De vierde generatie universiteit: het nieuwe tijdperk van open innovatie en ecosysteemdenken

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The Fourth-Generation University: The New Era of Open Innovation and Ecosystem Thinking

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Are universities on the brink of a new era? As the academic landscape unfolds from closed knowledge houses to open innovation hubs, this article dives deep into the rise of the fourth-generation university. Discover how this new approach is not only changing the way in which knowledge is created and shared but also how it is redefining the relationships between universities, industry, government and society.

In the world of academic education and research, we are at the edge of a revolutionary transformation. Expectations regarding how universities should create value for society are evolving in response to changing societal needs and political priorities. In recent decades, the emphasis has been on the 'third mission' in which universities should focus on economic valorization in addition to education and research.

However, the current societal, technological, economic and socio-geopolitical climate requires universities to take on an expanded role. This includes, in particular, the development of solutions to societal challenges in close collaboration with a wide range of stakeholders in an open innovation ecosystem. After decades of traditional education and research, universities are therefore shifting to a new paradigm: the fourth-generation university (4GU).

This article explores this transformation, looking specifically at the role of open innovation and the integration of regional innovation ecosystems, with Eindhoven University of Technology as an illustrative example.

The Evolution of Universities: From Contemplation to Innovation

Before delving into the characteristics and benefits of the fourth-generation university, it is useful to understand the evolution of universities over the centuries.

First Generation (1GU): The Classical University

The university's origins date back to the Middle Ages. The 1GU can be described as the classical university, with a focus on theology, philosophy and classical languages. These institutions were designed to transmit knowledge, primarily through oral communication and manuscripts. The university was a place of contemplation, study and religious formation.

Second Generation (2GU): The Research University

During the industrial revolution, with the growth of the sciences and the need for new knowledge, universities evolved into the 2GU, the research university. Here, the emphasis was placed on the creation of new knowledge through scientific research. Laboratories were

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standardized and the university became a place in which new ideas and innovations were born.

Third Generation (3GU): The Entrepreneurial University
The late 20th century saw the rise of the 3GU, or the entrepreneurial university. In this era, the notion of the triple-helix model began to dominate, emphasizing the interaction between universities, industry and government (Leydesdorff & Etzkowitz, 2000). Entrepreneurial universities went beyond knowledge transfer and research; they became economic players. They commercialized research results, promoted start-ups and fostered innovation by forming closer ties with industry.

The New Paradigm: Towards the Fourth-Generation University
In an ever-changing world influenced by technology, globalization and economic shifts, education and scientific research thus transformed from 1GU to 2GU to 3GU. We are currently on the eve of the shift towards the 4GU. The 4GU represents a shift to a quadruple-helix model in which, in addition to universities, industry and government, society plays a central role in knowledge creation and innovation.

A Changing Social Contract for Universities
While the university was traditionally seen as an incubator of free and autonomous research, the focus is now shifting to the needs of society. Martin (2003) calls this the changing social contract for science, which ultimately reflects the evolution of the university. Referring to Guston & Keniston (1994), he provides an illustration from the science policy of the United States:

> *"The scientific community must seek to establish a new contract with policy makers based not on demands for autonomy and ever increasing funds, but on the implementation of an explicit research agenda rooted in [social] goals."*

In essence, this revised social contract means that scientists and universities must address the needs of the 'users' in the economy and society. They are also confronted with more explicit accountability for funding received. An alternative interpretation of this shift is what some describe as a transition from 'Mode 1' to 'Mode 2' knowledge production. While Mode 1 represents knowledge production primarily within individual disciplines and within universities, Mode 2 represents multidisciplinary research conducted in diverse institutions with a more direct influence of societal needs from an early stage. See Table 1 for an overview.

Table 1: Changing paradigm of knowledge production

'Mode 1' knowledge production	**'Mode 2' knowledge production**
Knowledge produced in the context of academic interests	Knowledge produced in the context of application
Disciplinary approach	Transdisciplinary approach
Relative homogeneity of skills	Relative heterogeneity of skills
Hierarchical organization	Flatter hierarchies and temporary organizational structures
Limited societal responsibility and introspection	Increased societal responsibility and reflexivity
Traditional peer review within specialized communities	A broader system of quality control

Source: Gibbons (2003)

With this historical context in mind, the shift to a fourth-generation university (4GU) is a logical next step in the evolution. Table 2 gives an overview of topics that differ among the four generations of universities.

