and promotes new types of education and research, such as challenge-based education and mission-driven research.

We're getting towards a better and shared understanding of the importance of connecting across the full knowledge value chain

Mattias Björnmalm

The concept was well received and resonated with participants, who recognised the ongoing transition of many universities and the need to better profile their contributions. "We're getting towards a better and shared understanding of the importance of connecting across the full knowledge value chain," noted Mattias Björnmalm, secretary general of CESAER, adding that universities play a unique role as a bridge across education, research and innovation. They engage with the full knowledge value chain, from the very early stages of research to collaboration with companies for product launch and marketing.

Other participants also envisioned a 4th generation university as a key player and driver of innovation ecosystems, with increasing co-creation with industry and societal partners. They called on policymakers to fully recognise this driving role of the university, and help to develop it further, while tuning national and European policies to the opportunities it brings.

However, some experts noted that developing universal rules or parameters for 4th generation universities is challenging due to differences in the economic characteristics of the regions, such as their size, breadth of disciplines and research infrastructure development. Valeria Bandini, head of Europe and Internationalization Area, ART-ER, noted that defining impact indicators is also difficult because establishing clear cause-effect links is problematic. She proposed focusing on output/performance indicators instead. "One way would be to observe and detect case studies giving evidence to the socio-economic value produced," she said.

Eindhoven University of Technology in the Netherlands focuses on making a contribution to regional development, while maintaining international partnerships. Robert-Jan Smits, President of the University's Executive Board, highlighted that 80% of the university's Dutch master students and 62% international students stay in the region. "That's a very strong metric to show the role we play for our local innovation ecosystem," he said.

Additionally, Smits stressed the importance of long-term strategic cooperation with companies, providing an example of a 10-year agreement between Eindhoven University of Technology and Dutch semiconductor supplier ASML, with a broader impact on the many companies that are part of the semiconductor value chain. He said that introducing new forms of education is key to prepare graduates who will be working in the high-tech ecosystem where communication and teamwork are critical. Eindhoven University has developed a "challenge-based learning" where students work together to solve specific challenges.

Smits has invited other universities to contribute to the development of the 4th generation university concept and its associated indicators. He emphasised that this concept is intended to support strategic choices to achieve and strengthen this profile, rather than to set these universities apart from other knowledge institutions.

Robert-Jan Smits, President of the Executive Board, Eindhoven University of Technology



However, some of the roundtable participants found the "stay in the region" indicator too narrow, as it may fail to account for new industries that have not yet emerged in the region or result in a delayed regional impact.

Furthermore, university representatives stressed the need for university autonomy and expressed some reservations about taking the needs of the companies in the region on board in the university's strategy, arguing that universities should work autonomously to prepare for the challenges of the future. "Those big innovation challenges will require the creation of knowledge that we don't see the application for now," one participant stressed, adding that universities should go beyond the technological aspects of innovation and embrace the bigger picture, including social dimensions.

That is one of the reasons why they want to collaborate with us: because we can come up with new ideas

Toril A. Nagelhus Hernes

Similarly, Toril A. Nagelhus Hernes, pro-rector, innovation, Norwegian University of Science and Technology, said that long-term partnerships with industry benefit from the autonomy that universities have and should maintain. Companies cannot predict what will be the next product or solutions they really need. "That is one of the reasons why they want to collaborate with us: because we can come up with new ideas. We are free. We are open, and then, if there are interesting results, they may have new market opportunities," she explained. She concluded that the new generation of universities should balance challenge-based research with free open academic research.

Enabling small and medium enterprises (SMEs) to collaborate with universities is also important. While SMEs are often more innovative compared to bigger players, Paul Noon, deputy vicechancellor, enterprise and innovation at Coventry University, contended that the current system doesn't provide enough support for their cooperation with academic institutions. "There is something broken in the ecosystem, and we need to work on this hard," he added. Finally, there was a consensus that 4th generation universities, while having a strong focus on a RIE should also maintain a global orientation. Andreas Pinkwart, director of the excellence centre for innovation, transfer and entrepreneurship at Dresden University of Technology, stressed that both universities and industry have an international outlook, but often collaborate in the regional ecosystem. The regions that act as sponsors of these collaborations also want universities that can compete on the international stage.

We need to think very carefully about the geographical dimension to this concept

Orla Feely

Building on that point, Orla Feely, President of University College Dublin, emphasised the value of the 4th generation concept to foster a more nuanced understanding of how universities collaborate within their regions. However, she cautioned that if top universities concentrate their efforts within individual regions without collaborating on an international level, it could eventually hinder European competitiveness. "We need to think very carefully about the geographical dimension to this concept," she said. Feely argued that universities should have the flexibility to choose whether to prioritise local impact or focus on their global role.

