Migration Letters

Volume: 20, No: S2(2023), pp. 1113-1122

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)
www.migrationletters.com

The Role of Blockchain Technology in the Transparency and Environmental Efficiency of Modern Supply Chains

James Boonds Lazaro Osorio[1], Omar Eduardo Alvarez Huarca[2], Bryan Alejandro Cruz Macías[3], Luis Rolando, Murga Paulino[4]

Abstract

A documentary review was carried out on the production and publication of research papers related to the study of the BLOCKCHAIN and Supply Chain variables. The purpose of the bibliometric analysis proposed in this document was to know the main characteristics of the volume of publications registered in the Scopus database during the period 2017-2022 by Latin American institutions, achieving the identification of 101 publications. The information provided by this platform was organized through graphs and figures, categorizing the information by Year of Publication, Country of Origin, Area of Knowledge and Type of Publication. Once these characteristics have been described, the position of different authors on the proposed topic is referenced through a qualitative analysis. Among the main findings made through this research, it is found that Brazil, with 50 publications, was the Latin American country with the highest scientific production registered in the name of authors affiliated with institutions of that nation. The Area of Knowledge that made the greatest contribution to the construction of bibliographic material related to the study of the Efficiency of BLOCKCHAIN in Supply Chains was Computer Science with 59 published documents, and the most used Publication Type during the period indicated above were Journal Articles with 43% of the total scientific production.

Keywords: *Blockchain, Supply Chain, Efficiency.*

1. Introduction

Blockchain technology has become a transformative force in today's supply chains, changing the way businesses manage, track, and optimize operations. In the era of globalized trade and complex logistics networks, supply chain management has become increasingly complex and faces many challenges in terms of transparency, traceability, and reliability. Blockchain solves many of these problems by providing a decentralized, immutable, and transparent ledger that can improve the efficiency, security, and integrity of supply chain processes. This comprehensive introduction explores the essential role blockchain plays in today's supply chains and illustrates its key benefits, applications, and potential future developments.

One of the main benefits of blockchain in supply chain management is increased transparency. With a shared, immutable ledger, real-time information on the movement and status of goods is available to all members of the supply chain. This transparency helps

[1] Universidad Internacional de la Rioja, ing.jlazaroo@gmail.com, ORCID: 0000-0001-6397-4468
[2] Universidad César Vallejo, alvarezhuarca.95@gmail.com, ORCID: 0000-0003-3284-3099
[3] Universidad Estatal del Sur de Manabí, Carrera de Ingeniería Ambiental, bryan.cruz@unesum.edu.ec, ORCID: 0000-0003-3462-6928
[4] Universidad Nacional Daniel Alcides Carrión, UNDAC, Pasco, lmurgapa@undac.edu.pe, ORCID: 0000-0003-1840-0371

eliminate information asymmetry and reduce delays, disputes, and errors. For example, manufacturers can trace the origin of raw materials and ensure that ethical and sustainable procurement practices are followed. In addition, retailers can verify the authenticity of the product and reduce the risk of counterfeit products entering the market.

Blockchain technology also makes supply chains more efficient by streamlining processes and reducing paperwork. Smart contracts are self-executing protocols built into the blockchain that automate various supply chain tasks. These contracts can automatically trigger actions based on predefined conditions, such as payment releases, inventory updates, or shipment notifications. By eliminating human intervention and intermediaries, smart contracts reduce administrative costs, reduce errors, and speed up transaction processing.

In addition, blockchain improves the traceability and visibility of the supply chain. Each product or component can be assigned a unique identifier, such as a digital token or QR code, which is recorded on the blockchain. It allows stakeholders to track the flow of goods at all stages, from production to delivery. In the event of a product recall or quality issue, blockchain can quickly identify affected items, reducing the impact on consumers and the company's financial losses.

Importantly, trust is another important aspect of supply chains that blockchain addresses. By providing a decentralized and immutable record of transactions, blockchain eliminates the need for intermediaries and fosters trust among participants. In traditional supply chains, trust is often established through contracts, legal agreements, or reputation. However, these mechanisms can be easily manipulated or violated. Blockchain, on the other hand, provides trust through encryption algorithms and consensus mechanisms, making it extremely difficult to manipulate or falsify data. For this reason, this article seeks to describe the main characteristics of the compendium of publications indexed in the Scopus database related to the variables BLOCKCHAIN and Supply Chain, as well. Such as the description of the position of certain authors affiliated with institutions, during the period between 2017 and 2022.