Table 2: Description of four generations of universities

	1st generation	**2nd generation**	**3rd generation**	**4th generation**
Objective	Education	Education & research	Education, research & valorization	Mission-driven education, research & valorization
Role	Defending the truth	Discovering nature	Creating economic value	Creating societal value
Method	Stochastic	Monodisciplinary science	Interdisciplinary science	Transdisciplinary science & multi-actor innovation
Human capital development	Professionals	Professionals & scientists	Professionals, scientists & entrepreneurs	Professionals, scientists, entrepreneurs & ecosystem participants (incl. artists, clients, etc.)
Orientation	Universal	National	Global	Ecosystem
Organization	Colleges	Departments	Institutions & centers	Innovation spaces
Interaction with surroundings	Isolated	Local community	Industrial partnerships	Integrated with global & local ecosystems
Technology integration	Minimal	Basic	Systemic and integral with digital tools	Advanced (digital) technology & AI integration
Funding model	Religious/royal funding	Government support	Public-private partnerships	Various streams, including entrepreneurial initiatives
Collaborative relationships	No	Other academics	Industry	Industry, NGOs, communities, public authorities
Stakeholder involvement	Closed	Limited	Active	Highly active with feedback loops

The Fourth-Generation University: From Closed Knowledge House to Open Innovation Hub
Open innovation is central to the 4GU, representing a distributed innovation model in which organizations share knowledge across their borders in order to accelerate innovation processes (Chesbrough & Bogers, 2014). The quadruple-helix model recognizes the importance of involving society in this process, whereby the role of open innovation in bringing stakeholders together to address major societal challenges is also becoming increasingly important (McGahan et al., 2021).

Traditional universities functioned mainly from a closed system, but the 4GU breaks with this tradition and looks beyond mere research and education. This concerns active participation in sustainable and regional development. Knowledge sharing is central, blurring the boundaries between universities, industry and society. These universities increasingly act as orchestrators

of the regional ecosystem (Thomas et al., 2021), engaging both socially and digitally and focusing their strategic missions on societal priorities (Carayannis & Morawska-Jancelewicz, 2022).

The 4GU recognizes the importance of regional connections. This collaboration leads to the formation of regional innovation ecosystems that increasingly define the innovation landscape. Within such an ecosystem, all involved parties exchange knowledge and collaborate on innovative solutions. A mission-driven innovation policy – as described by Mazzucato (2018), for example – that exerts significant influence on the strategic direction of both higher education and research funding calls for a shift to a new system (Aagaard et al., 2022). This also calls for collaborative skills and strategies of universities, companies and policymakers (Bogers et al., 2018).

TU Eindhoven: A Pioneer in the 4GU Movement

Eindhoven University of Technology (TU/e) illustrates how universities can put these 4GU principles into practice. TU/e's approach is representative of the changing social contract between universities and society, which places more emphasis on regional growth and sustainable development.

Strategically, TU/e has chosen to be not only an academic institution but also a driver of innovation and change. TU/e's strategy, focused on collaboration and innovation, has a significant impact on forms of organization. New interdisciplinary research centers, collaboration with multinationals such as ASML and Philips, and the integration of students in real-world projects all illustrate this transformation, as shaped in Innovation Space, TU/e's expertise center for Challenge-Based Learning (CBL) and entrepreneurship. The transformation to a 4GU is further underscored by initiatives such as Eindhoven Engine, an innovation accelerator that brings together multidisciplinary teams from various sectors to work on groundbreaking projects together with Fontys University of Applied Sciences, TNO and ecosystem partners. This emphasis on collaboration and practice-oriented and society-driven research around societally relevant issues – linked, for instance, to the Sustainable Development Goals (SDGs) – is characteristic of the manner in which the university is increasingly organizing and operating.

In the area of leadership, TU/e has taken on a pioneering role by actively collaborating with start-ups via The Gate, the one-stop shop for entrepreneurship in the region. This initiative provides a bridge between young entrepreneurs and academic researchers, resulting in a rich exchange of ideas and a strengthening of the entrepreneurial climate on the campus. In education, Innovation Space goes a step further by literally placing students, researchers and industry professionals side by side to work on real projects. Here, it is not only technical expertise that is shared but also insights into the broader societal context from a CBL perspective. Here too, focused work is done on solutions for societally relevant issues and preparations are made for the implementation of outcomes via 'impact start-ups'.