Although the EU is running various initiatives to support regional development, such as industrial doctorate programmes and the involvement of the universities in Smart Specialisation Strategies, Salla Saastamoinen, deputy director-general of the Joint Research Centre of the European Commission, said that more systemic transformation is required, and that local authorities are an essential part of the equation to increase innovation. She highlighted how the Commission is working on Partnerships for Regional Innovation to involve all stakeholders – regions, cities, industry, universities, and society – in this transformation. The Commission has also developed a practical guide, called ACTIONbook, describing tools and approaches universities can use to contribute to regional transformation via co-creation with local actors. Regulatory sandboxes and new fiscal models for technological and social innovation may be helpful to strengthen the driving role of a university in an RIE.

Sjoerd Mentink of Philips, a multinational company with origins in the Brainport Eindhoven, underlined that speed and excellence are both key to achieving innovation. He noted that speed, in particular, represents the trade-off between local and global dynamics. Whereas excellence



Nick Fowler, Chief Academic Officer, Elsevier



has a strong global dimension, speed is often achieved through collaboration with trusted partners. These partnerships thrive in a regional setting, where close proximity fosters effective collaboration.

How to measure universities' impact across boundaries

A crucial question to determining the future role of universities is how to measure whether new approaches deliver societal benefits and advance socio-economic development. To that end, the roundtable focused on methodologies for tracking and measuring RIE partnerships. Participants also outlined key goals and milestones for universities transitioning to 4th generation status.

Nick Fowler, chief academic officer at Elsevier, noted that traditional rankings are inadequate for assessing both local and global impact. To address this, Elsevier has worked with Eindhoven University of Technology to collect data and identify existing gaps across four dimensions: education, research, valorisation and governance. He pointed out that while some metrics, such as the percentage of research articles co-authored with industrial partners, are readily available, others, like alumni rates, are more challenging to obtain. Fowler cautioned against an overreliance on readily available data, warning of the danger of measuring what is convenient instead of what is truly important.

The goal is to provide a dashboard of those indicators which are relevant to the concept of 4th generation university

Nick Fowler

"The goal is to provide a dashboard of those indicators which are relevant to the concept of 4th generation university. But I absolutely do not expect universities to optimise every dimension of that dashboard," he stressed. Fowler underscored that the dashboard should enable individual universities to pursue their own strategies. For example, some may focus on educating students in certain technology areas, while others prioritise close ties with specific sectors or companies. Fowler encouraged universities to cooperate to aggregate data sets and develop new indicators.

Toril A. Nagelhus Hernes, Pro-Rector, Innovation, Norwegian University of Science and Technology (NTNU)



Dr. Erwin Gianchandani, Assistant Director of the Directorate for Technology, Innovation and Partnerships, National Science Foundation

Given the varying geographies of RIEs and the distinct regional characteristics of each university, strict benchmarks would not do justice to the performance of universities. However, several key indicators will be relevant and beneficial to all universities that align with the 4th generation profile. Other participants agreed that universities need to employ indicators that account for differences in their strategies. Andrew Ginger, vice provost for international engagement at Northeastern University, emphasised that measurement should focus on the university's primary objectives and long-term impact.

Of course, not every impact lends itself to measurement in a quantitative form. One participant, whilst supportive of the idea of a dashboard containing various indicators, called for space for qualitative approaches. For example, if a university tries to raise awareness about sustainable transitions among small companies, the impact will not necessarily be measurable.

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We should always strive for excellence in our research activities; this way, it's also attractive for industry to collaborate with us

Toril A. Nagelhus Hernes

Nagelhus Hernes (Norwegian University of Science and Technology) reminded participants about the role of excellence in making an impact. "We should always strive for excellence in our research activities; this way, it's also attractive for industry to collaborate with us," she said. The Societal Readiness Levels (SRL), assessing the adaptation of a particular technology, product, or process by society, should also be taken into account, Nagelhus Hernes added.

The quality of student output is another crucial factor. Naomie Verstraeten, chief innovation and technology officer of Brainport Development, stressed the importance of a strong focus on excellence in research and student output to enhance regional strengths and help build international cooperation.

