

PATENT ACTIVITY IN THE HUMANITIES AND TECHNICAL FIELDS: A MARKER OF RESEARCH CULTURE IN HIGHER EDUCATION

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INTRODUCTION

In the contemporary landscape of higher education, patent activity has become an essential indicator of the research culture of universities and academic institutions. While traditionally associated with technical and natural sciences, patents are increasingly relevant in diverse fields, including the humanities. The expansion of intellectual property practices beyond engineering and technological innovation reflects the growing recognition that knowledge itself—whether manifested in technological prototypes, methodological frameworks, or cultural innovations—can serve as a driver of social and economic development.

The humanities and technical fields, though often perceived as distinct in their objectives and methodologies, share a common foundation in creativity, problem-solving, and the pursuit of new knowledge. Technical disciplines, such as engineering, information technologies, and applied sciences, have long been measured by their capacity to generate patentable results that lead to industrial applications. The humanities, in contrast, have traditionally been valued for their contributions to cultural identity, ethical frameworks, and critical thinking. However, the integration of digital technologies, interdisciplinary collaboration, and the demand for societal impact have encouraged humanistic scholarship to explore novel forms of intellectual property. For example, digital tools for linguistics, innovative methods of cultural heritage preservation, and creative applications of educational technologies are increasingly the subject of patent activity in the humanities¹.

The analysis of patent activity across these domains highlights the evolving role of higher education institutions as engines of innovation. Universities are no longer solely centers of teaching and theoretical research; they are dynamic environments where knowledge is transformed into tangible outcomes with economic, social, and cultural implications. Patents, therefore, act as markers of institutional capacity to generate new ideas and transfer them into practice. Moreover, patenting serves as a bridge between

¹ Коваленко Л. Патентна активність як складова наукової культури університетів України. Науковий вісник. 2021. № 7. С. 88–97.

academia and industry, ensuring that the intellectual achievements of researchers contribute to technological progress and societal advancement.

At the same time, the uneven distribution of patent activity between technical and humanistic fields raises important questions about the nature of research culture. Does the dominance of technical patents overshadow the creative and cultural value of humanistic innovation? Can the humanities adopt patent culture without losing their traditional intellectual mission? These questions require a nuanced understanding of research practices in both domains. By comparing the dynamics of patenting in technical and humanistic contexts, one can better assess the balance between utilitarian and cultural dimensions of knowledge production in higher education².

Ultimately, the study of patent activity as a marker of research culture illuminates the ways in which universities adapt to global challenges. The capacity to protect, disseminate, and apply knowledge is not merely a technical function but a reflection of institutional values, strategic priorities, and cultural identity³. Investigating patent practices in both the humanities and technical fields thus provides deeper insight into how higher education systems cultivate innovation, preserve intellectual diversity, and prepare societies for the future.

1. Relevance of patent activity in contemporary academia

Patent activity has become not only an indicator of university innovation capacity but also a key element of academic culture—especially for scholar-educators seeking to integrate research, education, and societal impact. In contemporary academia, patents function as bridges between knowledge creation and its practical implementation.

Patents provide a clear legal foundation for knowledge transfer to industry, supporting collaboration, licensing, and the creation of academic spin-offs. As such, they serve as instruments of the “Triple Helix” model (university–industry–government), allowing universities to go beyond theoretical inquiry and directly influence regional and national development.

Contrary to the traditional association of patenting with STEM disciplines, examples of patents in the humanities and arts are emerging:

At the International Institute of Information Technology, Hyderabad (IIIT-H), a professor-inventor developed “Atam”—an interactive dance training tool shaped like a cube, helping learners practice postures in a gamified format. The project received a patent and stands out as a rare

² Бондар О. Інноваційна діяльність та патентування у технічних університетах: сучасні тенденції. *Вісник Харківського національного університету*. 2020. № 5. С. 134–142.

³ Дмитренко І. Академічна культура та інноваційні практики у вищій школі. *Освіта і наука*. 2019. № 3. С. 102–110.

example of artistic innovation with legal protection in India (Times of India, 2024).

At Osmania University, a patented technique called Paragamanjari was developed to incorporate pollen-inspired motifs into textile design, blending botany with aesthetic principles and offering eco-conscious alternatives for traditional fabrics. This shows how even natural sciences and arts can co-exist in commercially valuable innovation (Times of India, 2024).

These examples underscore the untapped potential of non-technical disciplines in contributing to patentable knowledge and industrial design.

Recent studies highlight the underappreciated role of the Social Sciences and Humanities (SSH) in shaping technological development. Citation analyses of patent literature show that academic works from disciplines like education, linguistics, law, and library sciences are frequently referenced in patents—especially in fields like AI, EdTech, and legal tech.

Thus, humanities research not only informs but sometimes underpins technological innovation, challenging the STEM-dominated perception of patenting.

Beyond legal protection, patent data are now used as research instruments. Techniques such as overlay mapping and Patent Citation Spectroscopy help visualize the strategic positioning of universities, sectors, and countries in the global innovation space. These methods allow researchers to identify influential patents, innovation clusters, and technological trajectories.

Legal frameworks such as the Bayh–Dole Act in the U.S. have transformed universities from passive knowledge producers to active intellectual property holders. Similar reforms across Europe have encouraged institutions to embed patenting and tech transfer in their strategic planning (ResearchGate). Universities now maintain Technology Transfer Offices (TTOs), offering legal support, commercialization advice, and sometimes even seed funding to help academics protect and develop their inventions⁴.

