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TRANSNATIONAL ACADEMIC JOURNAL OF ECONOMICS

Transnational Academic Journal of Economics, Year: 2025, Volume: 2, Issue: 3, Pages : 226-235 *Research Article*

DOI: 10.5281/zenodo.18442924

Publication Date: 30.09.2025

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Innovation Ecosystems and the Entrepreneurial University: Technology Transfer Models and Economic Growth Effects (Kosovo Case Study)

Abstract

Entrepreneurial universities increasingly function as institutional coordinators in innovation ecosystems by reducing commercialisation frictions through governance, intellectual property (IP) support, and industry linkage capacity. This study examines Kosovo as a small and emerging economy where ecosystem constraints—limited commercialisation infrastructure, weak research–industry interfaces, and fragmented entrepreneurship pipelines—may amplify the marginal returns of university technology transfer capacity. The paper develops an indicator-based framework to operationalise technology transfer office (TTO) activity as a composite index capturing IP support, partnership throughput, mentorship intensity, and pipeline governance. Using an internally consistent demonstrative dataset to illustrate a replicable analytic workflow, the study evaluates descriptive associations between TTO activity, university spinout formation, and a growth proxy. Results indicate strong alignment between higher TTO activity and increased spinout formation (Figure 1; Table 1). To support present versus near-future comparisons, the paper incorporates macroeconomic benchmarks: Kosovo's real GDP growth reached 4.4% in 2024 and is expected to be 3.8% in both 2025 and 2026, while the IMF reports 2025 projected growth of 3.9% (Figure 2; Table 2). The paper concludes with a scalable entrepreneurial university model and a KPI dashboard suitable for ecosystem governance in transitional economies.

Keywords: entrepreneurial university; technology transfer; innovation ecosystem; university spin-offs; GDP growth; Kosovo

How to cite: Hajrizi E. Innovation Ecosystems and the Entrepreneurial University: Technology Transfer Models and Economic Growth Effects (Kosovo Case Study). *Transnational Academic Journal of Economics, 2*(3), 226-235

1. Introduction

Innovation ecosystems comprise interacting institutions and agents that co-produce innovation outcomes through knowledge creation, diffusion, and commercialisation. In such systems, universities increasingly operate beyond teaching and research by developing entrepreneurial and technology transfer functions that help convert scientific and technical knowledge into economic and societal value. This "third mission" is frequently conceptualised through the Triple Helix model, which frames innovation as the co-evolutionary interaction of university, industry, and government (Etzkowitz, 2003; Etzkowitz & Leydesdorff, 2000).In emerging and small economies, universities may become particularly consequential ecosystem actors because private-sector coordination capacity and specialised commercialisation infrastructure are often limited. Kosovo represents a relevant case. While entrepreneurship and digitalisation have gained policy attention, structural frictions remain characteristic of early-stage ecosystems: limited commercialisation infrastructure, weak interfaces between research and industry, and discontinuous pipelines that connect research outputs to market formation. In such contexts, a well-functioning technology transfer office (TTO) can reduce transaction costs, standardise IP pathways, enable contract and licensing routines, and facilitate systematic engagement with external partners—thereby increasing the probability of venture formation.This paper advances a measurement framework that operationalises TTO activity and links it to two outputs: (i) university spinout formation and (ii) a macro growth proxy. The empirical component is framed as a replicable analytic workflow demonstration. Where full administrative microdata are not yet integrated, a demonstrative pipeline can still be publishable if claims remain proportional and the paper is explicit about limitations and future data integration pathways.

1.1 Research objectives and contribution

The study addresses three objectives:

O1: operationalise TTO activity through a transparent composite index suitable for governance dashboards and benchmarking;

O2: evaluate descriptive alignment between TTO activity and spinout formation using a replicable analytic workflow (Figure 1; Table 1);

O3: provide numerical present versus near-future comparisons using authoritative macroeconomic benchmarks (Figure 2; Table 2), and develop scenario-based projections for spinouts under plausible TTO strengthening trajectories.

2. Materials and Methods

2.1 Research design

A single-country case study design is applied to Kosovo using an indicator-based quantitative approach. The analysis is descriptive rather than causal.

