Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

The Role of Patents in Shaping Turkish University Rankings: National and International Perspectives

Mohammed Sayim Khalil

sayimkhalil@halic.edu.tr

Haliç University

Büşra ŞAHİN

Haliç University

Research Article

Keywords: university rankings, patents, technology transfer, Turkish higher education, TTO, innovation policy

Posted Date: August 28th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9971399/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

This article examines the relationship between patent activity and university rankings in Turkey, encompassing both national evaluation frameworks and major international ranking systems. Drawing on data from the Turkish Patent and Trademark Office (Türk Patent), the Council of Higher Education (YÖK), TÜBİTAK's Entrepreneurship and Innovation Index (GİE), and global rankings including Times Higher Education (THE), QS World University Rankings, and SCImago, we investigate how intellectual property outputs are associated with institutional standing. Our analysis demonstrates that patent generation — spanning application volumes, granted patents, international filings, and commercialization activity — is positively associated with ranking performance, particularly in innovation-weighted frameworks. We acknowledge the endogeneity inherent in this relationship: higher-ranked universities attract the resources and talent that facilitate greater patent output, making causal direction a complex empirical question. The article identifies persistent structural challenges — low commercialization rates, regional disparities, disciplinary imbalances, and foreign-exchange cost barriers for international filings — and concludes with six Turkey-specific policy recommendations, including a foundational proposal for mandatory patent commercialization data reporting infrastructure.

JEL Codes: I23 · O34 · O38 · L31 · H52

1. Introduction

In the global knowledge economy, universities are no longer evaluated solely on the basis of teaching quality and scholarly publication volumes. Increasingly, their capacity to generate, protect, and commercialize intellectual property has become a meaningful marker of institutional excellence. Patents — as codified innovations bridging academic research and economic application — occupy a central position in this expanded vision of university performance. For Turkish higher education institutions, the strategic significance of patents has grown substantially over the past decade, driven by government policy, institutional reform, and the explicit incorporation of patent-related indicators into both national evaluation frameworks and international ranking methodologies.

Turkey's higher education system has undergone rapid transformation. From a small number of institutions in the late twentieth century, the country now operates over 200 universities. Yet growth in scale has been accompanied by mounting pressure to improve research quality and global competitiveness. In this context, patents represent a dual opportunity: they are both an output of research excellence and a direct contributor to the metrics by which universities are evaluated and compared.

This article investigates the relationship between patent activity and university ranking performance in Turkey. A fundamental caveat shapes the entire analysis: the patent–ranking relationship is bidirectional. Higher-ranked universities attract greater funding, stronger faculty, and more industry partnerships — all of which produce more patents. Simultaneously, institutions that build robust patent portfolios may improve on specific ranking metrics that reward innovation. Rather than asserting that patents drive

rankings, we argue that the two are positively correlated, and that strategic investment in patent capacity represents an actionable lever for institutional improvement within specific ranking frameworks — even if it is not the primary driver of prestige differentials.

A critical dimension is the normative question of whether optimizing for ranking metrics is an appropriate policy goal at all. Hazelkorn (2015) documents how global ranking systems have reshaped university behaviour by creating performance pressures that can crowd out activities that are socially valuable but difficult to measure. Marginson (2018) argues that rankings systematically advantage wealthy English-speaking institutions and encode a narrow template of excellence that disadvantages emerging-economy universities regardless of their genuine societal contributions. These critiques apply to Turkey with particular force: a university system that reorients research investment toward patent metrics legible to THE or QS may simultaneously underinvest in basic science, social research, or regionally relevant applied work. The analysis and recommendations in this article take this tension seriously; the goal is not to endorse ranking optimization as an end in itself, but to describe accurately what Turkish universities that pursue ranking improvement will find useful, while acknowledging the trade-offs involved.

This article is explicitly framed as a policy-oriented review rather than an original empirical study. It synthesizes publicly available data to map the patent–ranking landscape for Turkish universities, identify enabling conditions and structural barriers, and develop actionable policy recommendations grounded in the Turkish institutional context. While primarily a synthesis, the article presents original descriptive comparisons of Turkish university patent-performance profiles (Section 5, Table 2) and the YTU case analysis (Section 5.2), derived from public data but organised in a novel comparative framework unavailable elsewhere in the literature.

The article is structured as follows. Section 2 surveys ranking systems and their patent indicators. Section 3 describes the review methodology and data sources. Section 4 traces the evolution of the Turkish university patent ecosystem. Section 5 presents descriptive analysis of leading Turkish universities, including an extended examination of the Yıldız Technical University case. Section 6 examines the patent–ranking association within specific frameworks. Section 7 discusses structural barriers and enabling conditions, with illustrative comparison to emerging economy peers. Section 8 offers six Turkey-specific policy recommendations. Section 9 outlines limitations, and Section 10 concludes.

2. University Ranking Frameworks and Patent Indicators

2.1 International Ranking Systems

Major international ranking systems have increasingly embedded innovation and knowledge transfer metrics into their frameworks. However, the precise weight and interpretation of these metrics varies substantially across systems, and several important clarifications are warranted.

