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Emílio Arruda José Montero Filho

Cristiana Fernandes De Muylder

Airton Cardoso Cançado

Ruby Roy Dholakia

Angela Paladino



Invited Article

Technology Perspectives and Innovative Scenarios Applied in the Amazon Region

Perspectivas Tecnológicas e Cenários Inovadores Aplicados na Região Amazônica



Emílio José Montero Arruda Filho¹
 Cristiana Fernandes De Muylder²
 Airton Cardoso Caçado³
 Ruby Roy Dholakia⁴
 Angela Paladino⁵

Universidade da Amazônia, Programa de Pós-graduação em Administração, Belém, PA, Brasil¹

Universidade FUMEC, Programa de Doutorado e Mestrado em Administração, Belo Horizonte, MG, Brasil²

Universidade Federal do Tocantins, Programa de Pós-graduação em Desenvolvimento Regional, Palmas, TO, Brasil³

University of Rhode Island, College of Business, Kingston, RI, USA⁴

University of Melbourne, Faculty of Business and Economics, Melbourne, Victoria, AU⁵

Resumo

Este artigo tem como objetivo resumir as perspectivas tecnológicas e os cenários inovadores aplicados na região amazônica. Uma chamada de artigos para a edição especial possibilitou quatro manuscritos aceitos que servem como fonte para este resumo. Todos esses artigos enfocam casos específicos na região da Amazônia Legal e fornecem evidências empíricas sustentadas por teorias e literatura relevante. Todos os artigos enfatizaram a necessidade de investimento na forma de redes para desenvolvimento e inovação. Um descritivo, usando de abordagem qualitativa utilizando o software bibliométrico WordStat 8® identificou as palavras mais utilizadas nos quatro artigos que incluem esta edição especial. Os termos mais relevantes identificados foram: rede, inovação, firmas, produção, pesquisa e desenvolvimento. No total, esses artigos apontam para parceiros e instituições variadas, necessários para construir redes de desenvolvimento e inovação. Esta edição especial é um primeiro passo para construir uma base de conhecimento focada na região amazônica que falta na literatura acadêmica. Contribuições futuras devem construir e expandir a discussão de casos empíricos e refletir diferentes disciplinas que contribuem para indústrias, políticas, sociedade e redes. Isso é necessário para melhorar inovação e desenvolvimento econômico desta importante região.

Palavras-chave: inovação; rede; empresas; pesquisa e desenvolvimento; região amazônica.

Abstract

This paper aims to summarize the technology perspectives and innovative scenarios applied in the Amazon region. A call for papers for the Special Issue yielded four accepted articles that serve as the source for the summary. All these articles focus on specific cases in the Legal Amazon region and provide empirical evidence supported by theories and relevant literature. All the articles emphasized the need for investment in the form of networks for development and innovation. A descriptive, qualitative approach using the bibliometric software WordStat 8® identified the words most frequently used in the four papers included this special issue. The most relevant terms identified were: network, innovation, firms, production, research and development. In total, these articles point to varied partners and institutions necessary for building networks to further development and innovation. This Special Issue is a first step to building a knowledge base focused on the Amazon region that is missing in the academic literature. Future contributions must build and expand the discussion of empirical cases and reflect different disciplines that contribute to industries, policies, society and networks. This is necessary to improve innovation and economic development of this important region.

Keywords: innovation; network; firms; research and development; Amazon region.

JEL Code: O3, N66, L14.

Introduction

Innovation is improving our world and the ways that we live. It impacts our governing according to the sociological structure, political environment and interactions between society and institutions. The use of different tools and strategies in the new technological environment (Zhou, Dong, Kong, & Liu, 2019) is becoming more and more common, attractive and integrated (Harris & Blair, 2006; Lee, Park, & Kang, 2018). The internet of things, nanotechnologies, robotics, artificial intelligence and innovative technology centers, among others, are transforming organizations and our society.

It is important to understand that innovation stimulates development, entrepreneurship and success in new environments (Nobre et al., 2016). In this regard, Tidd and Bessant (2018) described changes pertaining to the integration of technology, market a. This integration is likely to foster market interest and capacity more than government policies.