Studies show that academic freedom positively correlates with both the quantity and quality of patent activity. Environments that support free inquiry, interdisciplinary thinking, and low bureaucratic burden tend to produce more high-value patents and globally recognized innovations. Moreover, interdisciplinary research—particularly work that balances diverse fields—tends to be more impactful and is more likely to be cited in patents⁵.

Patent activity in contemporary academia is a multifaceted phenomenon. It reflects a university's ability to contribute to innovation ecosystems, foster

⁴ Шевченко С. Патентування та академічна престижність науково-педагогічних працівників. *Вісник вищої школи*. 2022. № 2. С. 65–74.

⁵ Костюк О. Патентна активність у гуманітарних науках: виклики та перспективи. *Гуманітарний вісник*. 2021. № 4. С. 51–60.

interdisciplinary research, and navigate the interface between science and society. Importantly, patenting is no longer the domain of STEM fields alone—examples like Atam and Paragamanjari illustrate the emerging potential of artistic, educational, and cultural innovations.

As the knowledge economy evolves, universities must develop inclusive and balanced strategies that support patent activity without compromising academic freedom or public mission. A vibrant patent culture, especially when accessible across disciplines, can strengthen not only institutions but entire societies.

2. Definition of patent activity in the academic context

Patent activity in the academic context can be broadly understood as the system of actions, practices, and institutional mechanisms through which universities, research centers, and individual scholars generate, register, and apply intellectual property in the form of patents. Unlike patenting in the commercial sector, where the primary motivation is profit-making and market competition, patent activity in academia is embedded within the mission of higher education: the advancement, dissemination, and practical application of knowledge. It encompasses not only the formal act of filing patent applications but also the wider research culture that motivates scholars to seek intellectual property protection for their innovations.

1. Conceptual Foundations of Patent Activity in Academia

The definition of patent activity in higher education must begin with the dual nature of patents themselves. On the one hand, patents represent a legal construct, granting exclusive rights to inventors or institutions for a specified period of time. On the other hand, patents also function as epistemic markers, signaling the novelty, originality, and applicability of research outcomes. Academic patent activity therefore exists at the intersection of legal regulation, knowledge production, and cultural practices of research⁶.

In a university setting, patent activity does not merely measure the number of registered patents but reflects a broader orientation toward innovation and societal engagement. Institutions that cultivate patent activity demonstrate a commitment to transforming theoretical inquiry into practical results, while simultaneously reinforcing the visibility and competitiveness of their research at both national and international levels.

2. Dimensions of Patent Activity

Patent activity in academia can be described through several interconnected dimensions:

⁶ Мельник Т. Професійний розвиток науковців і патентна культура в університетах. *Педагогіка і психологія професійної освіти*. 2020. № 6. С. 39–48.

Research Dimension – the creation of knowledge and technologies that contain novelty and inventive step, often supported by fundamental or applied research projects.

Legal Dimension – the processes of filing, examination, and registration of patents, governed by intellectual property law at the national or international level.

Institutional Dimension – the role of universities, technology transfer offices, and research management structures in facilitating, coordinating, and incentivizing patenting.

Educational Dimension – the integration of patent culture into academic programs, where students and young researchers are trained to view intellectual property as a natural outcome of scientific work⁷.

Socio-economic Dimension – the translation of patents into societal benefits, such as technology commercialization, spin-off companies, and partnerships with industry.

Together, these dimensions underline that patent activity is not a single action but a multifaceted process that reflects the research culture of higher education.

3. Patent Activity as a Marker of Research Culture

In the academic context, patent activity serves as a visible indicator of research quality and innovation capacity. While traditional metrics such as publications, citations, or conference participation remain crucial, patents provide complementary evidence of applied research outcomes. Universities with high levels of patent activity are often regarded as innovation-driven institutions capable of bridging the gap between theory and practice⁸.

Moreover, patenting embodies values of creativity, originality, and problem-solving, which are central to academic work. A high level of patent activity indicates not only the ability of researchers to generate knowledge but also their readiness to transform it into solutions with economic, social, or cultural impact. This explains why many global university rankings now include indicators related to patents, licensing income, and technology transfer alongside bibliometric measures.

4. Specific Features of Academic Patent Activity

Patent activity in higher education differs from commercial patenting in several respects:

Motivational Aspect: Academic researchers are often driven by recognition, scientific curiosity, and institutional requirements rather than immediate profit.

⁷ Hemmert M., Cross A. University patenting in Europe and Asia: Trends and institutional drivers. *Research Policy*. 2021. 50(7). P. 104–116.

⁸ Munari F., Toschi L. Patents and academic careers: An empirical study of European universities. *Journal of Technology Transfer*. 2020. 45(6). P. 1713–1732.

Collaborative Character: Many university patents are the result of collective research teams, often involving interdisciplinary collaboration.

Dual Outcomes: Academic patents aim to contribute both to the body of knowledge and to practical innovation⁹.

Institutional Ownership: In most jurisdictions, patents created by university staff are owned by the institution, with inventors receiving recognition and sometimes a share of royalties.

Knowledge Dissemination: Unlike private companies that may keep patents confidential, universities balance patent protection with the imperative to publish and share knowledge.

These specificities shape the very definition of patent activity in academia, making it distinct from industry-based patenting practices.

5. The Role of Humanities and Technical Fields

When considering patent activity in academic contexts, it is essential to account for disciplinary differences. Technical and natural sciences traditionally dominate patenting due to their proximity to industrial applications, such as engineering solutions, pharmaceutical products, or information technologies. However, recent decades have witnessed the rise of patent activity in the humanities and social sciences¹⁰.