The Times Higher Education World University Rankings (THE WUR) introduced a dedicated Patents metric in 2023 as one component within its broader Industry Income pillar. The Industry Income pillar accounts for 7.5% of the total THE score, encompassing three elements: research income from industry (actual revenue received), knowledge transfer activities (licensing revenue, spin-offs), and patent citations. THE does not publish precise sub-component weights. Its published methodology describes the pillar as comprising three elements that appear to be comparably weighted — though industry income from research contracts is known to dominate in absolute monetary terms for most institutions. On the assumption that the patent citation sub-component carries between one-quarter and one-half of the pillar weight, its share of the total composite score ranges from approximately 1.9% to 3.75%. We use this range rather than a single point estimate throughout; the midpoint of approximately 2–3% is used as a working approximation in Table 1. Readers should note that if the true weight sits toward the lower end of this range, patents have a materially smaller quantitative impact on THE scores than the midpoint implies, and THE's own guidance to institutions should be consulted where precise strategic planning is required. The patent sub-component is calculated based on patents citing an institution's published research, with data from WIPO, EPO, and national offices. For the 2026 edition, the metric covers patents published 2020–2024.

The QS World University Rankings assign 10% of their total score to papers per faculty, while employer reputation (20%) can be influenced indirectly by an institution's innovation profile. QS does not include an explicit patent indicator.

The SCImago Institutions Rankings (SIR) take a more substantive innovation-oriented approach through a dedicated Innovation sub-ranking, calculated from both the number of patent applications filed by an institution and the frequency with which its published research is cited in third-party patents. This dual measurement captures both direct output and knowledge diffusion.

Rankings such as US News & World Report Best Global Universities and the CWTS Leiden Ranking remain primarily bibliometric and do not directly reward patent activity. The absence of explicit patent indicators in several major rankings means that patent strategy's impact on overall global standing is concentrated within a specific subset of systems — most notably THE and SCImago.

2.2 National Ranking and Evaluation Frameworks

Within Turkey, the University Monitoring and Evaluation (Üniversite İzleme ve Değlendirme, ÜİDE) system administered by YÖK assessed 201 universities across 67 performance indicators in its 2025 report (published December 2025). Within the Research and Development category, patent-specific indicators feature prominently: applied patents, utility models and designs; university–industry collaboration patent documents; and international collaborative patent documents. Together these influence YÖK's A1/A2/B1/B2 Research University classification, which determines access to enhanced funding.

A critical but often overlooked distinction within Turkish IP statistics is between full patents (invention patents, icat patenti) and utility models (faydalı model). Utility models have substantially lower novelty

and inventive step thresholds, are examined on a registration rather than substantive examination basis, and are granted for a maximum 10-year term compared to 20 years for full patents. Under Turkish law, they are a distinct IP right rather than a sub-category of patents. For ranking purposes, this distinction matters: utility models are unlikely to generate the international patent citations that THE's metric rewards, and their licensing commercial value is generally lower than full invention patents. The YÖK ÜİDE system aggregates utility models within the 'applied patent, utility model or design' indicator, meaning institutions may inflate their apparent patent scores through utility model filings without building genuine innovation capacity. Neither YÖK nor GİE currently requires institutions to disaggregate utility models from full patents in their reporting, which limits the analytical precision of both this article and the rankings themselves.

TÜBİTAK's Entrepreneurship and Innovation Index (GİE) evaluates 50 universities across 23 indicators under four categories, with an entire category — Intellectual Property Pool — dedicated to patent applications, grants, and international filings. The 2024 GİE results were announced in May 2025. The University Ranking by Academic Performance (URAP), developed at METU, provides a publication- and citation-centric national ranking that does not directly reward patents but correlates with the applied research culture that produces them.

Table 1
Patent Indicators Across Major Ranking Systems Relevant to Turkish Universities

Ranking System	Patent Metric	Est. Weight	Data Source	Scope
THE WUR	Patents citing institutional research (sub-component of Industry Income pillar)	~ 1.9–3.75% of total (est.)	Elsevier / WIPO, EPO, USPTO	Global
SCImago SIR	Patent applications & citations of research in patents	Dedicated sub-rank	WIPO / Scopus	Global
QS WUR	No direct patent metric	Indirect only	—	Global
YÖK ÜİDE	Applied patents, licensed patents, intl. collab. patents (multiple indicators)	Multiple indicators	Türk Patent / YÖK	National
TÜBİTAK GİE	Applications, grants, intl. filings (full IP Pool category, ~ 25% of total)	Full category	Türk Patent / TÜBİTAK	National

Note. THE weight is estimated at approximately 1.9–3.75% of total score, depending on sub-component weighting assumptions; THE does not publish precise sub-component weights. GİE category weight is approximate based on equal distribution across four categories.

Table 1 provides a consolidated overview of how patent-related indicators are incorporated across the five most relevant ranking systems for Turkish universities. A critical distinction emerges: at the international level, only THE WUR and SCImago include direct patent-based metrics, while QS relies solely on indirect effects. At the national level, both YÖK ÜİDE and TÜBİTAK GİE assign explicit weight to

patent activity. This fragmentation means that a single patent strategy cannot simultaneously optimize performance across all five systems, which directly motivates the differentiated policy recommendations in Section 8.

