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Innovation in Xingu Seeds Network: proposal for the improved supply chain efficiency

Valeria Santos Guimarães [1]*, Fernando Hadad Zaidan [2], José Luis Braga [3]

[1]*Master's degree in Process and Systems Engineering and Management, Institute of Technological Education, Brazil. (* Corresponding author: cqe1@@hotmail.com)*
[2]*PhD in Information Science, Professor at the Institute of Technological Education, Brazil.*
[3]*PhD in Informatics, Professor at the Institute of Technological Education, Brazil.*

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A B S T R A C T

The objective was to know and understand, from a systematic literature review, associated with the State of the Art through Systematic Review (StArt) tool, which are the innovations that have generated increased efficiency in agribusiness supply chains. The reference produced by this article will provide the Xingu Seed Network and the new networks documentation capable of adding innovations to the supply chain and expanding the potential for distribution of native seeds. The methodology used is qualitative, exploratory, and bibliographic. Finally, the present review data indicate that few studies (27 studies) in the last five years on the subject; after data, extraction obtains five articles that present the innovation in supply chain-related to agribusiness, however nonspecific network of native seeds.

Keywords: Innovation, Seed Supply Chain, Xingu Seed Network, Systematic Literature Review.

Inovação na Rede de Sementes do Xingu: proposta para o aprimoramento da eficiência na cadeia de suprimentos

R E S U M O

Objetivou-se conhecer e entender, a partir de uma revisão sistemática de literatura associada à ferramenta *State of the Art through Systematic Review* (StArt), quais inovações têm gerado aumento de eficiência em cadeias de suprimentos do agronegócio. O referencial produzido por este artigo proporcionará à Rede de Sementes do Xingu e às novas redes de suprimento uma documentação capaz de agregar inovações às cadeias de suprimentos e, assim, ampliar o potencial de distribuição de sementes nativas. A metodologia utilizada é do tipo qualitativa, exploratória e bibliográfica. Por fim, os dados da presente revisão indicam que poucos estudos foram elaborados sobre o tema nos últimos cinco anos, tendo sido identificados inicialmente 27 trabalhos e, após extração dos dados, foram obtidos 5 artigos que apresentaram inovações em cadeias de suprimentos relacionadas ao agronegócio, entretanto, nenhum específico para rede de sementes nativas.

Palavras-Chaves: Inovação, Cadeia de Suprimento de Sementes, Rede de Sementes do Xingu, Revisão Sistemática de Literatura.

1. Introduction

The maps and data available for consultation at the National Institute of Space Research (INPE) since 2004 allow full access to all information generated by the satellite monitoring system of deforestation of the Brazilian Amazon forest. The estimates generated are considered reliable by national and international scientists, and recent results indicate a level of accuracy close to 95% (Kintish, 2007). From 2015 to 2017, the National Institute for Space Research (INPE) developed and improved the TerraMA2 monitoring, analysis, and warning platform for environmental extremes that use dynamic, static, and scripting Phyton programming language, with geographical operators on environmental data. The INPE reports, with support of this platform checking the increase in the practice of deforestation and burning in the national territory.

The report released by the Ministry of the Environment (MMA) and the Ministry of Science, Technology, Innovation, and Communications (MCTIC) in 2018 revealed that deforestation rates between August 2017 and July 2018 had increased 13.7% over the previous 12 months. Suppressing a total of 7,900 km² of the Amazon rainforest, this is the highest rate reported since 2009 when 7,464 km² registered, according to data from the World Wildlife Fund (WWF) (WWF, 2018).

In the biology of Amazonian plants and the knowledge, it is possible to predict the possibility of mass extinction of plant and animal species (Uhl et al., 1991). The current species existing in the Amazon forest have little chance and time to develop adaptations to resist and survive through deforestation. To stimulate the seed collection and expand the regeneration capacity of degraded areas, establish eight seed networks in Brazil. Although most have not remained as business units, in Mato Grosso, the Xingu Seed Network (XSN) has presented itself as a self-sustaining management system.

Created in 2007, the XSN represents a reference in the community-based and family-based forest value chain. In its 12 years of operation, the network supports 5,000 hectares of restoration of degraded areas with 200 tons of native seeds of 220 different species. The Xingu Seed Network's supply chain functional system is mainly composed of a complex logistics of storage and distribution used for marketing the different seed species (Urzedo, 2017). According to Matopoulos et al. (2007) and Chopra and Meindl (2013), the supply chain is a network of several components involving various stages.

Similarly, the value chain is a concept related to the combination of generic value-added activities that work together to provide value to customers (Pandey & Tewari, 2010). However, this value is not conditioned to a financial value but can be valuable in exchanging information, building networks, and learning new processes (AFC, 2004). The supply chain performance depends on coordination among these actors, network trainers, and that this coordination requires each supply chain component to consider the effects of its actions on other components (Chopra & Meindl, 2013). In this sense, innovations in these mechanisms could improve supply chain performance (Arshinder & Deshmukh, 2008).