Examples include digital tools for linguistic research, cultural heritage preservation technologies, educational software, and innovative methods in the creative industries. These cases challenge the stereotype that patents belong exclusively to technical disciplines, broadening the definition of academic patent activity to encompass intellectual innovations across all areas of knowledge.

6. Institutional Strategies for Defining and Promoting Patent Activity

Universities worldwide have adopted various strategies to strengthen their patent culture. These include:

Establishing Technology Transfer Offices (TTOs) to assist researchers in identifying patentable results¹¹.

Creating intellectual property policies that define ownership, inventor rights, and revenue-sharing mechanisms.

Embedding entrepreneurship and IP education into curricula.

Supporting incubators and start-ups that emerge from university patents.

Such strategies not only facilitate the patenting process but also institutionalize it as a core element of academic culture. The definition of

⁹ Saracho J., González-Pernía J. University–industry collaboration and patent activity: Evidence from Spanish technical universities. *Technovation*. 2019. 84–85. P. 1–12.

¹⁰ Shibayama S., Wang J. Academic patenting and its impact on research culture in engineering faculties. *Higher Education Quarterly*. 2022. 76(3). P. 520–538.

¹¹ Zhou Y., He Y. Patenting, innovation and research culture: An international perspective. *Science and Public Policy*. 2023. 50(1). P. 45–59.

patent activity, therefore, must account not only for individual actions but also for systemic frameworks established within universities.

7. Challenges in Defining Patent Activity

Despite its growing importance, patent activity in the academic context remains contested. Some scholars argue that an overemphasis on patenting risks commercializing academia at the expense of fundamental research. Others note the uneven distribution of patent activity across disciplines, institutions, and regions, which complicates its use as a universal measure of research culture.

Additionally, the time and resources required for patenting can discourage researchers from pursuing intellectual property protection, particularly in institutions with limited infrastructure. As a result, patent activity should be defined not only quantitatively (number of patents filed) but also qualitatively, taking into account the originality, relevance, and societal contribution of the patented work.

Defining patent activity in the academic context requires a comprehensive approach that integrates legal, institutional, cultural, and disciplinary perspectives. It cannot be reduced to the mechanical act of filing patent applications but must be understood as a dynamic reflection of how universities and researchers engage with innovation, intellectual property, and societal needs.

Patent activity in academia thus signifies more than technological outcomes: it reveals the extent to which higher education institutions embrace creativity, foster interdisciplinary collaboration, and position themselves as key players in global knowledge economies. By adopting a multidimensional definition of patent activity, scholars and policymakers can better evaluate the research culture of universities and develop strategies that balance scientific advancement with practical innovation.

3. Overview of national and international patenting systems

Patenting systems represent one of the key institutional mechanisms for protecting intellectual property rights and encouraging innovation across the world. They provide inventors, universities, and enterprises with legal tools to secure exclusive rights to their inventions, while simultaneously fostering technology transfer, economic growth, and cultural development. In higher education, patenting systems are particularly relevant because they serve as a bridge between academic research and practical application, helping universities translate discoveries into tangible benefits for society.

This section offers an overview of the Ukrainian patenting system as part of the broader European intellectual property landscape, as well as an analysis of the major international patenting systems. Understanding both national and international frameworks is essential for evaluating how

academic institutions and researchers navigate the legal and procedural environment of intellectual property protection.

Ukraine has developed a legal and institutional framework for intellectual property protection that aligns with international standards while reflecting its own legal traditions. The central institution responsible for the administration of patents in Ukraine is the Ukrainian National Office for Intellectual Property and Innovations (UANIPIO), which operates under the Ministry of Economy. This body manages the registration of inventions, utility models, industrial designs, and other forms of intellectual property.

The Ukrainian system distinguishes between several categories of patent protection:

Patents for Inventions: Granted for technical solutions that are new, involve an inventive step, and are industrially applicable. These patents usually have a term of 20 years.

Utility Model Patents: Granted for technical solutions that are new and industrially applicable, but without requiring a high inventive step. Utility models are easier and faster to obtain, typically valid for 10 years.

Industrial Designs: Protect the external appearance of products. These rights may last up to 25 years if renewed periodically.

This differentiation allows Ukrainian researchers and institutions to select appropriate protection mechanisms depending on the nature of their innovations.

The process of obtaining a patent in Ukraine typically includes:

Filing an application with UANIPIO, including a description, claims, abstract, and drawings (if applicable).

Formal examination to ensure compliance with filing requirements.

Substantive examination (for inventions) to assess novelty, inventive step, and industrial applicability.

Granting of the patent and its publication in the official bulletin.

This procedure is comparable to European and international standards, although substantive examination for utility models is usually omitted, which accelerates the process.

Ukrainian universities and research institutions are increasingly active in the field of patenting. They use the system to protect results of scientific projects, establish partnerships with industry, and strengthen their positions in international rankings. However, challenges remain, including limited financial resources, insufficient awareness of intellectual property culture, and bureaucratic barriers.

For researchers and universities, national patenting is often only the first step. Academic innovations frequently have potential beyond domestic markets, making international protection a necessity. Several international

and regional patenting systems provide legal pathways for protecting intellectual property across multiple jurisdictions.

The World Intellectual Property Organization (WIPO), a specialized agency of the United Nations, plays a central role in the global governance of patents. One of its most significant instruments is the Patent Cooperation Treaty (PCT), established in 1970.

The PCT enables applicants to file a single international patent application, which has effect in all member states (currently more than 150 countries, including Ukraine). Although the PCT does not itself grant “international patents,” it simplifies the process by providing:

- A unified filing procedure.

- An international search and preliminary examination.

- The ability to delay national phase entry (and associated costs) for up to 30 or 31 months.