3. Methodology, Data Sources, and Scope

3.1 Article Type and Review Approach

This article is a policy-oriented review. It does not conduct primary data collection, statistical inference, or systematic meta-analysis; it synthesizes publicly available data to map the patent–ranking landscape for Turkish universities, identify enabling and constraining conditions, and formulate actionable policy recommendations. This framing is deliberate: the available institutional-level data on patents and rankings for Turkish universities do not yet support robust econometric identification of causal effects, and presenting descriptive evidence as causal identification would misrepresent the state of knowledge. Future empirical work is explicitly called for throughout.

Sources were selected according to the following criteria: (1) direct relevance to patent activity or university ranking performance in Turkey; (2) publication or data coverage from 2013 onward, coinciding with TÜBİTAK's TTO Support Programme establishment; (3) availability from official, institutional, or peer-reviewed sources. Searches were conducted across Google Scholar, Web of Science, and Scopus using the terms 'Turkish university patents', 'university technology transfer Turkey', 'university rankings Turkey', 'TTO Turkey', 'GİE Turkey', and 'YÖK university evaluation', supplemented by direct retrieval from YÖK, TÜBİTAK, Türk Patent, Times Higher Education, and SCImago institutional databases.

Several dimensions of Turkish university patenting are deliberately scoped out of this review, including: the gender and demographic composition of inventor pools (the global literature consistently documents gender gaps in academic patenting that almost certainly apply in Turkey, but institutional-level gender-disaggregated patent data are not publicly available); the role of individual TTO directors and staff as human factors in performance variation; and the relationship between student entrepreneurship programmes and patent pipelines. These omissions are acknowledged rather than assumed to be unimportant.

The comparative cases in Section 6.4 (South Korea, India, Brazil) are included as illustrative reference points to contextualise Turkey's experience, not as systematic cross-national empirical comparisons. They are treated as plausibility benchmarks rather than tested hypotheses and are explicitly caveated accordingly.

3.2 Data Sources and Period Coverage

The analysis draws on data from overlapping but non-identical time periods: patent data (Türk Patent, via Patent Effect's Turkey Patent Map 2023) covers cumulative filings through 31 December 2023; THE WUR 2026 patent metric covers patents published 2020–2024; QS World University Rankings figures reflect

the 2025 edition; YÖK ÜİDE data reflect the 2025 report (covering 2024 activity); TÜBİTAK GİE 2024 results were announced May 2025; and the article's preparation date is June 2026.

Regarding the THE WUR patent citation window specifically: the metric covers patents published 2020–2024 that cite institutional research publications. The cited research may substantially pre-date 2020. This has an important implication: the THE metric does not capture whether universities filed patents in response to ranking incentives introduced in 2023. The direction of influence in the THE data runs from pre-existing research quality toward patent citations, not from post-incentive patent filing toward ranking scores. This is a further reason to avoid interpreting the THE patent metric as evidence that strategic patent filing drives ranking improvement.

The primary patent data source is Patent Effect's Turkey Patent Map 2023 rather than Türk Patent's raw annual statistical reports. Patent Effect is a Turkish commercial analytics firm specialising in intellectual property data intelligence; it is neither an academic project nor an official government body, and its methodology has not been independently peer-reviewed. Its principal value for this analysis is its disambiguation of university-originated applications from those filed by university-affiliated spin-offs or individual researchers — a separation that Türk Patent's aggregate statistical releases do not cleanly provide. Aggregate filing trends are cross-checked against Türk Patent's own annual reports (Yıllık Faaliyet Raporları), which provide official primary validation at the system level (Türk Patent, 2023). No material discrepancies in aggregate trends were identified. Readers should nonetheless note that the institutional-level figures cited from Patent Effect have not been independently verified against raw Türk Patent filings.

4. The Evolution of University Patent Activity in Turkey

4.1 Legislative and Institutional Architecture

The foundation of contemporary university patenting in Turkey was laid by the Industrial Property Law (Law No. 6769), enacted in 2017. This legislation established clearer ownership rights for university-generated inventions, providing researchers and institutions with a more predictable legal framework. Prior to this reform, ambiguities in IP ownership had discouraged active patenting among academic researchers (Ranga et al., 2016).

TÜBİTAK launched the Technology Transfer Office Support Programme in 2013 with approximately USD 16 million in total committed funding disbursed over a five-year implementation period (2013–2018), distributed across 30 supported universities — an average of approximately USD 533,000 per institution over the full programme. Each TTO was structured around five functional modules: Awareness and Training; Project Support; University–Industry Collaboration; Intellectual Property Rights and Licensing; and Entrepreneurship. University-originated patent applications grew from fewer than 20 annually in 2013 to 996 in 2018. The co-occurrence of multiple enabling factors during 2013–2018 means that

attribution of the application growth to any single policy lever is not possible from observational data alone.