According to the Oslo Manual, innovation introduces a new or significantly improved good or service, in terms of its typical characteristics or uses, or the implementation of new or significantly improved production, distribution, marketing, or organizational methods or processes (OECD, 2018). From this perspective, organizations from different production chains have analyzed ways to incorporate innovation in their business activities aiming at efficiency gains in their operations, whether in the development of new products or processes (Santos, Fazion & Meroe, 2011). Through the above, it is understandable that XSN and other organizations, in a global competitiveness context, begin to improve their performance through efficient operations and investments in innovation (Heikkilä, 2002). For Lowe and Preckel (2004), there is a growing interest in both the academic and organizational environment to generate innovations to respond to problems that hamper supply chains' efficiency.

The paper aims to know and understand from a systematic literature review associated with the State of the Art through Systematic Review (StArt) tool and the ROSES protocol what innovations have generated increased efficiency in seed supply chains. The aims explicitly: i) identify the contribution of innovation to improve supply chain efficiency; ii) identify the main work in the literature on innovation in the seed supply chain; iii) report on the possibilities of implementing these innovations in the RSX supply chain; and iv) confirm that StArt has interactive and easy to understand functionalities, as well as whether this tool supports the execution of systematic literature reviews broadly and consistently.

2. Material and Methods

The research is a qualitative character. This approach included bibliographic/documental research and exploratory research. The concept of Easterby-Smity, Thorpe, and Lowe (1999), research procedures are necessary to meet the problem raised and its purposes and, according to Saunders, Lewis, and Thornill (2012), the answer to the problem can be given by understanding the facts, so that the concern of the researcher is in the context in which the events happen.

The qualitative approach ran from a comprehensive perspective, which required a critical stance from the authors regarding the perception and assimilation of the central problem's various viewpoints (Ferreira, 2015). The information in the qualitative process, although not quantifiable, has, throughout the process of conducting the investigation, the guarantee of circumscribing the subjective character of the object analyzed (Gil, 2017).

It developed research synthesis methods to establish comparisons and conclusions, from a collection of studies, through interpretative and inductive methods. The RSL is a form of research that uses the literature on a given topic as a data source.

The Xingu Seed Network's value chain's selection of scientific content is through searching in collections made available by the administrators SciELO, Ebsco, OasisBR, and Google Academic. Apply advanced search modes for the period between 2009 (RSX creation year) and April 2019.

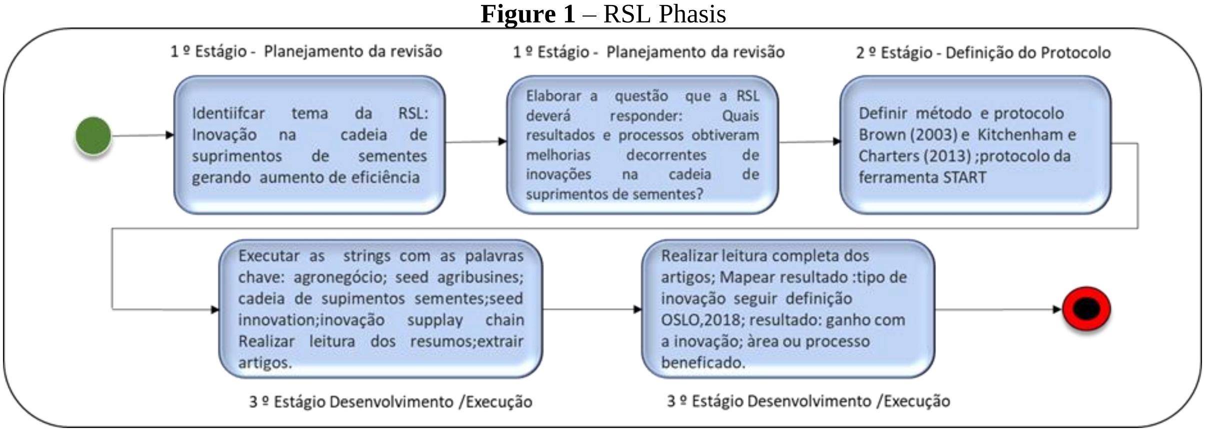
Table 1 shows the research model that generated the two doctoral theses on the Xingu Seed Network subject by Sanches (2015) and Urzedo (2014).

Table 1 – Selection of articles, thesis, and dissertations about XSN

Administrator	Research mode	Quantity found	Selected quantity
EBSCO	Search with the word "Xingu”	893	2
EBSCO	Search with "Xingu Sementes”	893	2
EBSCO	Search with “Xingu seeds”	39	2
EBSCO	Search with Full text only “Xingu sementes”	2	2

Brown (2003), based on extensive work, provides a conceptual framework that divides RSL execution into three stages: i) planning the review; ii) developing the review; iii) writing the review report. Kitchenham and Charters (2013) outline three stages to conduct an RSL: i) planning, ii) execution and iii) adding/issuing reports. That said, the RSL of this article was developed as defined in Figure 1, presented below.

Figure 1 – RSL Phasis



The first and second stages, planning and definition of the protocol, are critical steps in conducting systematic reviews, especially when using the StArt tool. This fact occurs since any change in the initial information may, throughout the studies' extraction, generate disruptions in the links pre-established in the protocol and thus lose the traceability of the criteria for selection, extraction, and summarization of documents found. Through the above, it becomes especially relevant the previous elaboration of the protocol before inserting the data in the tool (Table 2).

Table 2 – Protocol data for filling in StArt.