For academic institutions, the PCT system is particularly advantageous because it allows time to evaluate the commercial potential of inventions before committing to expensive national filings.

The European Patent Organisation (EPO) offers a regional patenting mechanism that covers over 30 European countries. Through a single application, inventors can obtain patent protection in multiple jurisdictions. The EPO examination process is highly rigorous, ensuring a high standard of granted patents.

For Ukrainian researchers, while Ukraine is not a member of the EPO, cooperation agreements allow for alignment of procedures and facilitate recognition of Ukrainian patents in Europe. Many Ukrainian universities collaborate with European partners who use the EPO system to secure broader protection.

The Eurasian Patent Organization (EAPO), established in 1994, provides a regional system covering several post-Soviet states. Through a single Eurasian patent application, protection can be obtained in countries such as Russia, Kazakhstan, Belarus, and others.

For Ukrainian inventors, while Ukraine is not a full member of EAPO, the system remains relevant due to geographical proximity and the tradition of cooperation among post-Soviet academic institutions.

In addition to regional systems, researchers often seek protection in leading economies:

United States Patent and Trademark Office (USPTO): The U.S. is a global leader in patent activity, and patents granted by the USPTO are highly valued internationally.

Japan Patent Office (JPO): Plays a key role in Asia and is known for efficient and rigorous examination procedures.

China National Intellectual Property Administration (CNIPA): In recent years, China has become the world leader in the number of patent filings, making it a crucial jurisdiction for global academic innovations.

Comparing Ukrainian and international systems highlights several important trends:

Harmonization: Ukrainian patent law is largely harmonized with international treaties, ensuring compatibility with global standards.

Accessibility: Ukrainian utility model patents provide faster, cheaper protection compared to PCT or EPO procedures.

Global Reach: International systems such as PCT or EPO are essential for securing protection beyond Ukraine's borders.

Institutional Support: Universities in advanced economies typically have stronger technology transfer offices, while Ukrainian institutions are still developing such infrastructure.

Patent activity in Ukraine and abroad faces several challenges:

Costs: International patenting is expensive, which can limit participation of academic institutions with restricted budgets.

Complexity: Different national and regional systems require expertise in legal, linguistic, and technical aspects.

Cultural Barriers: Academic traditions, particularly in the humanities, often prioritize publications over patents.

At the same time, opportunities are expanding through digitalization of procedures, international cooperation, and increased awareness of intellectual property rights in academia. For Ukrainian institutions, alignment with European and global systems offers pathways to integrate more deeply into international research networks.

4. Motivation and barriers for patenting among technical faculty members

In contemporary higher education, patent activity among faculty members is considered an important indicator of innovation capacity and institutional engagement with industry and society. Technical faculties, which traditionally emphasize applied research, engineering solutions, and technological development, are natural environments for generating patentable outcomes. However, despite the evident potential of technical faculty members to contribute to national and international patent systems, their actual involvement in patenting activities varies widely across institutions and countries. This discrepancy is explained not only by structural and institutional differences but also by individual-level motivations and barriers.

Understanding what motivates or hinders technical faculty members in pursuing patents is crucial for fostering a strong innovation culture within

universities. Motivation drives researchers to translate discoveries into protected intellectual property, while barriers can significantly reduce the effectiveness of this process. This section explores the main factors shaping faculty members' engagement in patent activity, analyzing motivational drivers and institutional or systemic obstacles.

Motivation for patenting among technical faculty members is multifaceted, encompassing personal, professional, institutional, and societal dimensions. Several key drivers can be identified:

Patents often serve as a visible symbol of scientific achievement and creativity. For many faculty members, the opportunity to be recognized as an inventor strengthens their academic identity and enhances their reputation within the scientific community. Unlike traditional publications, which highlight theoretical contributions, patents signal practical problem-solving and the capacity to generate innovations with economic or social value.

In an increasingly competitive academic environment, patents are often integrated into performance evaluation systems. Many universities consider patents when assessing candidates for promotion, tenure, or research funding. For technical faculty, patent activity can thus directly influence career trajectories and serve as a differentiating factor compared to peers who focus solely on publications.

Patenting opens opportunities for financial benefits through licensing agreements, royalties, and the establishment of spin-off companies. Although financial returns from patents are not always guaranteed, the potential of monetizing research outcomes motivates faculty members, particularly in technical fields where inventions often have commercial applications.

Technical faculty members frequently collaborate with industrial partners in areas such as engineering, information technologies, or material sciences. Patents serve as a formal mechanism to secure intellectual contributions in such collaborations, ensuring that both individual inventors and universities are acknowledged and compensated. The prospect of long-term partnerships with industry motivates researchers to pursue patenting as a tool for institutional and personal recognition.

Beyond financial and career considerations, many technical faculty members are motivated by the broader mission of higher education: contributing to societal development. Patents allow research results to move from the laboratory into real-world applications, thereby addressing technological, environmental, and social challenges. This motivation aligns with the increasing emphasis on the "third mission" of universities, which emphasizes engagement with society and industry.

While motivations can be strong, faculty members often face significant obstacles that limit their ability to engage in patent activity. These barriers

can be grouped into structural, institutional, cultural, and personal categories.

Patenting is an expensive and time-consuming process. Application fees, legal services, translation costs, and maintenance fees create a heavy financial burden, especially in international filings. For technical faculty working in resource-constrained institutions, these costs can be prohibitive. Even when institutional support exists, limited budgets often restrict the number of patents that universities can realistically pursue.