Some considerations are important organizational systems into one platform in order to provide the benefits of multifunctionality in the same architecture in this context. It is not sufficient to introduce new technologies, but also important to understand how users will accept and adopt the technologies to change their existing patterns of behaviors. For instance, multifunctional products with sustainable characteristics have been measured with respect to consumers' intentions and perceived value (Arruda-Filho & Brito, 2017). Customer referral reward programs to influence consumer interest in innovative products and services have been discussed by Dose, Walsh, Beatty and Elsner (2019).

Users are not limited to any specific contexts. Available research suggests concern with not only the evaluation of conceptual scenarios with respect to the use of innovation, but also with the application of innovation in different contexts. These include health care (Papa, Mital, Pisano, & Del Giudice, in press; Svensson & Hartmann, 2018), research and development (R&D) activities (Gezici, Orhangazi, & Yalçın, 2018) and e-government (Chen, Hu, Tseng, Juang, & Chang, 2019; Distel, 2018; Wirtz & Daiser, 2018). Education policies in developing countries have focused deeply on the importance of technology in this new environment (Jones, 2018).

Strategies in the context of sustainable-oriented innovation influencing inter-organizational relationships have also been included in the theoretical agenda (Neutzling, Land, Seuring, & Nascimento, 2018). Social equity is another strand of literature concerning responses to problems related to poverty and social inequality (Brillantes, Raquiza, & Lorenzo, 2019; Erreygers, 2019). Other studies have concerned the importance of designing innovative organizations based on different sectors (Christiansen & Gasparin, 2018; Garbuio & Dressel, 2019), and the importance of social innovation (Kohler & Chesbrough, 2019; Martí, Bakker, Dorado, Zietsma, & Wijk, 2019) to apply dynamic solutions to address societal needs. In addition to market-driven innovations (Lee, Yun et al., 2018; Li, Porter, & Suominen, 2018), the provision of government subsidies to accelerate rapid development and deployment of technology, especially emerging technologies, are critical. In general, studies concerning the deployment and acceptance of new technologies are still being updated in the academy and the literature on new technology introductions in the market, technological changes and cultural influences is growing (Skoumpoulou, Wong, Ng, & Lo, 2018).

The special issue - Background and paper selection process

Despite the available evidence from around the world, there has been relatively low development and deployment of innovative technologies within the Amazon region. The region's specific characteristics - cattle ranching, small producers, deforestation and greenhouse gas emission (Bogaerts et al., 2017) pose particular challenges. There is sufficient technology available in the market to improve this environment, including in rural areas, but this requires strategic partnerships with government, the private sector and the community. However, there is very little available evidence to provide a picture of the current initiatives in place. The goal of this Special Issue is to start the process of increasing our knowledge of initiatives in the Amazon region. The focus is on

illustrating the array of diverse approaches to the use of technologies and innovative products, service or process to achieve progress and prosperity for the Amazon region.

The Amazon region, very rich in terms of its natural resources, is economically under-developed. Thus, it offers a perfect opportunity in which to pursue new lines of technology deployment and to measure how these new processes, products, services and interactions can change citizens' quality of life and increase use of innovation in day-to-day use by individuals, companies and the government (Ju, Jin, & Zhou, 2018). In addition to the challenges of introducing innovative scenarios to the region, assuring that potential users accept, adopt and change their quality of life is another challenge that must be addressed for the Amazon region. These challenges require researchers' involvement from multiple disciplines as the contexts of technology and innovation are related to every area of study and research.

To generate and accumulate available evidence on technology deployment in the Amazon region, a Special Issue of *Journal of Contemporary Administration (RAC – Revista de Administração Contemporânea)* was designed to invite a broad range of topics that address innovation and technology diffusion, social innovation, organizational innovation, services, smart cities, economic growth and social equality.