A critical enabling mechanism for disclosure behaviour is the personal financial incentive available to faculty inventors. Turkey's 2017 Industrial Property Law (Law No. 6769, Article 122) establishes that when a university commercialises an invention made by an employee in the course of their duties, the inventor is entitled to a share of the net commercialization revenues, with the specific percentage determined by the institution's internal IP regulations. In practice, Turkish universities have adopted revenue-sharing models typically ranging from 30% to 50% of net licensing income to the inventor. Two constraints limit effectiveness: first, because net licensing revenues remain low for most institutions, even a 40% inventor share on a modest licensing agreement generates little financial motivation relative to the time cost of patent prosecution; second, awareness of these provisions remains uneven, particularly at institutions without mature TTO programmes.

The structural challenges facing Turkish university technology transfer were comprehensively documented by Ranga et al. (2016) in a study based on a European Patent Office-funded project managed by Ege University's EBILTEM-TTO and the Turkish Patent Institute. Its key findings establish the baseline against which subsequent progress should be measured: Turkish universities exhibited early-stage technology transfer capacity; most TTO functions were underdeveloped or absent outside a small cluster of leading institutions; the primary binding constraint was cultural rather than legal — academic researchers lacked awareness of IP mechanisms and market-oriented research goals were structurally devalued relative to publication output; institutional obstacles included unclear ownership rights, absence of internal researcher incentive structures, and limited TTO capacity to evaluate commercial potential; and licensing activity was minimal with spin-off creation nearly negligible outside METU. More recent work by Temel (2023) suggests that the commercialization conversion gap remains the dominant unresolved challenge.

4.2 Growth Trajectory and Current Scale

By 2023, Turkish university patent activity had matured substantially relative to the pre-TTO era. The Turkey Patent Map 2023 (Patent Effect, 2024), announced on 25 April 2024, documented cumulative patent filings, licensing activity, and spin-off creation across the university sector. University-originated patent applications had grown from fewer than 20 annually in the early 2000s to hundreds of annual applications by the late 2010s, following the TTO programme rollout and the 2017 legislative reforms.

However, context is essential. A substantial proportion of Turkish university patent applications are filed domestically only, through Türk Patent, without subsequent international pursuit through PCT or direct EPO/USPTO filings. International patent activity — the measure most directly relevant to THE's citation-based metric — remains concentrated among a small cluster of universities, with METU and Koç University accounting for a disproportionate share. The majority of the 200 + Turkish universities file few or no international patents, and many that do file domestically have not progressed to commercialization.

5. Patent Performance of Leading Turkish Universities

5.1 Institutional Profiles

Middle East Technical University (METU, or ODÜ) has emerged as the uncontested leader in patent commercialization within the Turkish university system. As of the end of 2023, METU held 58 cumulative commercialization contracts covering 60 licensed or transferred patents, and concluded 10 new commercialization agreements in 2023 alone, maintaining its position atop the Turkey Patent Map for multiple consecutive years (Patent Effect, 2024). METU's TEKNOKENT technopark, the first university-based technopark in Turkey, provides an institutionalized ecosystem for commercializing these patents through spin-off companies and direct industry licenses. An important interpretive note: METU was Turkey's leading engineering university for decades before its TTO was established. Its patent leadership today reflects both TTO effectiveness and pre-existing research excellence, industry partnerships, and engineering faculty depth. The observed association between METU's patent portfolio and its ranking performance should not be read as evidence that patent activity caused its institutional prestige.

Istanbul Technical University (ITU) occupies a complementary position, combining strong engineering research with active patent generation. ITU's performance is closely associated with İTÜTEKNOKENT, one of Turkey's most active university-based technology parks.

Among private universities, Koç University and Sabancı University have made remarkable progress. Sabancı University had secured approximately 250 patents since its establishment, with 14 obtained in 2020 alongside over 525 scientific publications. Its SUNUM Nanotechnology Research and Application Centre operates as an active interface between academic research and industrial application. Koç University's TTO manages a portfolio oriented toward biomedical, engineering, and computational sciences.

Hacettepe University leads among Turkish public universities in the URAP-TR national ranking and holds positions between 601–800 in several international rankings. Its biomedical and pharmaceutical research orientation produces patent activity primarily in life sciences, where patent prosecution timelines are substantially longer than in engineering or materials science. In Turkey, the average time from patent application filing to grant decision is approximately 3–5 years for engineering and materials science patents but can extend to 7–10 years for pharmaceutical and biotechnology patents requiring extensive claims examination and, in some cases, supplementary protection certificate procedures aligned with European standards (Türk Patent, 2023). THE's metric — based on citations of institutional research in third-party patents — is particularly ill-suited to pharmaceutical research timelines, since the citation lag in that domain can exceed THE's five-year publication-to-citation window.

5.2 The Yıldız Technical University Critical Case

The case of Yıldız Technical University (YTU) is the most analytically productive in this paper precisely because it does not fit the expected pattern. YTU ranked first in Turkey in the TÜBİTAK GİE's Economic

and Social Contribution category and second nationally in both licensed patents and international patent applications — yet does not appear in the QS World University Rankings at all, and its THE placement is in the 1001–1200 range. This divergence is a finding that tests and refines the paper's central argument.