What ties these initiatives together, however, is TU/e's overarching vision for the future of education and research. Rather than isolating itself, the university chooses to actively embed itself in the Brainport Eindhoven region, a leading technological hub in the Netherlands and one of Europe's most innovative technology regions. This embedding in the regional innovation ecosystem enables TU/e to respond quickly to changes in industry and society.

At a time in which universities around the world are grappling with questions regarding their relevance and role, TU/e aims to demonstrate how deep thinking on strategy, organization, people, leadership and change can lead to a renewed focus and a clear path forward. The fourth-generation university marks an important evolution in the academic landscape. By embracing the principles of open innovation and actively collaborating within regional innovation ecosystems, universities such as TU/e are better positioned to meet the needs of the 21st century. They are no longer mere knowledge institutions but active players in shaping an innovative and sustainable future.

Reflections on a New Academic Era

The constant evolution of universities mirrors the changing needs and challenges of our society. From a contemplative attitude in the classical university through a shift to the spirit of research and entrepreneurship, we have now arrived at an era in which universities are called upon to proactively participate in broad innovation ecosystems.

This call for change is not a whim or a fashion trend. It is an essential response to an increasingly complex world in which traditional borders – between disciplines, between academia and industry, and between countries – are blurring. In this context, the fourth-generation university should not be seen as an end point but as a new beginning. It is a chance to redefine the role of universities, to reinvent them as hubs of open innovation, as catalysts of regional development and as leaders in addressing global challenges.

Looking at examples such as TU/e, we see that this vision is already becoming a reality. But this transformation requires courage, vision and perseverance from all stakeholders within and outside of the academic world.

Towards a Future of Openness and Collaboration

The shift to the fourth-generation university is not just a reaction to external factors; it is also a chance for universities to increase their societal relevance and impact. In an era in which knowledge based on truth-seeking and impactful innovation is crucial for sustainable development, the role of the university as a catalyst for open innovation is no longer a luxury but a necessity.

While reflecting on the evolution of universities, we must therefore also look ahead and ask ourselves how we can shape these institutions so that, in partnership with society, they can meet future challenges in which the answer lies, in any case, in collaboration, openness and an unwavering belief in the power of knowledge.

In addition, a collective effort is needed from all ‘multidruple’ stakeholders in order to make the vision of a fourth-generation university a reality. This is a task not only for the universities themselves but also for business, government and society. Here are some actions that different stakeholders can take:

- **Universities**: Actively collaborate and share best practices to accelerate the transition to a fourth-generation university. Promote inter- and transdisciplinary learning by developing joint curricula and put co-creation at the heart of research and innovation projects. Invest in open innovation platforms and infrastructures that encourage knowledge sharing and collaborative innovation.
- **Other knowledge institutions:** Rethink your role in the knowledge economy and consider universities – and other knowledge institutions – as important co-creation

partners. Offer flexible and practically-oriented programs, work closely with local communities and businesses, and create innovative learning environments. Engage in inter-institutional collaborations and share resources and expertise to support the transition to a fourth-generation knowledge institution.

- **Public authorities:** Encourage interdisciplinary research and collaboration with grant schemes and policymaking. Create a policy environment that promotes open innovation and encourage knowledge institutions to collaborate with industry, societal organizations and the broader community.
- **Companies:** Invest in large-scale R&D collaborations with knowledge institutions. Share facilities and knowledge and offer extensive internship programs and training. See universities and other knowledge institutions as strategic partners in innovation.
- **Entrepreneurs:** Actively participate in networking events of knowledge institutions and enter into collaborations in research projects or product development. Respond quickly to the outcomes of joint research and seek support from incubator and accelerator programs linked to knowledge institutions.
- **Societal partners:** Strengthen collaboration with knowledge institutions to apply research and innovation to societal challenges. Initiate and invest in joint projects, share knowledge and networks, and encourage innovative solutions. Facilitate platforms in which knowledge institutions, citizens and industry can meet and collaborate.
- **Citizens:** Be actively involved in the knowledge community. This goes beyond attending public lectures and courses; consider also participating in citizen science projects. Understand and value the role of science and education in society and commit to policymaking and funding that support knowledge institutions.

Only through collaboration and joint efforts can we develop the next-generation university that is truly attuned to the needs and challenges of our time.

Notes:

- Parts of this article are based on: https://innovationorigins.com/nl/morgen-beter-maarten-steinbuch-eindhoven-als-trendsetter-voor-4e-generatie-universiteit/.
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