The call for papers was launched on June 25, 2018. The submission deadline was January 30, extended to February 20, 2018 to accommodate authors' needs. We received 18 manuscripts in total, and rejected one due to its format. Within the first 30 days, guest editors desk rejected 10 submissions. The remaining 7 articles were each reviewed by three independent reviewers involving about 21 reviewers. To ensure fairness and objectivity, two of the guest reviewers from the northern region were not assigned articles from authors at their own colleges or universities. After second and third rounds of revisions and reviews, only 4 articles were accepted through the blind review process, besides the first article of this issue which is the invited article from the editors.

It took about 4 months to complete the review process. We would like to recognize all the hard work and thank all the reviewers involved, as well as the editorial team of the RAC, especially Wesley Mendes da Silva (editor-in-chief) and Nadia Machuca (editorial assistant), for the attention they gave to the overall evaluations of the manuscript, as well as the revision process. We also want to thank the authors of the articles submitted as well as those whose articles appear in this special issue. We would like to encourage researchers to continue to focus their efforts on the Amazon region and contribute to the academic literature on technology development, deployment and adoption in this region.

The Papers

The studies selected for this special issue cover topics such as innovation, cooperation, technology, networks and society. The focus is on the Amazon region and the empirical studies include applications featuring family agriculture, interorganizational networks with university support, intelligent cities and public coproduction, public policies and the development of local and bioindustry networks. The articles included in this issues describe the diversity of mechanisms applied across the region, innovation frameworks that are reaching people across the region aimed at improving the quality of life or competitiveness of industry.

When analyzing the contents of the four articles, a descriptive, qualitative approach using the bibliometric software WordStat 8® identified the words most frequently used in the four papers included this special issue. The most relevant terms identified were: network, innovation, firms, production, research and development. The word map is shown in Figure 1. References were excluded in the bibliometric analysis.



Figure 1. Wordmap Network

Source: Data search using WordStat 8®.

The common set of words among the four papers identified through the wordmap network analysis demonstrates the alignment between of the selected papers and the call for papers. Through this Special Issue, we were able to generate some of the research that are ongoing in the region and hope that in the future, it will advance further research studies focused on the Amazon region.

The second article of the special issue, titled **Innovation and Diffusion of Technology in Agriculture in Floodplains in the Amazon** is by Petry, Sebastião, Martins e Barros (2019). The authors investigate how the adoption of innovations and the diffusion of technologies occur in the context of family agriculture. It also addresses the link between these types of innovations and the reduction of poverty. The paper relates the complexity of the family business environment in the agricultural sector to the need to use innovative resources for decision-making processes. The factors that affect technology adoption include seasonality of production, long-term return on investments in technology and the difficulties face by farmers using new technological resources (Saritas & Kuzminov, 2017).

The study analyzes the process of innovation and diffusion of hybrid watermelon cultivation in the Alto Solimões region. Characteristics of the region - soil type and climate that affect the agricultural practices of the producing families are considered. The results suggest that farmers seek new technologies and agricultural practices that can positively affect the quality of life of the families involved. Evidence is found that innovation and diffusion in the family agriculture environment are associated with regional support and development policies.

The study builds on previous studies from other regions of the world which have investigated the generation of innovations (Adenle, Manning, & Azadi, 2017; Kassie, Teklewold, Jaleta, Marennya, & Erenstein, 2015); the adoption and use of innovations in agribusiness (Kassie et al., 2015; Morrone, 2017) and rural innovation. Previous research on promotion of integrated pest management, technical training, and technical visits to promote rural innovation has also been considered (Morrone, 2017; Sunding & Zilberman, 2002). The authors also draw from the Brazilian scenario, particularly studies on the practices in floodplain regions in the Amazon involving quality agricultural production with better income for families (Abizaid, Coomes, Takasaki, & Arroyo-Mora, 2018;

Miltner & Coomes, 2015) use of innovative nondestructive practices (Cotta, 2015) which is the characteristic difference of common agricultural usage in the region.

As for its practical contribution, the article builds its arguments from the adoption and diffusion of innovation framework by Rogers (2003) as a way of guiding decision making (Bala & Goyal, 1998; Mühlenbernd, 2011). Previous studies on how farmers are influenced by their networks of relationships, friendship, family (Bandiera & Rasul, 2006; Feder, Just, & Zilberman, 1985) and social networks (Pratiwi & Suzuki, 2017) are described.