2. General Objective

To analyze, from a bibliometric and bibliographic perspective, the preparation and publication of research papers in high-impact journals indexed in the Scopus database on the BLOCKCHAIN and Supply Chain variables during the period 2017-2022 by Latin American institutions.

3. Methodology

This article is carried out through a research with a mixed orientation that combines the quantitative and qualitative method. On the one hand, a quantitative analysis of the information selected in Scopus is carried out under a bibliometric approach of the scientific production corresponding to the study of the BLOCKCHAIN and Supply Chain variables. On the other hand, examples of some research works published in the area of study mentioned above are analyzed from a qualitative perspective, based on a bibliographic approach that allows describing the position of different authors on the proposed topic. It is important to note that the entire search was carried out through Scopus, managing to establish the parameters referenced in *Figure 1*.

3.1. Methodological design

Figure 1. Methodological design
Source: Authors' own creation

3.1.1 Phase 1: Data collection

Data collection was carried out from the Search tool on the Scopus website, where 102 publications were obtained from the following filters:

TITLE-ABS-KEY (blockchain, AND supply AND chain) AND PUBYEAR > 2016 AND PUBYEAR < 2023 AND (LIMIT-TO (AFFILCOUNTRY , "Brazil") OR LIMIT-TO (AFFILCOUNTRY , "Mexico") OR LIMIT-TO (AFFILCOUNTRY , "Colombia") OR LIMIT-TO (AFFILCOUNTRY , "Peru") OR LIMIT-TO (AFFILCOUNTRY , "Ecuador") OR LIMIT-TO (AFFILCOUNTRY , "Chile") OR LIMIT-TO (AFFILCOUNTRY , "Argentina") OR LIMIT-TO (AFFILCOUNTRY , "Puerto Rico") OR LIMIT-TO (AFFILCOUNTRY , "Panama") OR LIMIT-TO (AFFILCOUNTRY , "Cuba"))

- Published documents whose study variables are related to the study of the BLOCKCHAIN and Supply Chain variables
- Limited to the period 2017-2022
- Limited to Latin American countries.
- Without distinction of area of knowledge.
- No distinction of type of publication.

3.1.2 Phase 2: Construction of analytical material

The information collected in Scopus during the previous phase is organized and then classified by graphs, figures and tables as follows:

- Co-occurrence of words.
- Year of publication
- Country of origin of the publication.
- Area of knowledge.
- Type of publication.

3.1.3 Phase 3: Drafting of conclusions and outcome document

In this phase, the results of the previous results are analysed, resulting in the determination of conclusions and, consequently, the obtaining of the final document.

4. Results

4.1 Co-occurrence of words

Figure 2 shows the co-occurrence of keywords found in the publications identified in the Scopus database.