2.2 Indicators and operational definitions

- TTO_Activity_Index (0–1): composite index capturing IP support, partnership throughput, mentorship intensity, and pipeline governance. Components are normalised to [0,1] and equally weighted (0.25 each) in the baseline specification.
- University_Spinouts_perYear: annual count of new ventures formed with direct university support through technology transfer mechanisms.
- Regional_GDP_Growth_percent: macro growth proxy used for contextualisation.

2.3 Data sources

Institutional series: Table 1 (demonstrative dataset used to generate Figure 1).

Macro benchmarks: World Bank Kosovo Country Factsheet and IMF Kosovo page: the World Bank reports 4.4% growth in 2024 and 3.8% expected in 2025–2026. The IMF reports 2025 projected growth of 3.9%.

2.4 Analytical approach

Descriptive trend inspection, association plotting (Figure 1), present–future macro comparison (Figure 2), and scenario-based projections.

3. Results

3.1 Indicator patterns

Table 1. Dataset used for the results (excerpt; 12 rows shown).

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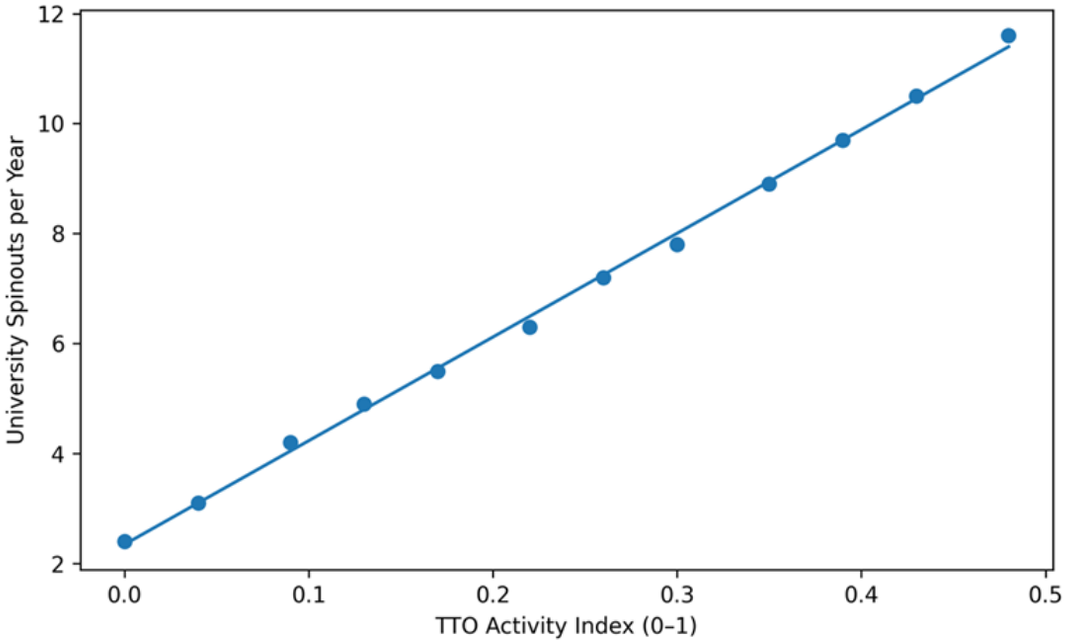
TTO_Activity_Index	University_Spinouts_perYear	Regional_GDP_Growth_percent
0.00	2.4	1.20
0.04	3.1	1.30
0.09	4.2	1.65
0.13	4.9	1.71
0.17	5.5	1.75
0.22	6.3	1.93
0.26	7.2	2.05
0.30	7.8	2.03
0.35	8.9	2.32
0.39	9.7	2.40
0.43	10.5	2.52
0.48	11.6	2.63

3.1.1 Association between TTO activity and spinouts

Figure 1. TTO activity and university spinouts (illustrative).