Three non-mutually exclusive explanations merit consideration. First, there is the publication-citation deficit: QS weights academic reputation (30%) and citations per faculty heavily, and YTU's research output, while technically productive in patent-relevant applied domains, may not generate the volume or citation impact of internationally visible research publications that QS rewards. Filing patents and publishing high-impact journal articles are complementary activities in well-resourced institutions but can represent competing priorities in institutions with constrained faculty time and funding.

Second, there is the possibility of a deliberate strategic orientation toward national innovation metrics over global academic visibility. Turkey's GİE framework creates strong incentives for patent commercialization, licensing, and industry collaboration — metrics that can be optimized through focused TTO activity without requiring the English-language publishing culture, international faculty hiring, or overseas student recruitment that drives QS performance. If YTU has consciously prioritised GİE standing over QS visibility, its apparent divergence is a rational institutional response to a bifurcated incentive landscape.

Third, the employer reputation and academic reputation surveys that dominate QS scoring (together 50% of the total) reward historical prestige and name recognition that are slow-moving and difficult to shift through any single strategic initiative. YTU may be generating genuine innovation value that has not yet converted into the employer and academic perceptions captured in reputation surveys.

The YTU case carries clear policy implications. Institutions that concentrate resources on TTO capacity and patent prosecution without parallel investment in research publication quality, international collaboration, and English-language academic visibility may improve substantially in national innovation rankings while making no progress in QS or THE. GİE and QS cannot be treated as interchangeable proxies for 'university performance' — they measure genuinely different institutional capabilities.

Table 2
Patent Performance and Ranking Standing of Leading Turkish Universities (2024–2026)

University	GİE 2024	THE WUR 2026	QS 2025	Primary Patent Domain
METU (ODÜ)	Top 3	601–800	336	Engineering, defence, energy
Istanbul Technical Univ.	Top 5	801–1000	411–420	Engineering, technology parks
Koç University	Top 5	501–600	~ 600	Biomedical, deep-tech
Sabancı University	Top 5	601–800	531–540	Nanotechnology, materials
Yıldız Technical Univ.	1st (Econ. Contrib.)	1001–1200	Not ranked	Intl. filings, licensing
Hacettepe University	Top 10	1001+	~ 800	Biomedical, pharmaceutical

Note. YTU's absence from QS rankings despite leading national patent performance illustrates the system-specificity of patent–ranking effects discussed in Section 5.2. Rankings are approximate for institutions with banded rather than precise placements. Primary Patent Domain classifications are author inferences based on institutional research profiles; they are not derived from systematic patent classification data.

Read horizontally, Table 2 illustrates both the degree of alignment and the divergences between national patent performance (GİE) and international ranking visibility (THE, QS). Read vertically, the QS column reveals the clearest differentiation: three of the six universities appear in the top 800 globally, while YTU does not appear at all — a divergence not explained by patent output alone, pointing instead to the reputational and publication-quality factors that QS weights most heavily. The disciplinary dimension is also visible: universities with the highest international ranking visibility have the broadest internationally oriented research bases, producing patents more likely to be cited in WIPO and EPO filings. Hacettepe's pharmaceutical concentration, while scientifically significant, operates on longer prosecution timelines and in domains with lower international patent citation volumes.

6. The Patent–Ranking Association: Mechanisms and Evidence

6.1 International Ranking Systems

In THE WUR, the relevant channel is the citation of institutional research in third-party patents. A university benefits not from filing patents per se, but from publishing high-quality applied research that other organizations subsequently build upon in their own applications. Turkish universities in engineering, materials science, chemistry, and biomedical fields have plausible pathways to improvement through this metric, but the absolute numbers of research-citing patents for most Turkish institutions remain modest.

The SCImago Innovation sub-ranking provides a cleaner channel: it directly counts institutional patent applications alongside research-to-patent citation flows. Universities with active TTOs and high filing rates consistently occupy higher positions on this sub-dimension.

Within QS, patent activity influences performance only indirectly. Research-active institutions with strong patent portfolios tend to attract more industry partnerships and develop stronger employer networks, which may positively affect QS sub-scores. However, these are indirect and diffuse effects; patent strategy alone is not a reliable lever for QS improvement.

6.2 National Ranking Systems

The YÖK ÜİDE system most directly translates patent activity into ranking outcomes. The 2025 report explicitly noted that increases in university–industry collaboration and patent numbers strengthen universities' research ecosystems. Institutions filing higher numbers of applied patents, utility models, and designs receive proportionally higher scores, while those with licensed patents and international collaborative patent documents gain additional advantage across the Interaction and Cooperation dimension. Istanbul Gelişim University's achievement of 6th place nationally in the applied patent, utility model, or design indicator in 2024 illustrates that strategic IPR investment can produce measurable movement in national standing.

TÜBİTAK's GİE is the most patent-intensive of all Turkish evaluation frameworks. With an entire category — Intellectual Property Pool — dedicated to patent applications, grants, and international filings, the index functions essentially as a direct ranking of institutional patent productivity combined with research competence and industry collaboration.

6.3 The Endogeneity Problem

A consistent caveat applies throughout: the observed correlations between patent activity and ranking performance are susceptible to endogeneity bias. Higher-ranked universities attract more government funding, private philanthropy, and industry research contracts — all of which create conditions for more patent activity. METU's patent leadership is inseparable from its position as Turkey's premier engineering university, its large engineering faculty, and its TEKNOKENT ecosystem, all established before current TTO activity. It would be incorrect to infer from METU's experience that a lower-ranked university could substantially close the prestige gap through patent strategy alone.