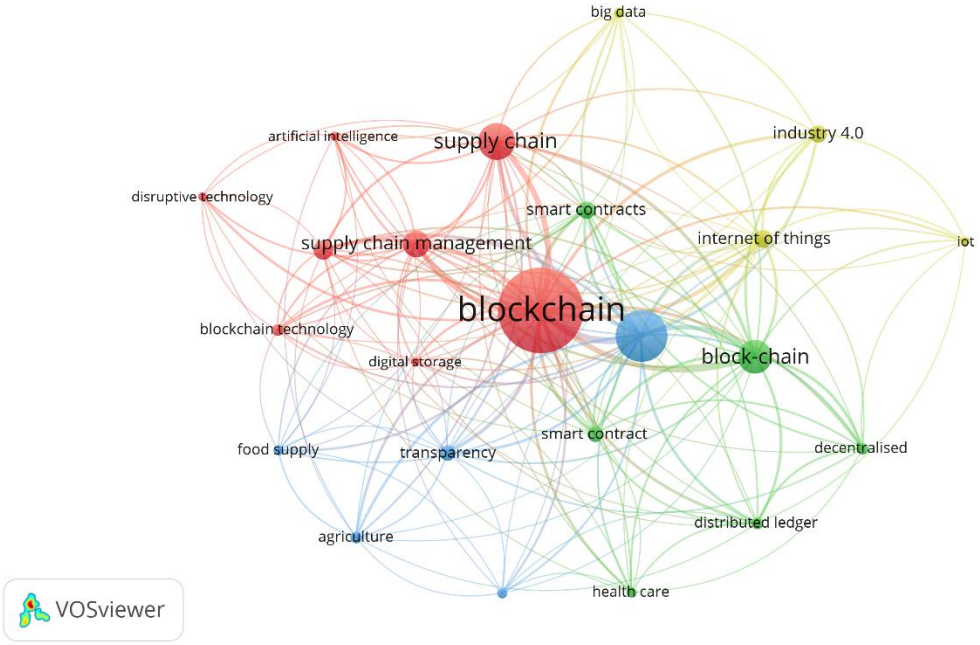

Figure 2. Co-occurrence of words

Source: Authors' own elaboration (2023); based on data exported from Scopus.

Blockchain was the most frequently used keyword within the studies identified through the execution of Phase 1 of the Methodological Design proposed for the development of this article. Supply Chain Management is among the most frequently used variables, associated with variables such as Supply Chain, Smart Contract, Industry 4.0, Artificial Intelligence, Disruptive Technology. Modern supply chains are characterized by complexity in their interconnected networks of various entities since they can span multiple geographies and include many stakeholders, such as manufacturers, suppliers, logistics providers, and retailers. These supply chains are often plagued by inefficiencies, complexity, and vulnerabilities that can lead to delays, errors, fraud, and increased costs. Modern supply chains are complex networks of interconnected entities that span multiple geographies and include many stakeholders, such as manufacturers, suppliers, logistics providers, and retailers. These supply chains are often plagued by inefficiencies, complexity, and vulnerabilities that can lead to delays, errors, fraud, and increased costs.

4.2 Distribution of scientific production by year of publication

Figure 3 shows how scientific production is distributed according to the year of publication.

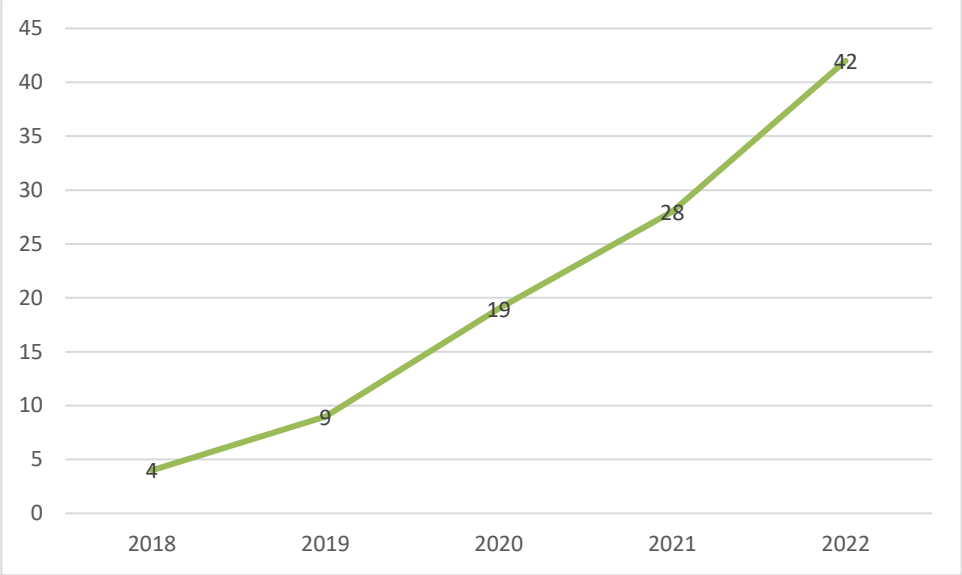

Figure 3. Distribution of scientific production by year of publication.