Campos do StArt	**Dados para inserção**
Objective*	Identify innovations in the seed supply chain that have increased efficiency in this chain.
Main question*	What processes have gained efficiency from innovations in the seed supply chain?
Sec. question	What could innovations in the seed supply chain be implemented in the Xingu seed network?
Keywords and synonyms*	Agribusiness supply chain; innovation; seed supply chain; seed supply chain innovation. Academic database
Sources selection criteria definition*	Academic databases
Studies languages	English and Portuguese
Soucers search methods	EBSCO Search Mode: Boolean/phrase Type of search: Advanced/Full text Period: July 2009 to November 2019 Type of document: Scientific Article Language: English and Portuguese Combination of words: agribusiness supply chain; agribusiness supply chain; innovation and seed supply chain; seed supply chain; seed supply chain
	Google Academic Find articles: exact phrase (Google Academic) Search: anywhere in the article Selected articles cited by at least 3 articles. Export: RafMan Period: July 2009 to November 2019 Type of document: Scientific article Language: English and Portuguese Combination of words: agribusiness supply chain; agribusiness supply chain; innovation and seed supply chain; seed supply chain; seed supply chain
Source list *	EBSCO and Google Academic
Study selection criteria* (inclusion ou exclusion)	(I) Supply chain innovation with efficiency gain (E) Supply chain innovation without efficiency gains (E) Innovation without link to the supply chain seeds (I) Innovation linked to the seed supply chain. Do not use SCAS
Quality form fields*	Summary; Type of innovation; Resulting results.
Data extration form fields*	Type of Innovation; results obtained; areas or processes in which the efficiency improvement occurred; applicable to XSN

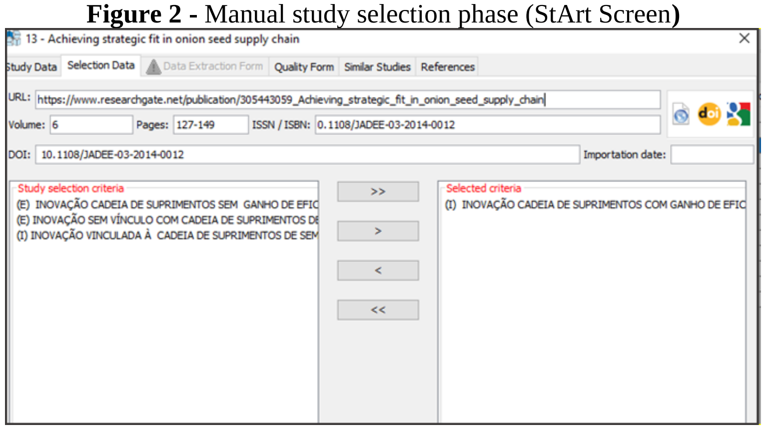
Source: authors (2020).

Note: *completion required; Score Citation Automatic Selection – SCAS

During the third stage, applies word combinations. The following bibliographic information is uploaded to StArt: author, title; keywords; periodical; year, and abstract, the latter being done manually for Google Academic. In the sequence, there is the selection of the articles. For this step, StArt has a semi-automatic selection option through the Score Citation Automatic Selection - SCAS module.

SCAS provides a score calculated based on the keywords defined in the protocol with those found in the studies' title, abstract, and keywords. A score for a supposed relevance of these in the context of the RSL. According to the protocol's previous definition, it does not use this functionality, so transcribe the articles' inclusion or exclusion criteria for StArt (Figure 2).

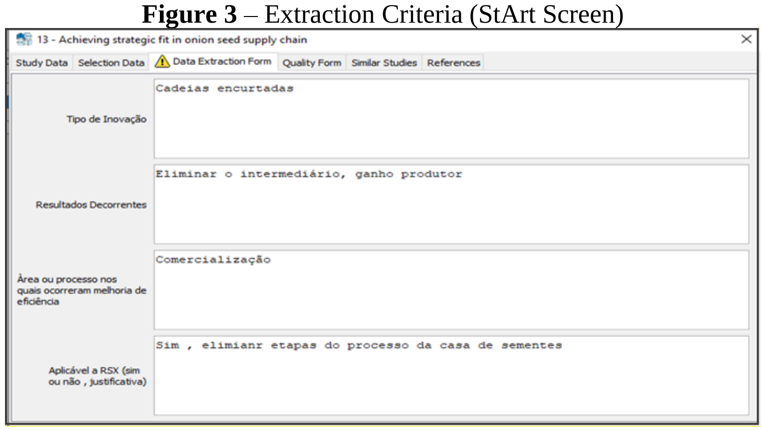
Figure 2 - Manual study selection phase (StArt Screen**)**



Source: authors (2020).

Using StArt, the software transfers the articles identified as accepted to the next phase of RSL. The conclusion that occurs with mapping the extraction results. All selected articles must have assigned information to the previously established criteria at the end of this activity, as shown in Figure 3.