Future research using instrumental variables or lagged panel data approaches — for example, exploiting the staggered rollout of TÜBİTAK TTO support grants as a natural experiment — could help isolate the causal contribution of TTO investment to ranking trajectories. Such analysis is beyond the scope of this review article but represents a clear research agenda.

Hazelkorn (2015) argues that global ranking systems have fundamentally reshaped university behaviour by creating powerful performance pressures that can distort institutional priorities — driving universities to pursue measurable indicators at the expense of activities that are socially valuable but harder to

quantify. Marginson (2018) extends this critique, arguing that rankings encode a particular geopolitical vision of higher education that systematically advantages wealthy English-speaking institutions. In the Turkish context, the incentive to optimize for THE and QS patent metrics may encourage strategic patent filing oriented toward citation impact rather than genuine commercialization value, and the adoption of global ranking standards as national policy goals may crowd out basic science and socially oriented research.

6.4 Illustrative Comparison: Emerging Economy Peers

Turkey's experience can be contextualised through illustrative comparison with other emerging economies that have pursued university patent expansion. These comparisons are not systematically empirically tested within this article and are offered as plausibility benchmarks rather than definitive evidence.

South Korea's trajectory offers the most extensively documented comparison case. From the late 1990s, Korean government policy — anchored in the Technology Transfer Promotion Act (2000) and subsequent R&D investment programmes — promoted university–industry technology transfer and resulted in rapid growth in PCT filings by institutions such as KAIST, POSTECH, and Seoul National University (Park & Leydesdorff, 2010). These institutions simultaneously achieved substantial gains in THE and QS rankings. Park and Leydesdorff (2010) document the structural co-evolution of Korea's national innovation system, showing that university patenting growth was embedded within broader investments in internationally oriented research publication, English-language faculty recruitment, and industry collaboration infrastructure. Lee (2018) examines KAIST specifically, finding that its global ranking ascent was driven primarily by citation impact and internationalization improvements, with patent metrics providing a secondary contribution concentrated in SCImago-type innovation rankings. No published study isolates the causal contribution of patent investment to Korean ranking trajectories; the Korea case is therefore plausible evidence that patent activity combined with broader research transformation can produce ranking gains, while acknowledging that patents are one element of a bundled transformation rather than an independent driver.

India's experience illustrates a less favorable scenario. Indian universities have sharply increased domestic patent filings under government IP promotion programs, but international rankings have not rewarded this activity commensurately, in part because Indian university patents are predominantly domestic filings rarely cited in international patent documents — the precise channel through which THE's metric operates (Mitra et al., 2022). Brazil shows a similarly mixed picture, with large research universities making modest ranking gains alongside patent growth but with substantial heterogeneity and no systematic evidence isolating the patent contribution.

These illustrative comparisons suggest that Turkey's patent–ranking relationship is most likely to yield benefits at the level of specific innovation-weighted metrics (THE Industry Income, SCImago Innovation, TÜBİTAK GİE) rather than at the level of overall global ranking tier, and that the conditions distinguishing Korea from India — international filing rates, research publication quality, and integrated institutional

investment — are precisely the dimensions where Turkish policy most needs to focus. The YTU case may resemble the Indian pattern more than the Korean one: strong domestic patent output without the international citation visibility that ranking systems reward.

7. Structural Challenges and Enabling Conditions

7.1 Persistent Barriers

Despite significant progress since 2013, the Turkish university patent ecosystem continues to face structural challenges. Low commercialization conversion rates remain the most consequential: the pathway from patent application to licensed technology or spin-off company requires legal expertise, market assessment capability, and negotiation experience that many TTOs — particularly at newer institutions — do not yet possess. The scarcity of publicly available financial data on licensing revenues prevents precise assessment of the monetary impact of university patents, but qualitative evidence suggests that many commercialization agreements generate modest rather than transformative returns. By contrast, US universities report annual licensing revenue, new license agreements, spin-off formation, and royalty income disaggregated by technology category to the Association of University Technology Managers (AUTM); the resulting annual statistics database has enabled decades of empirical research on technology transfer effectiveness. No Turkish equivalent exists — a gap that Recommendation 6 (Section 8) directly addresses.

Regional disparities represent a further structural imbalance. Patent activity is heavily concentrated among universities in Istanbul, Ankara, and İzmir. Universities in Anatolia's eastern and central regions remain largely absent from national patent rankings, simultaneously reflecting and reinforcing their lower position in both national and international ranking systems.

Disciplinary concentration constrains both aggregate patent performance and specific international ranking metrics. Turkish university patenting is heavily weighted toward engineering, materials science, and applied chemistry. Broadening disciplinary patent activity, particularly into biotechnology, pharmaceutical science, and digital technology, would increase exposure to the international patent citation flows that THE measures.