The US is also wrestling with how best to measure academic output and its impact, Erwin Gianchandani, assistant director of technology, innovation, and partnerships (TIP) at the US

Alexandr Hobza, Chief Economist, European Commission



Salla Saastamoinen, Deputy Director-General, JRC, European Commission

National Science Foundation (NSF) explained the approach that his team is taking. He outlined three pillars used for investment planning and evaluation for NSF's newest directorate, TIP, which he leads: diverse innovation ecosystems, technology translation and development, and workforce development. For each pillar, TIP has developed indicators to assess the progress of its investment portfolio, including to assess factors, such as the geographic diversity of participants, the involvement of various sectors and stakeholders in TIP-funded projects, and the emergence of new types of jobs in specific regions.

As a result, NSF has developed a more holistic approach to measuring the impact. One of the first things that NSF set out to do upon establishing TIP was the development of a 'value creation framework'. "What are trying to achieve? How are we thinking about the means by which we can achieve those goals? And what would change if we were to achieve those goals?" Gianchandani said. The value creation framework can be monitored from research projects to publications to patents and innovations.

Björnmalm praised this approach, underscoring the importance of connecting across the full knowledge value chain, encompassing both basic and applied research. A participant from academia added that 'adoption readiness' - instead of technological readiness - helps measure both the economic value and the social value universities create.

Implications for policymakers - how can they help?

The roundtable explored how policymakers can help to harness the full potential of 4th generation universities, as the EU strives to boost its global competitiveness by accelerating the green and digital transitions. In this context, the core question is how Europe can better align resources and programmes to support universities as co-creators of social and economic advancement.

Alexandr Hobza, chief economist, DG RTD at the European Commission, identified three key areas for improvement in Europe. The first is the translation of knowledge into innovation within ecosystems. The second is addressing the technology gap, particularly in digital technologies, between Europe and some of the world's most advanced economies. Finally, there is the issue of uneven allocation of innovation between regions, the so-called 'innovation divide'.

"If we want to boost innovative capacity and then contribute to competitiveness, we need, on the one hand, to promote excellence, but we also should do this in in the way that does not go in the direction of excessive concentration of innovative capacities," he said. Universities can play a role in addressing this challenge by becoming innovation hubs that generate and exchange knowledge and ensure connections within the local innovation ecosystems and with the global knowledge frontier. There are many success stories, but sometimes it is also evident that the lack of well-performing universities is holding regions back.

For Hobza, innovation happens in clusters, but the challenge is not only nurturing bigger and bigger clusters, but also making sure that they are well interconnected. Although there is local cooperation within and between regions in Europe, cross-country cooperation is still lacking, leading to under-utilisation of the Europe's innovative capacity, he contended.

"It is difficult for policymakers to support and stimulate innovation, because you have to engineer a systemic change which involves a number of players, which is notoriously difficult. This is where I think universities can come in," Hobza concluded.

Echoing the challenge of shifting excellence and innovation performance from one region to another, one participant called for a better framework to connect innovation ecosystems and advance innovation strategies at the regional level. Andrew Ginger, vice provost for international engagement at Northeastern University, also stressed the importance of strong networks to enhance capacity, systems, knowledge and experience, both to enable the transfer of processes and to support regional responsiveness.

Other participants suggested several strategies to overcome fragmentation and foster more collaboration between academia and industry. For example, Pinkwart (Dresden University of Technology) called for greater efforts to establish and develop spin-offs, while appealing for more freedom and autonomy for entrepreneurs and innovators through the simplification of regulations and bureaucratic procedures. This may create opportunities to build better and faster scale-ups. Sudhesh Kumar, president of AIRTO UK and vice president (health) at the University of Warwick, advocated for incentives for collaborative, rather than competitive, behaviour among universities. Naomi Verstraeten (Brainport Eindhoven) stressed that the capability of universities to foster regional strategy making is needed to align parties in a strong regional development agenda.

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Energy is the key area at the moment, and we have cities with their industries who know what to do

Markku Markkula

Indeed, the need for greater collaboration was a recurring theme in the discussion: The innovation agenda can succeed only with the joint commitment of various actors, including regions, cities, society, industry, universities and policymakers. "We need to use the best global knowledge. For that, we need the universities," noted Markku Markkula, vice-president of the European Committee of the Regions. To highlight the complexity of deciding who should coordinate the transformation, he provided the example of the EU Missions based on collaboration between universities, industry and cities to reach the 2030 climate neutrality target. "Energy is the key area at the moment, and we have cities with their industries who know what to do," he said.

Although cities have collaborative action plans based on their Climate-City-Contracts, the EU needs to accelerate the use of these, Markkula added, while noting that universities and industries have excellent knowledge within their networks, which should be integrated into EU city policy. Europe needs forerunners co-creating new innovative solutions to reach the ambitious climate neutrality targets, he stressed. "Let's implement this," Markkula concluded, pointing to the report on the 4th generation university.

Participants list

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