Figure 3 – Extraction Criteria (StArt Screen)



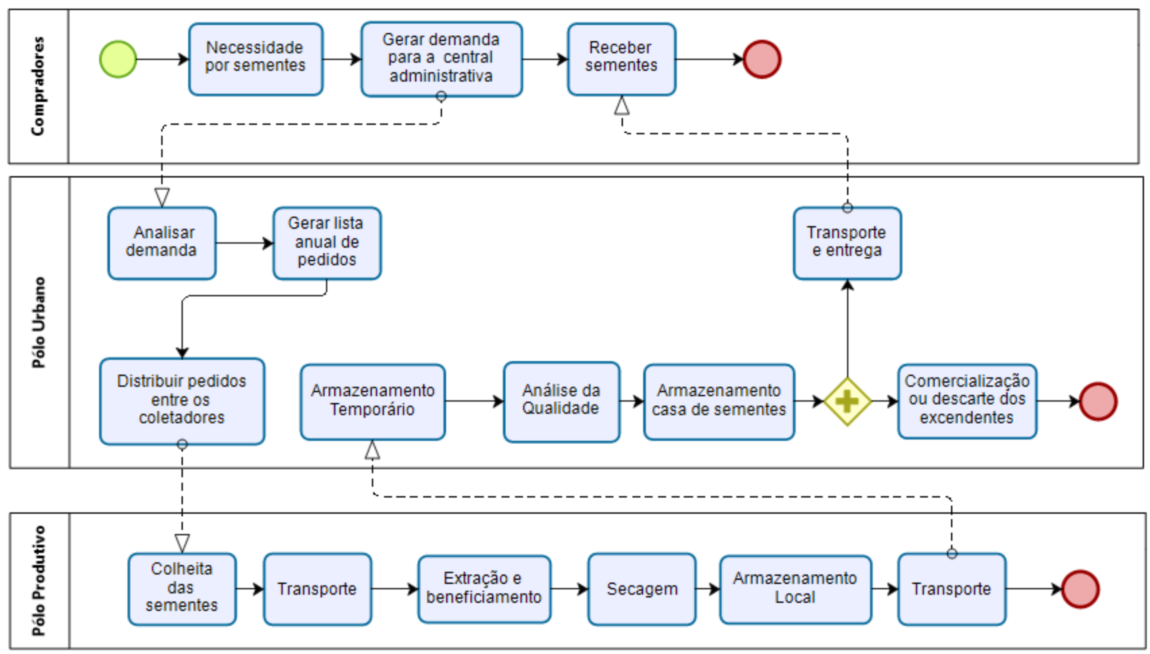
Source: authors (2020).

At this stage, from the complete reading of the article, if the article does not bring in its content information capable of complementing the gaps that answer the RSL questioning, the article is reclassified as rejected.

3. Development

The XSN value chain's functional system comprises a complex logistics of storage and distribution used to commercialize the different seed species, that is, an elaborate management system, which integrates the processes described in Figure 4.

Figure 4 – The functional system of the XSN value chain in the Brazilian Amazon covering stages, processes, and actors.



Source: Adapted, Urzedo (2014)

According to Urzedo (2014, p. 48), the " XSN management system is driven by an administrative center, which relies on technicians' work with the centralization of this activity by only one of the NGOs active." This process aims to relate demands and offers of different resources to plan strategies and articulate initiatives for the growth and strengthening of XSN.

One of the most relevant activities is the annual crossing of seed supply indicated by producers with buyer demands. It is possible to elaborate with two pieces of information on the annual seed production goals. However, to follow the guidelines of the National Plan for the Recovery of Native Vegetation - Planaveg and achieve one of the goals set in the plan, which is 809 tons of seeds per year (Brazil, 2017), 22,000 seed collectors would be needed in Brazil, that is, 50 networks like the XSN.

This estimative base is a scale of native seed production in Brazil following the Paris Agreement's targets for the restoration of 12.5 million hectares by 2030. The established scenarios (Table 3) by a percentage of the area to be planted in each restoration technique adapted from the Planaveg proposal (Freire, Urzedo & Rodrigues, 2017). The different scenarios presented are estimated from different forecasts of specific proportions of the various plant restoration systems.

Table 3 – Scenarios per percentage of area to be planted in each restoration technique.

System adoption scenarios	Vegetation restoration systems				Native seed demand	
	Total Planting (1,666 seedlings/ha)	Enrichment (600 seedlings/ha)	Direct sowing (30 kg native seeds/ha)	Assisted natural regeneration	The total quantity of seeds required (thousand ton/ha)	Annual quantity to be produced. (ton/ha)
Scenario 1	50%	20%	5%	25%	38,88	2.991
Scenario 2	40%	20%	2,5%	37,5%	26,00	1.999
Scenario 3	30%	20%	1,25%	48,75%	17,78	1.368
Scenario 4	20%	20%	0,5%	59,5%	11,45	881
Scenario 5	20%	20%	0,25%	59,75%	10,51	809

Source: Freire, Urzedo e Rodrigues (2017).

The criteria for the process of dividing the annual seed production among the collectors follow the parameters of the Xingu Seed Network Management Guide: 1º) if the demand for seeds of a species is greater than or equal to the potential of the groups, the request is made for all; 2º) if the demand for seeds of a species is a little less than the potential of the group, the request is reduced for all; 3º) if the demand for seeds of a species is much less than the potential of the groups, one or two groups should be selected that have the closest potential to this demand; 4º) the distance from where the planting will be and where the nucleus is located, that is, the closer the nucleus is to the place of delivery of seeds, the greater the possibility of the request; 5º) the history of delivery of seeds; 6º) if the group has not received an order for seeds of some species, this group will be prioritized for the next species following the division; 7º) at the end of the division of requests the lists are reviewed and, if a group has received little order, it will be prioritized in the demands for stock formation (Urzedo et al. , 2016).