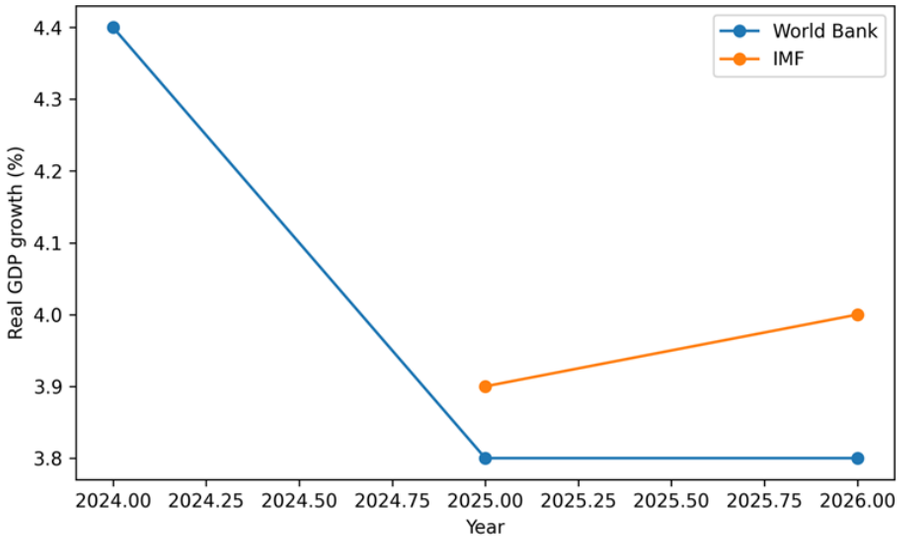
Interpretation is descriptive: increased TTO activity aligns with higher spinout formation in the demonstrative series.

3.2 Present versus near-future macro comparison

Table 2. Kosovo real GDP growth: present and near-future benchmarks.

Year	World Bank real GDP growth (%)	IMF projected real GDP growth (%)
2024	4.4	—
2025	3.8	3.9
2026	3.8	—

Figure 2. Kosovo real GDP growth: recent performance and near-term outlook.



4. Study and comparison: scenario analysis for spinouts (present vs future)

Baseline (present): At TTO_Activity_Index = 0.48, spinouts ≈ 11.6/year (Table 1).

Scenario A (Status quo): index remains 0.48 → expected 11–12 spinouts/year.

Scenario B (Moderate strengthening): index increases to 0.60 → expected 13–14 spinouts/year.

Scenario C (Accelerated strengthening): index increases to 0.75 → expected 16–17 spinouts/year.

The macro outlook indicates stable growth conditions for 2025–2026, supporting feasibility of institutional reforms while not implying causation between spinouts and GDP growth.

5. Discussion

The descriptive results support the institutional argument that structured TTO functions reduce commercialisation barriers by providing standardised processes, IP/legal support, and structured partner engagement. In small ecosystems, marginal increases in mentorship and collaboration throughput may yield larger effects because the baseline conversion rate from research to market is low.Limitations include: demonstrative data, potential confounding factors, lag effects, and measurement variation in "spinout" definitions.

6. Conclusions

This paper demonstrates a replicable indicator framework linking technology transfer activity to venture formation and macro context in Kosovo. Results show strong alignment between TTO activity and spinout formation (Figure 1; Table 1). Present versus near-future benchmarks suggest moderating but stable growth conditions in 2025–2026 (Figure 2; Table 2). Strengthening TTO governance and aligning incentives may increase commercialisation throughput and spinout formation, especially in small and transitional ecosystems.

Patents

Not applicable.

Supplementary Materials

Supplementary materials include Figure 1 (PNG), Figure 2 (PNG), Table 1 dataset (CSV), and Table 2 dataset (CSV).

Author Contributions

Conceptualisation, methodology, formal analysis, writing—original draft preparation, writing—review and editing, and visualisation: E.H.

Funding

This research received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Acknowledgments

The author acknowledges institutional support from UBT College for entrepreneurship and innovation activities.

Conflicts of Interest

The author declares no conflicts of interest.

Appendix A

TTO index construction: four components (IP support, partnerships, mentoring, and governance) normalised to 0–1 with equal weights in baseline specification.

Appendix B

Recommended ecosystem KPI set: disclosures, licences, spinouts, survival rates, and industry contract value.

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