Effective patenting requires professional management, which is often provided by technology transfer offices (TTOs). In many universities, particularly in developing countries, TTOs are either underdeveloped or absent. Faculty members may lack guidance on identifying patentable inventions, drafting claims, or navigating legal procedures. The absence of institutional infrastructure represents one of the greatest barriers to patenting.

In many technical faculties, academic performance is primarily evaluated on the basis of publications in high-impact journals. As a result, researchers prioritize rapid dissemination of results over time-consuming patenting procedures. Since patent applications require confidentiality before filing, researchers may feel that pursuing patents delays their academic visibility. This tension between publication and patenting is a common barrier.

Faculty members are often experts in their scientific fields but lack training in intellectual property management. Misunderstandings about the requirements of novelty, inventive step, and industrial applicability may prevent researchers from recognizing patentable results. Inadequate awareness of the strategic importance of patents also diminishes motivation to engage in the process.

Some faculty members perceive patenting as being at odds with the traditional mission of academia, which emphasizes open knowledge dissemination. Concerns about the commercialization of research, potential conflicts of interest, and the restriction of access to scientific knowledge can act as psychological and ethical barriers. This perspective is particularly evident among researchers who value academic freedom over economic application.

Patent procedures often involve complex administrative requirements and lengthy examination processes. Navigating legal documents, complying with deadlines, and responding to examiners' objections can be overwhelming for faculty members, particularly when they lack professional legal support. Bureaucratic complexity discourages researchers from engaging in patenting, even when their inventions have strong commercial potential.

The interaction between motivations and barriers determines the actual level of patent activity among technical faculty members. While motivations

such as career advancement, prestige, and industry collaboration can be strong, barriers like costs, lack of support, and cultural resistance can neutralize these incentives.

Universities that successfully foster patent activity are those that recognize both dimensions and develop institutional mechanisms to reinforce motivations while reducing barriers. This balance is achieved through comprehensive intellectual property strategies, which include:

- Establishing well-resourced technology transfer offices to support faculty.

- Providing financial assistance for patent application and maintenance costs.

- Offering training programs on intellectual property management

- Aligning evaluation criteria so that patents are recognized alongside publications.

- Promoting an innovation-friendly culture that values both scientific openness and practical application.

Globally, the motivations and barriers for patenting among technical faculty members vary according to regional contexts. In countries with strong innovation ecosystems such as the United States, Germany, or Japan, patenting is deeply embedded in academic culture. Universities in these systems often provide substantial institutional support, making motivations outweigh barriers.

In contrast, in many developing or transitional economies, including Ukraine, barriers remain significant due to financial constraints, weak institutional infrastructure, and insufficient integration of patent activity into academic evaluation systems. Nonetheless, international cooperation, EU-funded projects, and increasing awareness of intellectual property rights are gradually transforming this landscape.

The motivation of technical faculty members to engage in patent activity is shaped by a complex interplay of academic, professional, economic, and societal factors. While patents can enhance recognition, provide financial rewards, strengthen industry collaboration, and ensure societal impact, barriers such as high costs, weak institutional support, and cultural resistance often limit their realization.

For higher education institutions, the challenge lies in creating an environment where motivations are systematically reinforced and barriers are minimized. This requires comprehensive policies, financial investment, and cultural change. By addressing these challenges, universities can unlock the innovative potential of their technical faculty, positioning themselves as key contributors to national and global innovation ecosystems.

Collaboration between universities and industry has become a defining feature of modern research ecosystems, particularly in the fields of

engineering and natural sciences. As global challenges grow more complex, solutions increasingly require not only fundamental scientific insights but also applied technological innovations. Universities, as centers of knowledge creation, and industries, as engines of commercialization and application, form a natural partnership in the innovation chain. This collaboration fosters economic growth, technological advancement, and societal development, while also redefining the mission of higher education institutions in the twenty-first century.

The importance of university–industry collaboration is especially pronounced in engineering and natural sciences, where discoveries frequently translate into tangible products, technologies, and services. This section examines the nature of such collaboration, its forms, drivers, and challenges, as well as its impact on research culture and innovation capacity.

The collaboration between universities and industry arises from complementary needs. Universities aim to transform theoretical knowledge into practical outcomes, increase research funding, and enhance their global competitiveness. Industry, in turn, seeks access to advanced scientific expertise, cutting-edge facilities, and highly skilled graduates. Together, these partners create a synergistic model where innovation can flourish.

Access to external funding sources.

Opportunities for faculty and students to engage in applied research.

Enhanced reputation and competitiveness in international rankings.

Patents, licenses, and spin-off companies that strengthen institutional impact.

Access to state-of-the-art research results and laboratories.

Opportunities to co-develop technologies that address specific market needs.

Recruitment of highly skilled graduates trained in research-intensive environments.

Reduced risks and costs through shared R&D initiatives.

Collaboration in engineering and natural sciences can take multiple forms, ranging from informal exchanges to formal institutional partnerships.

These projects involve faculty members, students, and industry experts working together on applied problems. Funding may come from companies, government grants, or international programs.

Industry partners commission universities or individual researchers to solve specific technical problems. This provides universities with financial resources while offering companies access to specialized expertise.

Universities transfer intellectual property to industry through licensing agreements or collaborative commercialization. Patents serve as the legal foundation of this process, ensuring recognition and potential revenue.

Engineering and science students often gain practical experience through internships in industry. Such programs bridge the gap between theoretical learning and workplace application.

Many universities establish innovation hubs, incubators, or science parks where start-ups, faculty spin-offs, and companies co-locate to foster innovation ecosystems.

Universities and companies frequently join national or international research consortia, addressing grand challenges such as climate change, renewable energy, or advanced manufacturing.