In this sense, it optimizes this process so that the collected seeds are fully commercialized could expand collectors' orders and, consequently, to this business model's potential social benefits (Table 4). It is also worth mentioning the data regarding direct sowing reported in the table: the high number of seeds, 30 Kg /ha, that should be used for restoration by direct sowing.

Table 4 – Potential socio-economic results of community seed production

System adoption scenarios	Vegetation restoration systems			
	Annual quantity to be produced. (ton/ha)	Collectors (thousand)	Quantity (million R$/year)	Direct sowing (30 kg native seeds/ha)
Scenario 1	2.991	82	49	5%
Scenario 2	1.999	55	32	2,5%
Scenario 3	1.368	37	22	1,25%
Scenario 4	881	24	14	0,5%
Scenario 5	809	22	13	0,25%

Source: Adapted Junqueira (2018).

The direct sowing technique is the most promising in the environmental recovery process (Santos, Botelho & Davide, 2004). Direct sowing is a cheap and versatile reforestation procedure and is possibly used in most site conditions and, mainly, in natural regeneration and seedling planting without possibility with satisfactory results (Barnett & Baker, 1991; Mattei, 1995). The absence of transplant-shock at the time of planting and the high density of young plants may result in the rapid closure of the canopy (three to five years after sowing) to areas of direct sowing comparing to seedling planting (Willoughby et al., 2004; Muehlethaler

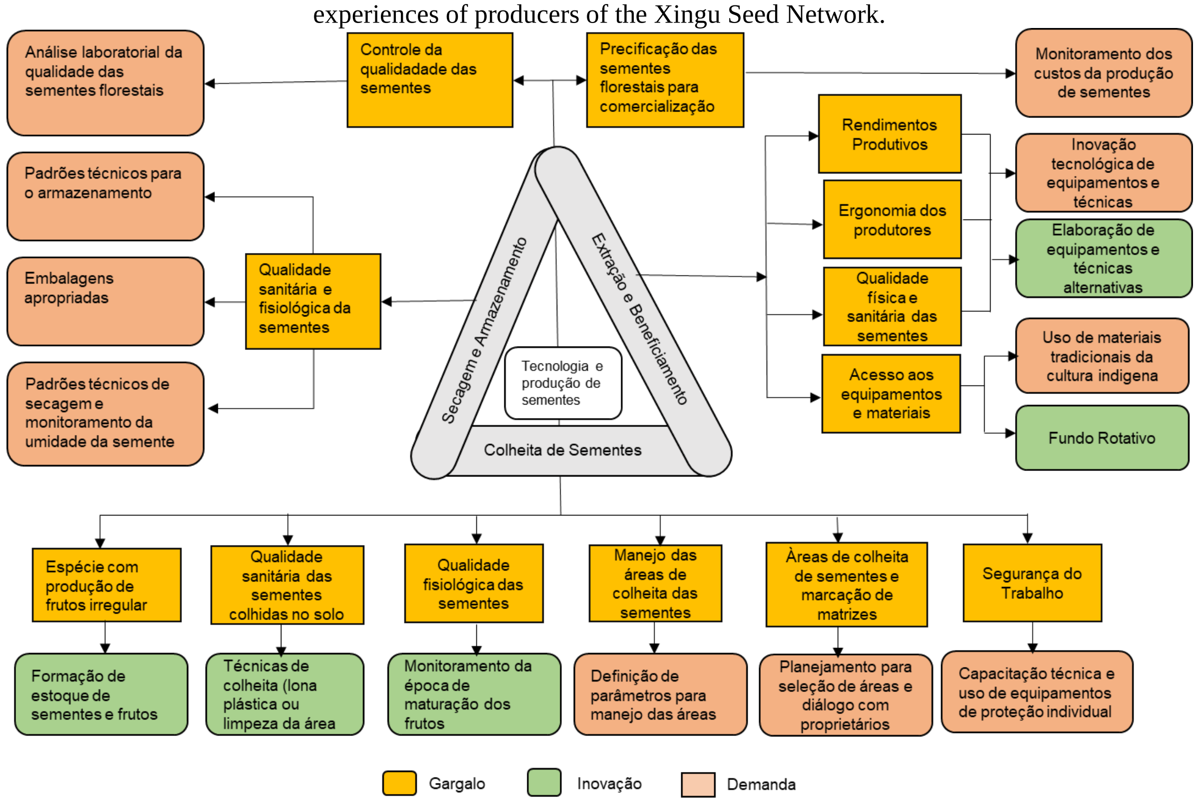
& Kamm, 2009).

However, according to Ticktin (2004) and Ticktin and Shackleton (2011), scientific studies should be carried out that are committed to assessing ecosystems' functional dynamics and populations of species subjected to different forest intensities seed harvesting. Considering that the commercialization of seeds is directly affected by this market's political and legal aspects, changes in forest codes allied to the State's lack of commitment in the inspection have led the violators not to look for the seeds. Another critical aspect, especially for indigenous people, is transportation.

About the difficulties found in transportation, in this process, the geographical distances to collect and drain the seeds, the difficulty of forming large lots point to the need for investments in infrastructure in the collecting centers themselves to ensure the minimum storage condition for delivering the seeds to the chambers in urban centers. Therefore, improving this process to present the feasibility of shortening the chain contributes to increased productivity and the number of collectors and optimizing future new seed networks.