The third article, entitled **Coproduction Between Government and Civil Society to Establish Smart Cities in the State of Pará**, is by Coutinho, Vasconcellos Sobrinho, Oliveira and Santiago (2019). Based on the concept of a smart city proposed by Caragliu, Del Bo and Nijkamp (2009), the authors consider investments made in human and social capital and how the adoption of traditional and modern infrastructures can be addressed by information and communication technologies (Lemos, 2013). The objective of this article is to discuss the possibilities of implementing the Intelligent Cities concept and to present alternative propositions that make feasible partnership initiatives for coproduction of public services between civil society and the government in the Brazilian Amazon.

A coproduction model is presented to explore the feasibility of implementing a data- and information-sharing service between a civil society organization, the state and municipal governments for specialized medical care. These data would serve multiple purposes giving through Wifi network to households and individuals, access in specific areas where the government telecommunications infrastructure is absent.

The theoretical foundation is the Quadruple Helix Model, which is an extension of the Triple Helix Model and includes civil society in the context of cooperation (Lindberg, Lindgren, & Packendorff, 2014). According to Coutinho et al. (2019), this model is very limited in the Amazon context, and the citizen has a central role to guarantee better results.

Existing literature have described different forms of citizen participation in models of coproduction of public good (Przebyłowicz, Cunha, & Meirelles, 2018; Salm & Menegasso, 2010), including cities with a focus on intelligent governance (Pereira, Cunha, Lampoltshammer, Parycek, & Testa, 2017). In all these contexts, several actors are responsible for making decisions about public services (Lopes, 2017).

The case studied in this article addresses the use of telemedicine in municipalities in the state of Pará. It involves intelligent solutions, based on partnerships to solve social problems. Seven poles (small communities using the system) were created, and these municipalities have capabilities to serve smaller municipalities in their surroundings.

This model of medical care follows the assumption of the Tel Aviv resolution, which does not allow virtual care directly between doctor and patient (The World Medical Association, 1999). Instead, the solution is implemented by a specialist in the capital (Belém) and the clinician who is present with the patient, at a remote service center. Therefore, the model has the character of teleconsulting, with medical doctors present end to end, in four specialties: neurology, neuro-pediatrics, cardiology and endocrinology.

The results of the field surveys carried out with managers and the population highlight the benefits of accessibility to the health care system for the poorest population in the Amazon, overcoming cultural, socioeconomic and geographical barriers. It is characteristic of the intelligent city, a concept of transformation (Komninos, 2006). Initiatives of this nature, if adopted on a large scale, could revolutionize the public health on a continental scale. The study also indicates that adopting smart city concepts and coproducing public services could contribute to reversing the typical perception that many have of public administration in Brazil.

The fourth article, titled **Go Global or Stay Local? Understanding How Fiscal Incentives Reshape Supply Networks**, investigates the way firms reconfigure their supply base and reshape their production network to capture value from Free Trade Zone (FTZ) incentives. It is authored by Martins, Siegler, Souza, Flynn, and Martins (2019).

In the study, the authors discuss the relevance of public policies regarding local development of specific regions. Specifically, they focus on the public actions of the Free Trade Zone (FTZ) aimed at reinforcing the domestic economy, allowing free trade with countries around the world. FTZs designate a site within a country where imported items are processed or used in manufacturing operations under special customs rules (Murphy & Knemeyer, 2015). The authors seek to understand how companies' supply chain strategies are impacted by local conditions under FTZ incentives, and how firms structure their networks to capture the benefits offered by FTZ. Specifically, the focus on FTZ developed in Manaus.

The paper's theoretical approach is based on the global production network framework (GPN), incorporating elements from economic geography to develop an understanding of how firms defines their network strategy in terms of R&D, design, production and marketing (Cheng, Farooq, & Johansen, 2015). The GPN helps in evaluating firms' impact on a region and the local economy (Henderson, Dicken, Hess, Coe, & Yeung, 2002). The authors indicate that the framework can be used to evaluate how firms react strategically in relation to their networks when opportunities, such as tax incentives, arise (Martins, Siegler, Souza, Flynn, & Martins, 2019). The article confirms the importance of the formation of collaboration networks focused on innovation.