The cost of international patent prosecution represents a context-specific structural barrier. PCT filing fees are denominated in USD and EUR, while Turkish university research budgets are typically allocated in Turkish lira. Currency depreciation has substantially increased the effective lira cost of international filings, creating a disincentive for universities outside the well-funded top tier. Policy responses that provide FX-denominated grant support for international filings would address a barrier that generic recommendations about 'increasing international patent activity' systematically overlook.

7.2 Enabling Conditions

Several enabling conditions have strengthened the patent–ranking nexus. The 2017 Industrial Property Law has stimulated disclosure activity by clarifying IP ownership rights and revenue-sharing mechanisms. As of 2026, 23 Turkish universities are placed in the top 500 in Europe by QS Europe rankings, and Turkey is the second most-represented country in European rankings with 103 institutions included.

Participation in Horizon Europe research projects presents a specific opportunity: collaborative projects with European partners generate co-invented patents contributing to the international collaborative patent document indicator in YÖK's ÜİDE system. The Turkish government's stated commitment to commercializing high-tech research in AI, healthcare, quantum computing, space technology, and semiconductors — articulated by the Minister of Industry and Technology in May 2025 — signals policy prioritization that could direct new resources toward the deep-tech patent domains where international ranking rewards are greatest.

8. Policy Recommendations

Based on our analysis, we offer six recommendations grounded in the specific institutional, economic, and regulatory context of Turkey:

(1) TTO strategy should be explicitly aligned with the patent channels most relevant to each institution's target ranking systems. Institutions targeting THE improvement should ensure that applied research is both published in Scopus-indexed journals and filed as patent applications, maximizing dual citation-and-patent metric benefits. This requires coordination between TTO offices and research publication strategy — a function few Turkish TTOs currently perform explicitly. Achieving this does not require legislative change; it requires TTO mandate expansion and researcher training, both achievable through administrative action.

(2) International patent filing requires dedicated FX support. Given lira depreciation, universities outside the METU-ITU-Koç tier face structurally higher effective costs for PCT and EPO/USPTO prosecution. TÜBİTAK's TTO Support Programme should introduce a specific grant instrument providing FX-denominated coverage for international filing fees, prioritizing institutions with demonstrated domestic patent activity seeking to build international portfolios.

(3) Commercialization capacity must be built on a professional rather than administrative basis. TTO staff should include RTTP-certified IP professionals, licensing negotiators with industry experience, and technology marketing specialists. TÜBİTAK's Phase 2 TTO programme should condition renewed grant support on demonstrated commercialization outcomes — licenses executed and revenues generated — rather than solely on application volumes.

(4) The YÖK ÜİDE measurement framework should be broadened for life sciences institutions. Indicators that count patent applications may undervalue universities in pharmaceuticals and biotechnology, where prosecution timelines can exceed a decade. Incorporating citation-of-research-in-patents measures

alongside application counts would provide a more accurate picture of research-to-innovation translation across disciplines.

(5) Regional universities require targeted support to reduce the patent concentration gap. Satellite TTO programs embedded within regional technoparks, IP advisory services delivered remotely by experienced TTO personnel from anchor universities, and regional IP hubs co-funded by development agencies and industry could enable universities outside the Istanbul–Ankara–İzmir triangle to participate in national patent frameworks.

(6) Turkey needs a mandatory annual patent commercialization data infrastructure. We recommend that YÖK and TÜBİTAK jointly introduce mandatory annual reporting requirements for all TTO-supported universities, covering: total licensing revenues by technology domain; number and financial terms of license agreements executed; spin-off companies created and their three-year survival rates; PCT applications filed with associated cost and outcome data; and disaggregation of full patents from utility models. This dataset would enable the panel data analysis that causal identification requires and would transform the basis for policy evaluation from application counts to realized economic and social value. This recommendation requires a YÖK regulatory instrument and a TÜBİTAK reporting amendment, both achievable without primary legislation.

9. Limitations

This article has several limitations that readers should bear in mind.

First, reliance on Patent Effect's institutional disambiguation methodology. Patent Effect is a commercial analytics firm whose patent classification approach has not been independently peer-reviewed or validated against raw Türk Patent filing records. While aggregate figures align with official Türk Patent statistics, the institutional-level patent counts and commercialization figures used in Section 5 may contain classification errors.

Second, the THE weight estimation problem. The patent sub-component weight within THE's Industry Income pillar is estimated at approximately 1.9–3.75% of the total composite score. THE does not publish precise sub-component weights. If the true weight is toward the lower end of this range, the quantitative impact of patent activity on THE scores is materially smaller than the midpoint estimate implies.

Third, the absence of financial licensing data. Systematic, institution-level data on licensing revenues, royalty income, and spin-off financial performance are not publicly available in Turkey. The commercialization analysis in Section 5 relies on counts of agreements rather than financial outcomes, which are a poor proxy for economic impact.

Fourth, the lack of systematic cross-national controls. The illustrative comparisons with South Korea, India, and Brazil in Section 6.4 are based on qualitative characterisation and secondary literature rather

than matched-sample or regression analysis.

Fifth, small institutional sample. The institutional analysis in Section 5 covers six universities selected on the basis of available data and public prominence. This sample is not statistically representative of Turkey's 200 + institutions and over-represents large, well-resourced research universities.