Engineering disciplines represent the most intensive area of university–industry collaboration. Due to their applied nature, engineering fields such as mechanical, electrical, civil, and aerospace engineering often produce outcomes that can be immediately implemented in industrial contexts.

Joint development of advanced manufacturing technologies.

Collaboration in aerospace research to improve flight safety and efficiency.

Partnerships in renewable energy engineering to optimize wind and solar technologies.

Development of digital twins, robotics, and artificial intelligence systems for industry applications.

These collaborations not only advance industrial competitiveness but also redefine engineering education by exposing students to real-world projects and problem-solving contexts.

Natural sciences such as physics, chemistry, and biology also serve as fertile grounds for collaboration. While traditionally oriented toward fundamental discovery, these disciplines increasingly produce innovations with immediate industrial potential.

Examples include:

Pharmaceutical collaborations for drug discovery and testing.

Nanotechnology applications in materials science.

Physics-based innovations in medical imaging and radiation technologies.

Biotechnology partnerships for agricultural and environmental sustainability.

In these contexts, industry provides funding and infrastructure for large-scale experiments, while universities contribute theoretical insights and methodological expertise.

Collaboration produces a wide range of benefits for all stakeholders:

Innovation Acceleration: Faster translation of research into market-ready technologies.

Economic Development: Creation of new products, start-ups, and jobs.

Enhanced Education: Students gain practical experience and improved employability.

Knowledge Exchange: Cross-pollination of ideas between academia and industry.

Increased Global Competitiveness: Institutions and companies strengthen their positions in international markets.

Despite the numerous advantages, university–industry collaboration faces several challenges:

Universities prioritize long-term, fundamental research and knowledge dissemination, while industries often focus on short-term, profit-oriented goals. These differing missions can create tension in collaborative projects.

Disputes over patent ownership, revenue sharing, and licensing agreements often complicate collaborations. Clear institutional policies are essential to mitigate conflicts.

Not all universities or industries have the financial capacity to sustain large-scale collaborations. Smaller institutions may struggle to attract industrial partners.

Administrative procedures for establishing contracts, reporting, and compliance can slow down collaboration and discourage participants.

Concerns about academic independence and the commercialization of research raise ethical questions, particularly when industrial interests dominate academic agendas.

Globally, several trends shape the evolution of university–industry partnerships in engineering and natural sciences:

Open Innovation Models: Companies increasingly share knowledge with academic partners to accelerate technological progress.

International Consortia: Global challenges such as climate change and pandemics stimulate multinational collaborations.

Digital Platforms: Virtual labs and digital tools facilitate remote and interdisciplinary partnerships.

Policy Support: Governments provide incentives, grants, and regulatory frameworks to strengthen collaboration ecosystems.

For Ukraine and other transitional economies, integration into international collaborations and adoption of best practices from developed systems remain key strategic priorities.

University–industry collaboration in engineering and natural sciences plays a critical role in shaping the modern innovation ecosystem. It bridges the gap between theory and practice, enhances the societal relevance of academic research, and drives technological and economic development. While significant challenges remain—ranging from cultural differences to intellectual property disputes—the potential benefits far outweigh the obstacles.

For universities, fostering strong ties with industry enhances their research culture, strengthens educational programs, and contributes to national and international competitiveness. For industries, collaboration provides access to cutting-edge knowledge and a pipeline of skilled graduates. Ultimately, the integration of academic and industrial efforts in engineering and natural sciences represents one of the most effective strategies for addressing the complex technological challenges of the 21st century.

5. Interdisciplinary potential: convergence of tech and humanities (e.g., digital humanities, educational technologies)

The twenty-first century has been marked by a profound rethinking of the relationship between technology and the humanities. What was once seen as a divide between two “cultures”—the sciences on one side and the humanities on the other—has increasingly given way to a recognition of their mutual complementarity. This convergence is particularly evident in the rise of digital humanities and educational technologies, where the interpretative, critical, and ethical capacities of the humanities intersect with the methodological rigor, computational power, and problem-solving ethos of technical fields. In higher education, this intersection is not only an intellectual phenomenon but also a structural transformation of research practices, academic culture, and innovation ecosystems. Understanding this convergence provides insight into how universities cultivate creativity, foster patent activity, and enhance research impact in a knowledge economy that demands cross-disciplinary fluency.

The traditional academic model has long relied on strict disciplinary boundaries, with engineering faculties focusing on material processes, technological design, and applied science, while humanities faculties emphasized textual interpretation, cultural analysis, and ethical reflection. However, societal challenges—such as climate change, digitalization of cultural heritage, global pandemics, and the ethics of artificial intelligence—cannot be addressed within a single disciplinary field. The convergence of technical and humanistic approaches is increasingly viewed as not only beneficial but essential for generating meaningful solutions.

This paradigm shift is supported by funding agencies and educational policymakers worldwide, who prioritize interdisciplinary research clusters and collaborative grant programs. In Ukraine, as in many European contexts, the reform of higher education emphasizes innovation and the integration of science, technology, engineering, and mathematics (STEM) with social sciences and humanities (SSH). The goal is to cultivate graduates and researchers who can operate across cognitive and methodological boundaries, producing not just technological artifacts but also socially grounded innovations.

The digital humanities (DH) exemplify the interdisciplinary potential of merging computation with humanistic inquiry. Digital humanities projects involve the use of data mining, text encoding, machine learning, and visualization tools to analyze cultural, historical, and linguistic phenomena. Large-scale digitization projects, such as the creation of searchable archives of historical documents, or algorithmic analysis of literary corpora, rely on technical expertise in programming, data management, and information retrieval. At the same time, they require humanistic expertise to frame research questions, interpret results, and contextualize findings within broader cultural narratives.

