

# From Data Integration to Innovation Diffusion: The Role of Information Systems into Empowering Innovation Ecosystems

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**Abstract.** *Developing nations embrace innovation ecosystems for socioeconomic growth. However, Information Systems (IS) research on Brazil's innovation ecosystems is still quite scarce. We address this gap by examining the nexus between IS and innovation ecosystem by approaching the Diffusion of Innovation Theory to analyze the “Mapa do Ecosystema de Inovação Cearense” as a descriptive case study. We delve into this IS project's deployed features, challenges, and future avenues of research. This paper contributes by sharing insights for other regions interested in enhancing their innovation ecosystems and by raising awareness of the idea of IS in empowering them.*

## 1. Introduction

In today's rapidly evolving global landscape, fostering innovation has become a priority for developing nations aiming to secure socio-economic growth. Countries worldwide recognize the importance of empowering innovation ecosystems, and Brazil is no exception. According to Jin-fu (2010), innovation ecosystems emerge as environments of intense cooperation between different entities from different sectors to generate knowledge. Within these ecosystems, different key elements must coalesce to ensure vitality, including government support, educational institutions, research and development organizations, access to capital, and cultivating an entrepreneurial culture. By forming these sociotechnical networks that facilitate the exchange of information and resources, organizations within these ecosystems gain competitive advantages that set them apart from those outside the network [Granstrand and Holgersson 2020].

In this dynamic and emerging context, we emphasize the Information Systems (IS) as an enabler for nurturing innovation ecosystems through diverse avenues. Notably, one can assert the role of IS in providing the digital infrastructure that underpins the diffusion of innovation. By drawing on the principles of Diffusion of Innovation Theory, which posits that the spread of innovations is influenced by various factors, including the characteristics of the innovation itself, adopter categories, communication channels,

and time, we can gain valuable insights into how IS are integrally woven into this process [Rogers et al. 2014]. In this sense, understanding how IS drives innovation diffusion within Brazil's innovation ecosystem poses as essential for stakeholders who aspire to harness the potential of these systems, including policymakers, businesses, and researchers.

Despite the promising role played by IS in enhancing innovation ecosystems, there is a noticeable lack of research focusing on examining Brazil's innovation ecosystems from the perspective of IS research, specifically within the Diffusion of Innovation Theory. Recognizing this gap, this paper aims to delve into a descriptive case study, namely the “Mapa do Ecosistema de Inovação Cearense”<sup>1</sup>, to discuss and increase the level of awareness about the **emerging idea of how IS can empower innovation ecosystems**. Importantly, we aim not only to showcase the case's features but also to point out different challenges and future avenues associated with IS for fostering innovation ecosystems.

Our paper's contribution lies in providing a real-world context that enables an analysis of how IS has been instrumental in promoting innovation diffusion within a local ecosystem in Brazil. Additionally, examining this case study may contribute as a blueprint for other regions aiming to harness the potential of IS to strengthen their innovation ecosystems. By sharing our practices and challenges in Ceará, other regions may also explore them for driving their own ecosystems using IS. Finally, through the discussion drawn from the Diffusion of Innovation Theory, we provide a clearer understanding of the role of IS in shaping the diffusion of innovations within an innovation ecosystem.

## 2. Analyzing “Mapa do Ecosistema de Inovação Cearense”: A Confluence of Information Systems and Diffusion of Innovation Theory

The “Mapa do Ecosistema de Inovação Cearense” (Figure 1 shows its homepage) is a collaborative IS, embodying its collaborative *ethos* in software development and utilization [Castro et al. 2021]. At its core, this platform is open source<sup>2</sup> and designed to seamlessly integrate data about various players, events, and patents, offering an interactive, open source, and open data resource. In this context, we advocate the relevance of delivering a collaborative IS that emphasizes visibility, openness, and networking among participants in the innovation ecosystem. As we can see, this perspective aligns with the Information Systems and Open World Challenges highlighted in the “I Grand Research Challenges in Information Systems in Brazil” [Boscarioli et al. 2017]. Hence, the “Mapa do Ecosistema de Inovação Cearense” introduces a convergence of IS and the Diffusion of Innovation Theory principles, facilitating a more comprehensive understanding of the participants within the innovation ecosystem. More specifically, this convergence emerges through the following currently deployed features on the platform (unfortunately, we could not include all their print screens due to space constraints):

1. **Web-Based Data Geovisualization:** This webpage displays data about entities within Ceara's innovation ecosystem, like startups, incubators, and accelerators, using a web-based geovisualization page. It aligns with the theory by using useful communication channels to share data and encourage networking;
2. **Patents Panel:** This webpage is dedicated to patent data related to Ceara, serving as a valuable resource for innovators, researchers, and businesses. This feature

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<sup>1</sup>Currently available at: <https://gesid.github.io/mapa-inovacao>

<sup>2</sup>GitHub repository: <https://github.com/gesid/mapa-inovacao>

- aligns with the theory's focus on the characteristics of the innovation itself;
3. **Startups Panel:** This webpage is dedicated to Ceará's startups data, serving as a resource for providing open data about their business model, startup segment, etc.
  4. **Events Panel:** This webpage features events related to Ceará's innovation ecosystem, acting as a communication channel for the diffusion of innovation. This issue helps stakeholders stay informed about upcoming events.
  5. **Public Dashboard:** This webpage emphasizes the theory's call for clear and effective communication of innovation-related information. It enhances data availability, including the value of open data through proper data visualization.