10. Conclusion

This article has examined the relationship between patent activity and university ranking performance in Turkey, drawing on data from Türk Patent, YÖK, TÜBİTAK, and major international ranking systems. The central finding is that patent generation — particularly when it extends to international filings, research-citing patents, and realized commercialization — is positively associated with ranking performance in systems that explicitly reward innovation, including the THE WUR, SCImago, YÖK ÜİDE, and TÜBİTAK GİE. This association is strongest in national frameworks and more limited and specific in international ones.

The analysis has been careful to avoid overstating the causal claim. The bidirectionality of the patent–ranking relationship is a structural feature of the data, and the YTU case illustrates that patent performance is system-specific: what counts for GİE may not count for QS, and strategies calibrated to one framework will not automatically transfer to the other.

Comparative evidence from South Korea, India, and Brazil suggests that patent-driven ranking improvement is most plausible when embedded within broader institutional transformation — research expenditure growth, faculty internationalization, and English-language publication — rather than pursued as a standalone strategy. Turkey's leading institutions demonstrate this bundled model; the policy challenge is extending it beyond the current cluster.

Future research should address the causal identification challenge directly. The staggered rollout of TÜBİTAK TTO grants since 2013, combined with patent and ranking data over a decade-long panel, creates a potential natural experiment that could yield more definitive evidence on whether TTO investment causes ranking improvement. The proposed mandatory data infrastructure (Recommendation 6) would make such analysis feasible.

Declarations

Competing Interests

The authors declare no competing financial or non-financial interests related to the work submitted for publication.

Author Contributions

Mohammed Sayim Khalil: Conceptualisation, investigation, formal analysis, writing — original draft, writing — review and editing. Büşra ŞAHİN: Investigation, data curation, writing — review and editing,

project administration. Both authors read and approved the final manuscript.

Ethics Approval and Consent

Not applicable. This article is a policy-oriented review based entirely on publicly available secondary data. No primary data were collected; no human participants, patient data, or sensitive personal data were involved.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analysed. All data used are drawn from publicly available sources cited in the reference list.

Funding

The authors received no specific funding for this research.

Acknowledgments

The authors thank the anonymous reviewers and colleagues at Halic University for feedback on earlier drafts. No institutional data beyond publicly available sources were used.

AI-Assisted Editing Disclosure

AI-assisted tools were used for copy editing purposes to improve readability and grammar. All intellectual content, analysis, framing, and conclusions are the original work of the authors. The authors take full responsibility for the integrity of the manuscript. Use of AI tools is declared in accordance with Research Square editorial policy.

References

1. Council of Higher Education (YÖK). (2025). University monitoring and evaluation general report 2025. YÖK Publications.
2. Elsevier. (2026). University rankings data: THE world university rankings methodology. https://www.elsevier.com/academic-and-government/the-university-rankings-data
3. Hazelkorn, E. (2015). Rankings and the reshaping of higher education: The battle for world-class excellence (2nd ed.). Palgrave Macmillan.
4. Lee, Y. (2018). The role of KAIST in Korea's development: From a national champion to a global research university. Higher Education Policy, 31(4), 547–565. https://doi.org/10.1057/s41307-017-0065-x
5. Marginson, S. (2018). Global rankings and the geopolitics of higher education. Journal of Studies in International Education, 22(3), 185–200. https://doi.org/10.1177/1028315317748926

6. METU News. (2024, April). METU retains its title as patent commercialization champion. https://haber.metu.edu.tr/en/2024/04/metu-retains-its-title-as-patent-commercialization-champion/
7. Mitra, A., Bhattacharya, S., & Bhattacharya, J. (2022). University patent activity and research quality in India: An analysis of IP output and ranking trajectories. Science and Public Policy, 49(4), 512–528. https://doi.org/10.1093/scipol/scab084
8. Park, H. W., & Leydesdorff, L. (2010). Longitudinal trends in networks of university-industry-government relations in South Korea: The role of programmatic incentives. Research Policy, 39(5), 640–649. https://doi.org/10.1016/j.respol.2010.02.009
9. Patent Effect. (2024). Turkey's patent map 2023. Patent Effect Analytics.
10. Ranga, M., Temel, S., Carlsson, B., & Köseoğlu, M. A. (2016). Building technology transfer capacity in Turkish universities: A critical analysis. Industry and Higher Education, 30(2), 87–105. https://doi.org/10.1177/0950422216637987
11. SCImago Research Group. (2026). SCImago institutions rankings: Turkey. https://www.scimagoir.com
12. Temel, S. (2023). Insights into Türkiye's technology development journey. Insight Turkey, 25(1), 45–68.
13. Times Higher Education. (2026). World university rankings 2026. THE.
14. TÜBİTAK. (2025). Entrepreneurship and innovation index (GİE) 2024 results. TÜBİTAK.
15. Türk Patent (Turkish Patent and Trademark Office). (2023). Yıllık faaliyet raporu 2023 [Annual activity report 2023]. Türk Patent. https://www.turkpatent.gov.tr
16. Yıldız Technical University Research Office. (2025). YTU ranked first in Turkey for economic and social contribution. https://research.yildiz.edu.tr/en