

## NETWORK MODEL OF REGIONAL ENTREPRENEURIAL ECOSYSTEMS IN SERBIA

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### ABSTRACT

This paper presents a network model that maps the multi-layered structure of regional entrepreneurial ecosystems in Serbia. Moving beyond factor-based analysis, they model how institutional, economic, technological and social dimensions operate as interdependent layers within a dynamic system. Empirical analysis in four regions, Vojvodina, Belgrade, Central Serbia and South Serbia, reveals that economic resources and social capital are the main drivers, shaping the institutional framework and technological infrastructure, which then act as key structural drivers. The results confirm pronounced spatial dependencies, whereby South Serbia shows significantly less developed network connectivity in all layers compared to more advanced regions. The proposed graphical model visualises these ecosystems as complex, multi-layered networks where systemic interactions between factors determine regional innovative capacity and entrepreneurial activity. The research contributes a contextualised framework for diagnosing ecosystem strengths and vulnerabilities, offering policymakers and stakeholders a practical tool for designing targeted, regionally specific interventions to foster entrepreneurship and sustainable economic development.

**Keywords:** regional ecosystem, multilayer networks, ecosystem connectivity, structural drivers, graphical model

### INTRODUCTION

The study of entrepreneurial ecosystems has evolved from identifying critical success factors to understanding their systemic, interdependent nature. Traditional approaches often treat elements as isolated variables, failing to capture the complex relational architecture that determines a region's innovative capacity. This deficiency is acute in transition economies like Serbia, where institutional gaps and uneven development create fragmented regional landscapes. To overcome static inventories, this work answers the call for a network perspective that models ecosystems as dynamic structures of interacting layers (Audretsch et al., 2021).

This paper deals with the development and application of a network model for mapping the multi-layered structure of regional entrepreneurial ecosystems in Serbia. The model conceptualises these ecosystems as consisting of four interdependent layers: institutional, economic, technological, and social. It examines not only the presence of these layers but, crucially, the density and direction of influence between them, enabling a diagnostic analysis of systemic connectivity and key structural drivers. The analysis focuses on four different regions: Belgrade, Vojvodina, Central Serbia and Southern Serbia. By applying this model, the study aims to reveal the specific configurations and spatial dependencies that characterise each ecosystem. The resulting framework provides policymakers with a nuanced tool for designing targeted interventions to strengthen ecosystem connectivity and encourage sustainable entrepreneurial activities in different regions of Serbia.

## **ENTREPRENEURIAL ECOSYSTEMS: A NETWORK PERSPECTIVE**

The entrepreneurial ecosystem framework provides a systemic view of entrepreneurship, emphasising the complex interdependence of actors, institutions, and cultural conditions in a geographic context. Its vitality depends not only on the presence of components such as finance or talent but also on the quality of the interactions between them (Stephenson and Gimenez, 2023). This chapter establishes the rationale for applying a multi-layered network approach to the heterogeneous regions of Serbia, which is particularly crucial for identifying and overcoming systemic obstacles to growth in a transition economy.

Theoretical foundations integrate structural and cultural dimensions. The structural dimension includes tangible resources and formal institutions: markets, financial capital, human capital, regulatory frameworks and infrastructure (World Economic Forum, 2013). The cultural dimension includes an entrepreneurial mindset, leadership, mentoring networks, risk tolerance and narrative legitimisation (Hamdan et al., 2025). This social context is constitutive of ecosystem trajectories, explaining why regions with similar resources produce different outcomes (Wadichar et al., 2022). An effective policy must therefore improve the connectivity between these parts, fostering adaptive environments (Stephenon and Gimenez, 2023).

A constant challenge is the lack of empirical validation for many frameworks, especially outside developed economies (Audretsch and Belitski, 2021). For transition economies like Serbia, with significant spatial differences and institutional gaps, generic models are insufficient. Research must develop localised tools that diagnose systemic bottlenecks. A key methodological advance is the modelling of ecosystems as multi-layered networks. This approach conceptualises the ecosystem as interconnected layers, typically institutional, economic, technological and social, and analyses the flows of influence between them (Belitski and Sikorski, 2024). It goes beyond listing elements to mapping the relational architecture, offering a diagnostic tool for assessing connectivity and identifying structural drivers.

The application of this perspective is crucial for the analysis of regional entrepreneurial opportunities in Serbia. From advanced Belgrade to less developed South Serbia, the regions represent a mosaic of development phases. A component-based assessment would reveal nominal similarities but would not explain differences in performance. The network model addresses this problem by hypothesising that performance is a function of the configuration and strength of connections between layers. The presence of financial capital (economic layer) can be ineffective if links to research (technological layer) are weak or if regulations (institutional layer) stifle implementation. In development contexts, the institutional layer often has a dominant, limiting influence on other dimensions, creating unique bottlenecks (Bojović et al., 2025). Layered network analysis reveals how elements interact or fail to interact in each specific region, providing the basis for targeted, evidence-based policy interventions.