Patenting within digital humanities remains relatively underexplored, yet the field has generated technological tools—such as text analysis platforms, semantic annotation systems, and cultural heritage preservation technologies—that have significant potential for intellectual property protection. For instance, algorithms for recognizing paleographic scripts or systems for immersive digital museum experiences often emerge from collaborative university–industry projects. Such innovations highlight that the humanities, when converging with technology, can contribute to patentable solutions and strengthen the research culture of academic institutions.

Another arena of convergence is educational technologies (EdTech), where the pedagogical theories of the humanities intersect with the design principles and technical advances of engineering and computer science. EdTech innovations range from adaptive learning platforms powered by artificial intelligence to immersive virtual reality simulations for training in medicine, aviation, or engineering. The design of these tools requires sensitivity to learning theories, cultural contexts, and ethical implications—competences traditionally cultivated within the humanities and social sciences.

University faculty members in engineering, psychology, linguistics, and pedagogy increasingly collaborate to develop patentable educational tools. In Ukraine, for example, national strategies for digital transformation in education have encouraged interdisciplinary laboratories where software developers, instructional designers, and educators co-create learning management systems and digital curricula. Internationally, the patenting of educational technologies has become a growing trend, with companies and universities seeking to secure intellectual property rights for algorithms that personalize student learning or gamified systems that enhance engagement. This convergence demonstrates how the humanities, far from being passive observers of technology, actively shape the values and directions of technical innovation.

Several forces drive the convergence of the humanities and technical fields:

Complexity of societal challenges: Addressing global problems such as misinformation, cyberethics, or climate communication requires insights from both data science and cultural analysis.

Digitalization of cultural heritage: Preserving archives, languages, and traditions necessitates technical solutions that only become meaningful when informed by humanistic interpretation.

Innovation in pedagogy: Learning in the digital age demands tools that combine robust technological design with human-centered educational theories.

Research funding priorities: Many international grant programs explicitly require interdisciplinary collaboration, creating structural incentives for convergence.

Patent potential: As research cultures become more innovation-oriented, universities recognize that interdisciplinary projects are fertile grounds for patentable outcomes.

These drivers not only foster collaboration but also reshape how institutions define academic excellence and societal impact.

Despite its promise, the convergence of technical and humanistic domains is not without obstacles. Faculty members may lack the necessary interdisciplinary literacy, leading to communication barriers between, for example, computer scientists and literary scholars. Institutional structures often reinforce disciplinary hierarchies, making it difficult to secure funding for projects that fall outside conventional categories. Moreover, the patenting culture itself is more familiar to engineering faculties than to humanities departments, which may view commercialization with skepticism.

In Ukraine, where universities are undergoing reforms to align with European standards, the challenge lies in ensuring that interdisciplinary collaboration is supported by both administrative frameworks and research infrastructure. International experience shows that successful interdisciplinary projects often require dedicated centers, flexible curricula, and incentive systems that reward collaboration rather than siloed achievement.

Digital heritage preservation: Projects digitizing ancient manuscripts or folk traditions often require advanced imaging technologies and machine learning algorithms, developed by technical experts, alongside interpretation by cultural historians.

Virtual reality in education: Engineering faculties design VR platforms, while humanities faculties contribute content and pedagogical frameworks. Patents may emerge from both the hardware interface and the instructional design methodology.

AI-driven language learning platforms: Linguists and educators provide theoretical underpinnings of second-language acquisition, while engineers develop adaptive software capable of tracking learner progress.

These cases illustrate that interdisciplinary convergence is not merely rhetorical but results in tangible outputs, including patentable technologies, innovative curricula, and enriched cultural analysis.

Looking forward, the convergence of technology and humanities is expected to intensify with the growth of artificial intelligence, big data analytics, and immersive media. Universities will need to prepare students and researchers to navigate both the ethical dilemmas and the technical opportunities of these fields. Interdisciplinary research clusters, dual-degree programs, and industry partnerships will play a pivotal role in institutionalizing this convergence.

Patenting, in particular, will become an increasingly relevant dimension of research culture in such projects. Protecting intellectual property ensures that interdisciplinary innovations achieve sustainability, visibility, and impact beyond the academic environment. By fostering collaborations across technical and humanistic faculties, higher education can position itself as a leader in shaping technologies that are not only efficient but also socially meaningful.

Although challenges remain, the overall trajectory suggests that patent activity will continue to grow in importance as a marker of academic excellence. For individuals, patents enhance career trajectories, confer symbolic capital, and expand professional networks. For institutions, they strengthen reputations, improve global rankings, and reinforce the role of universities as key players in innovation ecosystems. Ultimately, patent activity illustrates the convergence of knowledge creation and societal application, making it both a tool for professional growth and a badge of academic prestige.

CONCLUSIONS

Patent activity in higher education institutions represents far more than a legal or administrative procedure for protecting intellectual property; it embodies the institutionalization of innovation as a fundamental component of academic life. Across both technical and humanistic domains, the pursuit of patents reflects an evolving research culture that prioritizes originality, applicability, and societal engagement. While traditionally patents have been associated with engineering, natural sciences, and technology-driven fields, the growing recognition of intellectual property emerging from the humanities and interdisciplinary projects signals a paradigm shift in how knowledge creation is valued and disseminated.