The Figure 5 presents the bottlenecks in forest seed production and their respective innovations based on XSN producers' experiences.

Figure 5 – Bottlenecks in forest seed production and their respective innovations are demanded based on the experiences of producers of the Xingu Seed Network.



Source: Adapted Urzedo (2014).

The extraction and processing of forest seeds condition the production since the yield of species has wide variation, which demands the adoption of knowledge, techniques, materials, and equipment according to each, reflecting the collectors' time and dedication. The techniques adopted in the processing are essential to obtain seeds of physical and sanitary quality; however, the access to technologies and techniques was considered a bottleneck due to the infrastructure and low technological degree for seed.

The management of forest seed harvest areas can apply to different understandings regarding ecosystems' use and conservation. Thus, the socio-cultural groups of seed producers adopt forest management techniques to compromise ecosystems' dynamics and, consequently, maintain seed production.

Drying is the decisive stage of production; however, there are insufficient technical parameters in this process, and the same occurs with storage. The type of packaging adopted by the producers reflects the socioeconomic realities, which require the acquisition of specific or expensive packaging. The storage locations vary widely, from airy rooms to refrigerators. In long storage periods, the loss of many seeds may occur due to humidity. This long time for production flow occurs mainly in family and indigenous farmers, covering 50 to 450 km.

4. Results and Discussion

Using the world cloud functionality of the StArt tool, after loading the abstract of the articles, obtain the word cloud (Figure 6). This cloud demonstrates the degree to which keywords appear in the 27 selected papers' abstracts. Figure 7 represents the number of articles and their distribution in the selection and extraction phases.

Figure 6 – RSL wordcloud

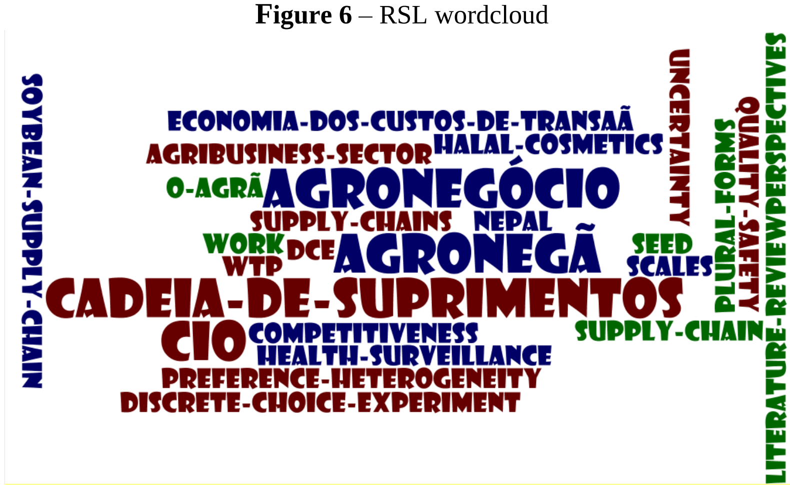


Figure 7 – Distribution of articles by RSL phase

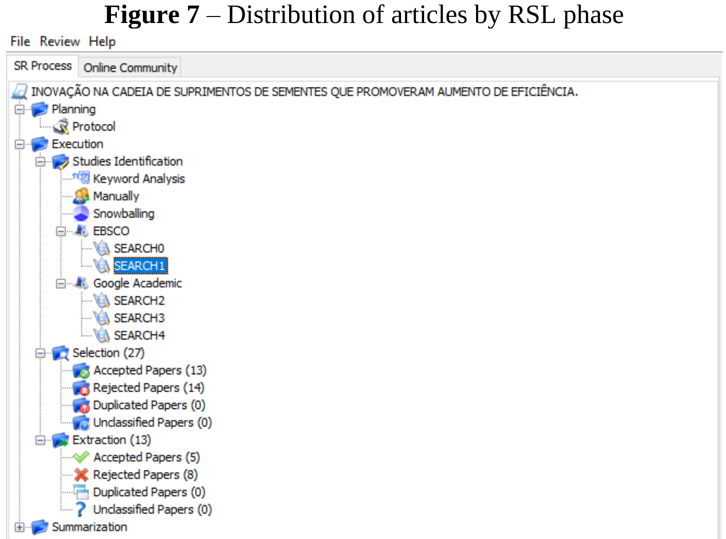


Table 5 presents the details of the articles' identification step by combining words and database.

Table 5 – Number of items identified by word combination.

Combination of words	Identification on StArt in the EBSCO platform	EBSCO Results	Identification on StArt in the Google platform	Google Results
Supply chain agribusiness	Search 0	8 articles	Search 2	14 articles
Cadeia suprimentos agronegócios	Search 1	3 articles	Search 3	1 article
Cadeia suprimentos (e) sementes	No articles	No articles	Search 5	1 article

We cannot get articles for the combinations of words: innovation (and) seed supply chain; innovation (and) seed supply chain. According to the objectives of RSL and its primary and secondary issues, it is possible to obtain the research result (Table 6), and it was possible to analyze the innovations and respective improvements in supply chain efficiency.