The fifth article by Mafra, Lasmar, and Vilela (2019), titled **Inter-organizational Relationships in the Amazon Bioindustry from the Entrepreneurs' Perception**, analyzes entrepreneurs' perceptions about interfirm relationships in the Amazonian bioindustry. Guided by previous research on organizational relationships as a way of ensuring competitive advantage (Mitrega & Pfaifar, 2015) and the formation of business networks and alliances (Gulati, 1998; Mitrega & Pfaifar, 2015), the authors emphasize ambiguity, in which trust is the important, but also a limiting link.

The biotechnology sector has existed for more than 15 years in the Amazon (Lasmar & Pimenta, 2015) and comprises a structure with sectors that vary from human health to the environment, and includes micro as well as large companies (Mafra, Lasmar, & Vilela, 2017). In the state of Amazonas, Barbosa and Bichara (2015) had indicated that 46.42% of companies in the Amazonian bioindustry have some type of agreement with private institutions, including distributors and suppliers. 32.41% have partnerships and/or agreements with distributors and 42.85% have partnerships with their suppliers of raw material.

Qualitative, descriptive and exploratory research is carried out among multiple bio-industry organizations studies to examine four theoretical hypotheses. The data are obtained using individual network pictures as a model-based tool (Henneberg, Mouzas, & Naudé, 2006). Interviewees are asked to illustrate their interorganizational relationships on a blank sheet of paper, indicating key entities for their activities.

The results of the research indicate that interorganizational relationships in the Amazonian bioindustry fall short of technical requirements. The entrepreneurs' perceptions reveal the entrepreneurial immaturity of the bioindustry with respect to cooperation; this is linked to the difficulties faced in maintaining activities due to various limitations.

The authors emphasize that the lack of cooperation is associated with low interest to cooperate, which is related to the autonomy of companies, or the low confidence in the quality of services that a partner company would add to the relationship. They recommended stimulating interorganizational relationships, emphasizing trust between entrepreneurs of the bioindustry. They also suggest some viable actions to achieve this goal.

Final Word

This special issue focused on cases of innovation and network cooperation specific to the Amazon region. The five articles included in this issue showcased research in several different spheres in the region. We hope that these studies start a new scientific trend toward enhancing the field of applied innovation and economic development. Further research with contributions from different disciplines can guide programs and policies that lead to development of industries, policies, society and networks in the Amazon region. We hope that these efforts to examine and report the technology and innovation applied in the current environment of low development will

lead local society in the Amazon region to gain new perspectives and potential opportunities, which should increase the quality of life in the region.

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Authors

Emílio José Montero Arruda Filho

Av. Alcindo Cacela, 287, Bloco E, 3º andar, 66060-902, Belém, PA, Brasil


E-mail address: emilio.arruda@unama.br

 <https://orcid.org/0000-0002-1574-8332>

Cristiana Fernandes De Muylder

Av Augusto Veloso,, 133, 30130-009, Belo Horizonte, MG, Brasil


E-mail address: cristiana.muylder@fumec.br

 <https://orcid.org/0000-0002-0813-0999>

Airton Cardoso Cançado

Quadra 109 Norte s/n, 77001-090, Palmas, TO, Brasil


E-mail address: airtoncardoso@yahoo.com.br

 <https://orcid.org/0000-0003-4698-1804>

Ruby Roy Dholakia

7 Lippitt Road, Kingston, RI 02881, USA

E-mail address: rddholakia@uri.edu

 <https://orcid.org/0000-0001-7569-6725>

Angela Paladino

Level 6, 111 Barry Street, Williams Centre for Learning Advancement, Faculty of Business & Economics, The University of Melbourne, Victoria 3010, Australia

E-mail address: a.paladino@unimelb.edu.au

 <https://orcid.org/0000-0003-1156-0102>