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## **CRITICAL FACTORS OF THE QUADRUPLE HELIX APPROACH IN TECHNOLOGICAL INNOVATION ENVIRONMENTS**

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### Introdução

The objective of this study was to investigate the critical factors that lead quadruple helix actors, particularly those from civil society, to engage proactively in technological innovation environments. To this end, we proposed an analysis framework based on four theoretical constructs: (i) Benefits, (ii) Openness, (iii) Engagement, and (iv) Interhelix Relationship. These constructs produce cause-and-effect relationships among themselves, leading to the development of three hypotheses. Hypotheses H1, H2, and H3 were tested using structural equation modeling.

### Problema de Pesquisa e Objetivo

What are the critical factors and how do they influence the participation of the fourth helix in technological innovation environments? The objective is to identify and investigate the critical factors that influence the engagement of civil society in technological innovation environments.

### Fundamentação Teórica

This article begins with the theoretical framework, which contains three subsections: the first discusses the Triple Helix and the Quadruple Helix; the second addresses collaborative governance (CG), which helps add theoretical information to the debate; and the third contains the theoretical measurement model used in the structural equation modeling.

### Metodologia

This is a quantitative study. Structured questionnaires were used to collect the data, and the research subjects were defined based on their involvement in technology parks, which constituted the locus of innovation environments investigated. One-hundred one valid responses were received. We used SmartPLS software to process and analyze the collected data.

### Análise dos Resultados

Among the critical factors represented by the confirmed hypotheses for active participation by the fourth helix (civil society) in innovation environments are those linked to perceived benefits (the greater those benefits, the greater is the engagement); openness to participation (the more open are channels for society's involvement, the greater the engagement), and finally, engagement and the quality of relationships among the other actors (civil society engagement improves the quality of governance arrangements established among the other actors involved in these innovation environments).

### Conclusão

The results indicated that both benefits and openness positively influence civil society engagement in innovation environments. Furthermore, engagement positively influences the relationship among QH actors. The results also indicated that the constructs of the structural model, as well as their originating observable variables, explain much of the engagement of civil society in innovation environments as well as the strengthening of relationships among QH actors. The model thus presented good explanatory and predictive power.

### Referências Bibliográficas

ETZKOWITZ, H; LEYDESDORFF, L. Universities and the global knowledge economy: a triple helix of university-industry-government relations. Amsterdam: University of Amsterdam, 1995.

CARAYANNIS, E. G.; CAMPBELL, D.F.J. 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem. International Journal of Technology Management. v. 46, nº. 3-4, p. 201-234, 2009. MINEIRO, A. C.; SOUZA, D. L.; VIEIRA, K. C.; CASTRO, C. C.; BRITO, M. J. Da Hélice Tríplice a Quíntupla: Uma Revisão Sistemática. Revista Economia & Gestão, v. 18, n. 51, p. 77-93, 2018. Dentre outras.