Table 6 – Search result

Article	Authors	Year	Incremental description of the innovation	Results obtained with the innovation	Process or area that obtained gain(s)	Has applicabilit y to XSN
O processo de encurtamento de uma cadeia produtiva de arroz motivadores e implicações	Santana e Sellitto	2020	Incremental: Shortening the chain	Reduction of costs	Marketing process	Yes
Governança e gestão da qualidade em uma rede de suprimentos no estado de Mato Grosso	Santos e Machado	2019	Incremental: Governance and quality management	Expanded assertiveness in decision making	Strategic process	Yes
Achieving strategic fit in onion seed supply chain	Timsina, Bastakoti e Shivakoti	2016	Incremental: Shortening the chain	Reduction of costs	Marketing process	Yes
The role and importance of strategic budgeting for competitiveness of the agribusiness supply chain	Savić, Vasiljević e Popović	2016	Incremental: Strategic Budget	Expanded assertiveness in decision making	Strategic and investment process	Yes
A life cycle framework of green IoT-based agriculture and its finance, operation, and management issues	Ruan et al.	2019	Incremental: IOT Green	Productivity gain	Product life cycle	Yes

From these data, it was possible to identify innovation's contribution to efficiency improvement in all supply chains resulting from the research.

5. Conclusion

Concluding this article's objective, it was possible to identify, from the RSL, five articles and their respective innovations that contributed to improving supply chains' efficiency.

The articles from Savić, Vasiljević, and Popović (2016) and Santana and Sellitto (2020) presented how to innovate in strategic processes through quality management, governance, and the strategic budget increased effectiveness in decision making.

The incremental innovation applied to rice commercialization and distribution of onion seeds, presented by Santana and Sellitto (2020) and Timsina, Bastakoti, and Shivakoti (2016), respectively, among other gains, proved effective in reducing costs in the supply chain of these products.

Finally, Ruan et al. (2019) discuss technological innovation for managing production processes, transportation, and commercialization of agricultural products based on the Internet of Things. The maximization of quality in the growth phase and the minimization of losses at the time of packaging and distribution are practical gains driven by this innovation type.

The public/private power, facing deforestation and employability, needs to broaden the vision about native seed networks' important performance and expand models such as XSN. The reproduction of these units has an elementary facilitator presented in this article, which links with the supply chain parameters and innovations described in this study.

Due to the limitation of studies related to the specific theme of native seeds, the scope of the information described in this article may not reveal all the characteristics regarding XSN. Another element to be considered is that no find articles presenting innovations in native seed networks.

About the theme's relevance, for future research to study the following hypotheses:

- Situation 1: The complex logistics of storage and distribution used for the marketing of the different species of RSX seeds could motivate the shortening of this chain.
- Situation 2: the internet of things could generate gains in the XSN supply chain; and
- Situation 3: quality management, strategic management, and strategic management of supplies would be innovations that would bring gains for XSN.

The StArt tool affirms that it provided sufficient conditions for synthesizing the articles and the RSL development in evaluation.

6. References

AFC – Agriculture and Food Council. (2004). **Agri-food value chains**: a practical guide to building customer-focused alliances. Alberta: Value Chain Initiative.

Arshinder, A. K., & Dekhmukh, S. G. (2008). Supply chain coordination: perspectives, empirical studies and research directions. **International Journal of Production Economics**, 115, 316-335.

Barnett, J. P., & Baker, J. B. (1991). Regeneration methods. In M. L. Duryea & P. M. Dougherty (Eds.). **Forest regeneration manual**. (pp. 35-55). Dordrecht: Kluver Academic Publishers.

Brasil. (2017). **Planaveg**: Plano Nacional de Recuperação da Vegetação Nativa. Brasília: Ministério do Meio Ambiente.

Brown, C. R. (2003). **Economic theories of the entrepreneur**: a systematic review of the literature. Cranfield: School of Management.

Chopra, S., & Meindl, P. (2013). **Supply chain management strategy, planning, and operation** (5th ed.). England: Pearson Education Limited.

Easterby-Smith, M., Thorpe, R., & Lowe, A. (1999). **Management research**: an introduction. London: Sage.

Ferreira, J. L. Neto. (2015). Pesquisa e metodologia em Michel Foucault. **Psic.: Teor. e Pesq**. 31(3), 411-420.

Freire, J. M., Urzedo. D. I., Rodrigues, F. C. M. (2017). A realidade da semente nativa no Brasil: desafios e oportunidades para a produção de larga escala. **Seed News**, 21(5), 24-28.

Gil, A. C. (2017). **Como elaborar projetos de pesquisa** (6a ed.). São Paulo: Atlas.

Heikkilä, J. (2002). From supply to demand chain management: efficiency and customer satisfaction. **Journal of Operations Management**, 20(6), 747-767.

Junqueira, R. G. P. (2018). **Iniciativas de apoio e fomento à implantação do PRA no Brasil**: Redes Comunitárias de Sementes. [Slides do PowerPoint]. Recuperado de: http://www.florestal.gov.br/documentos/acesso-informacao/institucional/area-de-imprensa/eventos/ii-encontro-nacional-tematico-do-sicar-dialogos-para-a-implementacao-dos-programas-de-regularizacao-ambiental-pra-no-brasil/3961-ii-encontro-pra-rede-de-sementes-xingu-isa-rodrigo-junqueira/file. Acesso em: 25/07/2020.