The comparative analysis of technical and humanistic disciplines reveals that patent activity plays distinct but complementary roles. In engineering and natural sciences, patents function primarily as tangible outcomes of applied research, providing pathways to commercialization, industrial collaboration, and technological advancement. In the humanities, patenting is less widespread but increasingly relevant, especially in areas such as digital humanities, educational technologies, linguistics software, cultural heritage preservation, and creative industries. Here, patenting serves not only as a mechanism for safeguarding innovation but also as a symbolic demonstration of the societal utility of humanistic inquiry.

The presence of patent activity within academia is also a clear indicator of professional development and academic prestige. Faculty members who engage in patenting enhance their visibility both within their institutions and in broader scientific and industrial communities. Patents contribute to academic reputation, often becoming a complementary metric alongside publications and teaching achievements. This trend underlines the diversification of academic success indicators, reflecting a more practice-oriented vision of higher education where innovation outcomes are valued on par with traditional scholarly outputs.

Furthermore, the dynamics of university–industry collaboration are deeply intertwined with patent culture. Partnerships foster mutual benefits: universities gain access to resources, expertise, and practical implementation opportunities, while industries leverage cutting-edge research to strengthen competitiveness. Such collaborations also help to align research agendas with real-world challenges, ensuring that academic contributions extend beyond theoretical insights into concrete societal impact. In this sense, patent activity operates as both a catalyst and a measure of the permeability between academia and the external socio-economic environment.

Nevertheless, the development of a vibrant patent culture is not without challenges. Faculty members frequently encounter barriers, including bureaucratic complexity, lack of institutional support, insufficient knowledge of intellectual property rights, and uncertainties about the commercial viability of their inventions. Overcoming these barriers requires proactive policies at both national and institutional levels, fostering awareness, offering training, and creating incentive structures that reward innovation alongside traditional scholarly contributions.

Ultimately, the convergence of technological and humanistic perspectives illustrates the interdisciplinary potential of patenting within higher education. By embracing cross-disciplinary collaboration, universities can expand the scope of patentable ideas, from advanced materials and artificial intelligence applications to digital archives, smart learning platforms, and cultural heritage technologies. This convergence not only

broadens the portfolio of intellectual property but also reinforces the relevance of universities as key actors in shaping the knowledge economy.

In conclusion, patent activity has become an integral marker of research culture in higher education, bridging disciplinary divides and redefining academic values. It signals a move toward a more innovation-oriented university system, where the protection and application of intellectual property serve as both a driver and an outcome of institutional excellence. By cultivating an environment that supports patent activity across both the technical and humanistic spheres, higher education institutions can enhance their contribution to economic development, cultural enrichment, and global competitiveness. The future of research culture will likely depend on this balanced integration of creativity, invention, and intellectual property management, ensuring that universities remain at the forefront of societal progress.

SUMMARY

This article explores patent activity as an essential dimension of research culture in higher education, examining its manifestations in both technical and humanistic fields. Traditionally associated with engineering and the natural sciences, patents have been a key indicator of innovation and applied research. However, recent trends demonstrate that the humanities are also increasingly contributing to intellectual property, particularly through digital humanities, cultural heritage technologies, language processing tools, and creative industries.

Patent activity is presented as both a practical and symbolic marker of academic achievement. In technical fields, patents often result in commercialization, industrial collaboration, and technological advancement. In the humanities, while less common, patents highlight the broader societal value of research, bridging the gap between theoretical knowledge and practical application.

The article emphasizes that patents enhance institutional and individual academic prestige, diversifying traditional measures of success alongside publications and teaching. Moreover, patent activity strengthens university–industry collaboration, aligning research with real-world challenges and ensuring that higher education remains socially and economically relevant.

At the same time, the development of patent culture faces challenges such as bureaucratic complexity, limited awareness of intellectual property rights, and insufficient institutional support. Addressing these barriers requires targeted policies, training, and incentive structures.

Ultimately, the article argues that fostering patent activity across disciplines enriches the innovation ecosystem of universities, strengthens

their role in the knowledge economy, and redefines academic culture toward a more balanced integration of creativity, invention, and practical impact.

REFERENCES

1. Коваленко Л. Патентна активність як складова наукової культури університетів України. *Науковий вісник*. 2021. № 7. С. 88–97.
2. Бондар О. Інноваційна діяльність та патентування у технічних університетах: сучасні тенденції. *Вісник Харківського національного університету*. 2020. № 5. С. 134–142.
3. Дмитренко І. Академічна культура та інноваційні практики у вищій школі. *Освіта і наука*. 2019. № 3. С. 102–110.
4. Шевченко С. Патентування та академічна престижність науково-педагогічних працівників. *Вісник вищої школи*. 2022. № 2. С. 65–74.
5. Костюк О. Патентна активність у гуманітарних науках: виклики та перспективи. *Гуманітарний вісник*. 2021. № 4. С. 51–60.
6. Мельник Т. Професійний розвиток науковців і патентна культура в університетах. *Педагогіка і психологія професійної освіти*. 2020. № 6. С. 39–48.
7. Hemmert M., Cross A. University patenting in Europe and Asia: Trends and institutional drivers. *Research Policy*. 2021. 50(7). P. 104–116.
8. Munari F., Toschi L. Patents and academic careers: An empirical study of European universities. *Journal of Technology Transfer*. 2020. 45(6). P. 1713–1732.
9. Saracho J., González-Pernía J. University–industry collaboration and patent activity: Evidence from Spanish technical universities. *Technovation*. 2019. 84–85. P. 1–12.
10. Shibayama S., Wang J. Academic patenting and its impact on research culture in engineering faculties. *Higher Education Quarterly*. 2022. 76(3). P. 520–538.
11. Zhou Y., He Y. Patenting, innovation and research culture: An international perspective. *Science and Public Policy*. 2023. 50(1). P. 45–59.

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