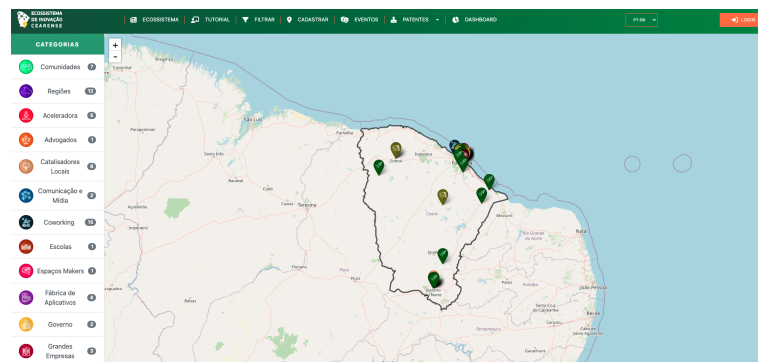


Figure 1. Homepage from “Mapa do Ecosistema de Inovação Cearense”.

### 3. Challenges and Future Avenues of Research

The analysis of the “Mapa do Ecosistema de Inovação Cearense” through the lens of Innovation Diffusion Theory sheds light on the dynamic role of IS in fostering regional innovation ecosystems. However, this opportunity also brings to the forefront different challenges for future research in the field of IS within the context of innovation ecosystems, serving as proxies to raise awareness of our proposed idea:

- **Data Quality and Integration Challenges:** One prominent challenge is ensuring data quality and integration. The accuracy and reliability of data, especially in collaborative systems, are critical for their success. Future research could focus on methods and technologies for enhancing data quality and streamlining data integration processes. Given the rapid pace of change within innovation ecosystems, exemplified by the constant emergence and decline of startups, how can we ensure the timeliness and accuracy of data? Can we identify any emerging patterns in the data that could be useful for predictive analytics on the ecosystems' future?
- **Customization and Personalization:** Providing a personalized experience within IS platforms is fundamental for enhancing user engagement and adoption. Research can explore techniques for tailoring IS to individual user needs, offering personalized recommendations, and supporting adaptive interfaces according to the persona. For instance, as an angel investor, startup founder, or policymaker, what resources or information could be found in the platform and in which way?
- **Governance:** The long-term sustainability of collaborative IS platforms like ours depends on the effectiveness of their governance models. Future research can investigate governance approaches that balance openness, community engagement, and platform sustainability. How can we orchestrate an inclusive environment that fosters openness, collaboration, engagement, and value co-creation?

- **Impact Assessment:** While the platform demonstrates its utility, assessing its impact on the local innovation ecosystem is complex. Future research can explore methods and metrics for evaluating the platform’s influence on collaboration, innovation diffusion, and ecosystem growth. To what extent has the platform facilitated the diffusion of innovative ideas and technologies in practice?

Furthermore, the 20th edition of the Brazilian Symposium on Information Systems (SBSI 2024) with the theme “Perspectives and Trends in Information Systems in Digital Agriculture” offers a significant opportunity to delve into the agriculture digital ecosystem. Building upon this open call, we highlight below two future and strategic pathways that can be explored to leverage Ceará’s agriculture ecosystem through the “Mapa do Ecosistema de Inovação Cearense”, including analogous IS in other regions:

- **Linking Agriculture with Different Sectors:** Promote cross-sector collaboration between agriculture and technology providers, research institutions, agritechs, and financial organizations. In this context, we can devise strategies to match the demand and supply for deploying agricultural solutions throughout the value chain.
- **Sustainability and Circular Agriculture:** Embracing sustainability in agriculture is a global priority. Our platform can be expanded to include data and information related to sustainable practices, circular agriculture, and environmental impact. Future work can explore how IS can empower various agents within a circular economy pipeline to promote eco-friendly and sustainable approaches.

#### 4. Concluding Remarks

This paper discussed the idea of Information Systems (IS) in empowering innovation ecosystems, illustrated by the case of “Mapa do Ecosistema de Inovação Cearense”. In particular, the confluence of IS and Innovation Diffusion Theory has illuminated the dynamic interaction between technology, collaboration, and the diffusion of innovation. By highlighting the features deployed by our platform, it has become evident that IS serves as innovation enabler, not only by providing a digital infrastructure for visibility but also by embodying open data and networking among stakeholders. The challenges and future avenues scoped by our study signify the need for ongoing research and development. Our paper emphasizes the relevance of IS as a driver of innovation and encourages further exploration to unlock the full potential of IS in nurturing innovation ecosystems in Brazil.

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