The network model proposed in this paper operationalises this advanced theoretical perspective. It enables a comparative analysis of the regions of Serbia by mapping the structure and interdependence of their institutional, economic, technological and social layers. This approach responds to calls for empirically grounded, context-sensitive models by Chen (2019) and aligns with an emphasis on relational diagnostics over static overviews (Belitski and Sikorski, 2024). In the next chapter, the construction of this model will be described in detail and applied to diagnose configurations, strengths and critical gaps within the key regional ecosystems of Serbia (Milošev et al., 2025). Finally, this framework aims to inform strategic development by pointing out where connectivity needs to be strengthened to unlock regional entrepreneurial potential.

## **SYNTHESIS OF THE GRAPHIC MODEL**

This chapter synthesises the theoretical and methodological foundations previously presented in order to construct a multi-layered network model for the empirical analysis of regional entrepreneurial

ecosystems in Serbia. The proposed graphical model serves as a diagnostic framework, translating the complex, interdependent reality of regional entrepreneurship into a structured, comparable form. It is not designed as a mere descriptive inventory but as a relational map that visualises the strength, direction and critical gaps in the connections between the basic components of the ecosystem (Stephenson and Gimenez, 2023). This synthesis is key to moving from abstract systems theory to a practical tool capable of generating useful insights for regional development policy.

The architecture of the model is explicitly built on an integrated structural-cultural perspective. The model conceptualises any given regional ecosystem as consisting of four primary, interconnected layers: institutional, economic, technological, and social. The institutional layer includes formal rules, regulatory frameworks, government policies and support organisations. The economic layer includes markets, financial capital, industries and corporate actors. The technological layer consists of knowledge producers, research infrastructure, innovation centres and digital adoption (Audretsch et al., 2023; Fletcher et al., 2026). The social layer includes the informal domain of entrepreneurial mindset, leadership, trust, networks and social narratives (World Economic Forum, 2013; Hamdan et al., 2025). The basic premise of the model is that the entrepreneurial performance and resilience of a region are emergent properties of the specific configuration and quality of interactions between these layers and not a simple sum of their individual states.

To operationalise this premise, the model uses network logic where each layer is represented as a set of nodes, and critical relationships between layers are mapped as directed links. For example, the link from the institutional layer to the economic layer may represent the flow of regulatory incentives or public procurement, while the reciprocal link may symbolise private sector feedback in policy design. The strength and density of these interlayer connections are the primary focuses of analysis. Crucially, the model assumes that in transitional economies like Serbia, the institutional layer often acts as a dominant, limiting node, potentially stifling flows from the technological to the economic layer or inhibiting the positive social narratives necessary for risk-taking (Bojović et al., 2025). Visualising these dynamics enables identification of whether an ecosystem is characterised by synergistic amplification or fragmented, weak links that stifle systemic momentum.

The specific parameters of the model, including the weight assigned to each interlayer connection and the selection of key indicators for each node, were calibrated through an iterative process of analysing qualitative and quantitative data on regional relations, institutional factors and entrepreneurial outcomes in different regions of Serbia. This empirical grounding ensures that the model reflects the specific contextual bottlenecks and opportunities observed in the transitional context of Serbia, rather than being a generic imported example.

The graphical output of this model is a multilayer network diagram for each analysed region. Such a diagram visually codifies the architecture of the ecosystem, making its relational strengths and weaknesses immediately apparent. A dense network of strong, two-way connections between all four layers would represent a mature, well-integrated and adaptive ecosystem. In contrast, a diagram depicting a dominant, isolated institutional layer with weak, infrequent links to an underdeveloped technological layer would diagnose a classic systemic failure in knowledge commercialisation. This visual diagnostic capability directly responds to the demand for tools that move beyond static overviews to dynamic relational diagnostics (Belicki and Sikorski, 2024).

Therefore, this synthesised graphical model (Figure 1) fulfils several key functions. First, it provides a standardised but flexible framework for the comparative analysis of heterogeneous regions of Serbia, from advanced Belgrade to less developed Southern Serbia. Second, it acts as a practical and diagnostic tool that pinpoints connections, specifically missing or weak cross-layer connections, where political intervention can be most effectively focused on strengthening systemic connectivity. It offers a communication tool for translating complex systemic analysis into an intuitive visual format for policymakers and stakeholders, facilitating a shared understanding of regional entrepreneurial dynamics. By mapping the interdependence structure, the model makes the intangible ecosystem

tangible, providing a clear basis for evidence-based strategies aimed at unlocking regional entrepreneurial potential through improved connectivity (Milošev et al., 2025).