Kintish, E. (2007). Carbon emissions: improved monitoring of rainforests helps pierce haze of deforestation. **Science**, 316(5824), 536-537.

Kitchenham, B., & Brereton, P. (2013). A systematic review of systematic review process research in software engineering. **Information and Software Technology**, 55, 2049-2075.

Lowe, T. J., & Preckel, P. V. (2004). Decision technologies for agribusiness problems: a brief review of selected literature and a call for research. **Manufacturing and Service Operations Management**, 6(3), 201-208.

Matopoulos, A., Vlachopoulou, M., Manthou, V., & Manos, B. (2007). A conceptual framework for supply chain collaboration: empirical evidence from the agri-food industry. **Supply Chain Management: an International Journal**, 12(3), 177-186.

Mattei, V. L. Agentes limitantes a implantação de *Pinus taeda* L. por semeadura direta. (1995). **Ciência Florestal**, 5(1), 9-18.

Muehlethaler, U., & Kamm, U. (2009). Innovative direct seeding method in the forest. **Agrarforschung**, 16(10), 384-389.

OECD – Organisation for Economic Co-operation and Development. (2018). **Oslo manual 2018**: guidelines for collecting, reporting and using data on innovation (4th ed.). Paris/Eurostat, Luxembourg: OECD Publishing.

Pandey, M., & Tewari, D. (2010). **The agribusiness book**: a marketing & value-chain perspective (analyzing South Asia). International BOOK Distributing Co., Publishing Division IBDC.

Ruan, J. et al. (2019). A life cycle framework of green IoT-based agriculture and its finance, operation, and management issues. **IEEE Communications Magazine**, 57(3), 90-96.

Sanches, R. A. (2015). **Campanha 'Y Ikatu Xingu**: governança ambiental da região das nascentes do Xingu (Mato Grosso, Brasil). Tese de doutorado, Universidade Estadual de Campinas, Campinas, SP, Brasil.

Santana, V. M., & Sellitto, M. A. (2020). O processo de encurtamento de uma cadeia produtiva de arroz: motivadores e implicações. **Revista Produção Online**, 20(1), 95-118.

Santos, A. B. A., Fazion, C., & Meroe, G. P. S. (2011). Inovação: um estudo sobre a evolução do conceito de Schumpeter. **Revista PUC-SP**, 5(1).

Santos, C. E., & Machado, M. C. (2019). Governança e gestão da qualidade em uma rede de suprimentos no estado de Mato Grosso. **Exacta**, 17(1), 157-170.

Santos, N. A., Jr., Botelho, S. A., & Davide, A. C. (2004). Estudo da germinação e sobrevivência de espécies arbóreas em sistema de semeadura direta, visando à recomposição de mata ciliar. **Cerne**, 10(1), 103-117.

Saunders, M., Lewis, P., & Thornhill, A. (2012). **Research methods for business students**. Harlow: Pearson Education Ltd.

Savić, B., Vasiljević, Z., & Popović, N. (2016). The role and importance of strategic budgeting for competitiveness of the agribusiness supply chain. **Ekonomika poljoprivrede**, 63, 295-312.

Ticktin, T. (2004). The ecological implications of harvesting, non-timber forest products. **The journal of Applied Ecology**, 41, 11-21.

Ticktin, T., & Shackleton, C. (2011). Harvesting non-timber forest products sustainably: opportunities and challenges. In S. Shackleton, C. Shackleton, P. Shanley. (Ed). **Non-timber forest products in the global context** (pp. 149-169). Heidleberg: Springer.

Timsina, K., Bastakoti, R., & Shivakoti, G. (2016). Achieving strategic fit in onion seed supply chain. **Journal of Agribusiness in Developing and Emerging Economies**, 6, 127-149.

Uhl, C., Da Silva, J. M. C., Nepstad, D. C., & Vieira, I. C. G. (1991). Restauração da floresta em pastagens degradadas. **Ciência Hoje**, 13(76), 23-31.

Urzedo, D. I. de. (2014). **Trilhando recomeços**: a socioeconomia da produção de sementes florestais do Alto Xingu na Amazônia brasileira. Tese de doutorado, Universidade de São Paulo, Piracicaba, SP, Brasil.

Urzedo, D. I. de. (2017). Organização comunitária para as sementes florestais no Xingu-Araguaia. **Informativo ABRATES**, Londrina, 27(2), 37. Disponível em: http://www.cbsementes.com.br/files/INFORMATIVO%20-%20Anais%20XXCBSementes.pdf. Acesso em: 6/9/2019.

Urzedo, D. I. de., Reis, A. L. dos., Souza, B. D. F. de., & Araújo, C. A. de. (2016). **Guia de gestão da rede de sementes do Xingu**. s/l: Rede de Sementes do Xingu.

Willoughby, I., Jinks, R., Gosling, P., & Kerr, G. (2004). **Creating new broadleaved woodland by direct seeding**. Edinburgh: Forestry Comission.

WWF – World Wildlife Fund. (2018). **Maior aumento de desmatamento da Amazônia em dez anos.** [*S.l.*], novembro. Disponível em: https://www.wwf.org.br/?68662/maior-aumento-desmatamento-amazonia-dez-anos. Acesso em: 12/02/2020.