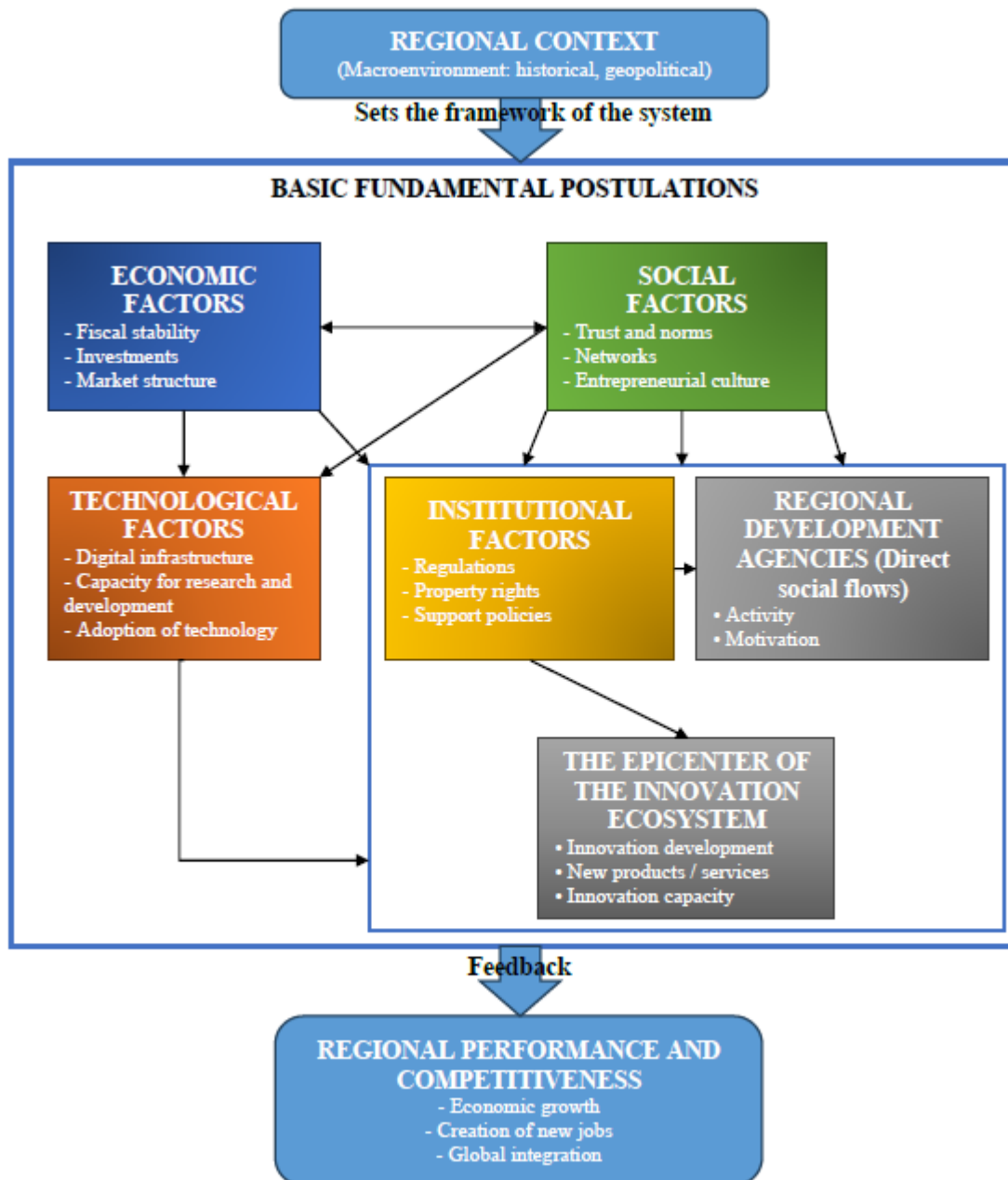


Figure 1: Network model of the entrepreneurial ecosystem

## SUGGESTIONS AND GUIDELINES

Based on the developed analytical framework, future research should expand and refine the network model through several key directions:

- Deepening the qualitative research of the causal mechanisms behind the identified relational patterns.
- Expansion of longitudinal studies to monitor ecosystem evolution and impacts of interventions over time.
- Integrating firm-level performance data to link ecosystem structure to enterprise success.
- Applying the multi-layered model to other transition economies for comparative analysis.

- Examining the role of digital infrastructure as a special layer within the technological dimension.
- Examining specific governance models that most effectively improve cross-layer connectivity.
- Assessment of the impact of external shocks on the resilience of the ecosystem network.
- Model validation through participatory action research with regional policymakers.

## CONCLUSION

This research determined the necessity and usefulness of applying a multi-layered network model for the analysis of regional entrepreneurial ecosystems in Serbia. The framework developed here decisively goes beyond static, component-based assessments by visualising the entrepreneurial ecosystem as a dynamic structure of interdependent institutional, economic, technological and social layers. The primary finding is that the entrepreneurial vitality of a region is a new property of the strength and configuration of connections between these layers, not just the presence of their individual elements.

For a transition economy like Serbia, which is characterised by significant regional differences, this model provides a critical diagnostic tool. It reveals how an often dominant institutional layer can restrict flows within a system, creating unique bottlenecks that stifle growth. Effective policy must shift from supporting isolated actors to strategically fostering connectivity, bridging the gap between research and markets, finance and innovation, and formal institutions and entrepreneurial culture. By pinpointing these specific relational weaknesses, the model enables targeted evidence-based interventions. This approach offers a path towards unlocking latent regional potential by transforming fragmented resources into connected, synergistic and self-reinforcing entrepreneurial environments.

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