Source: Authors' own elaboration (2023); based on data exported from Scopus

Among the main characteristics evidenced through the distribution of scientific production by year of publication, the number of publications registered in Scopus was in 2022, reaching a total of 42 documents published in journals indexed on this platform. This can be explained thanks to articles such as the one entitled "Horticulture 4.0: Adoption of Industry 4.0 technologies in horticulture to achieve sustainable agriculture" this article aims to address the importance and application of Industry 4.0 technologies, such as the Internet of Things, cloud computing, artificial intelligence, Blockchain and big data for horticulture, to improve traditional practices of disease detection, irrigation management, fertilizer management, maturity identification, and marketing. and supply chain, soil fertility, and weather patterns before, during, and after harvest. Based on the analysis, the article identifies challenges and suggests some vital recommendations for future work. In horticultural settings, vital recommendations such as robotics, drones with vision technology and artificial intelligence for the detection of pests, weeds, plant diseases, and malnutrition, and cutting-edge computing wearables that can be developed with IoT and artificial intelligence to predict and estimate crop diseases are suggested. in the studio.(Singh, 2022)

4.3 Distribution of scientific production by country of origin.

Figure 4 shows how the scientific production is distributed according to the nationality of the authors.

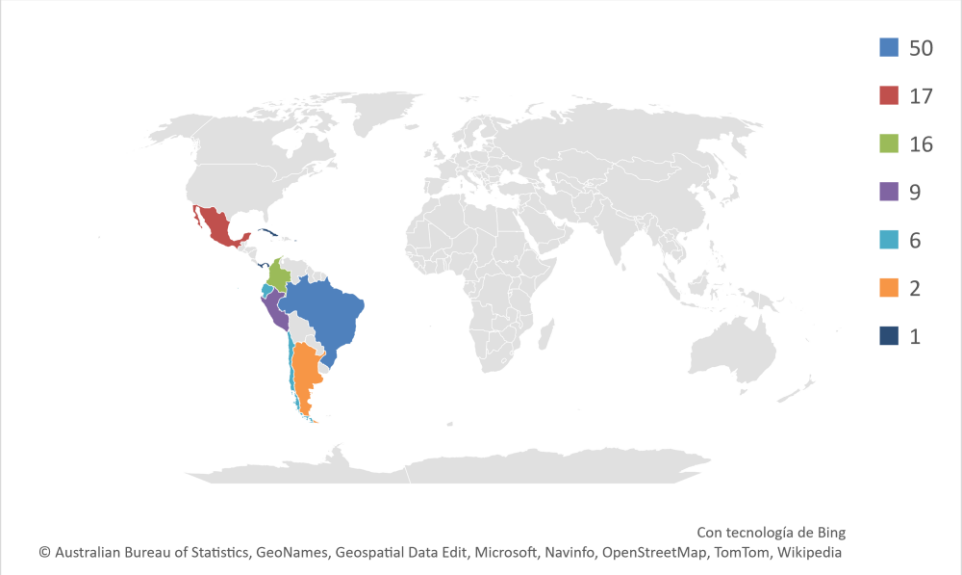

Figure 4. Distribution of scientific production by country of origin.

Source: Authors' own elaboration (2023); based on data provided by Scopus.

Within the distribution of scientific production by country of origin, the registrations from institutions were taken into account, establishing Brazil as the country of this community, with the highest number of publications indexed in Scopus during the period 2017-2022, with a total of 50 publications in total. In second place, Mexico with 17 scientific papers, and Colombia occupying the third place presenting to the scientific community, with a total of 16 documents among which is the article entitled "Traceability of the supply chain of coffee of Colombian origin through a Blockchain implementation" This exploratory study explains how to implement Blockchain technology for a supply chain using a proof of concept in Hyperledger Fabric, An open distributed ledger platform. This approach made it possible to identify feasibility and some implementation challenges, generate feedback, and exemplify a way to trace the origin of the product using a distributed ledger technology. To this end, the case study of origin coffee is analyzed, given the relevance of traceability in this type of coffee and the cultural and economic importance of this agricultural product in the Colombian context. In addition, the data stored on the Blockchain and some aspects of the technological architecture are discussed.(Bettín-Díaz, 2022)

4.4 Distribution of scientific production by area of knowledge

Figure 5 shows the distribution of the elaboration of scientific publications based on the area of knowledge through which the different research methodologies are implemented.

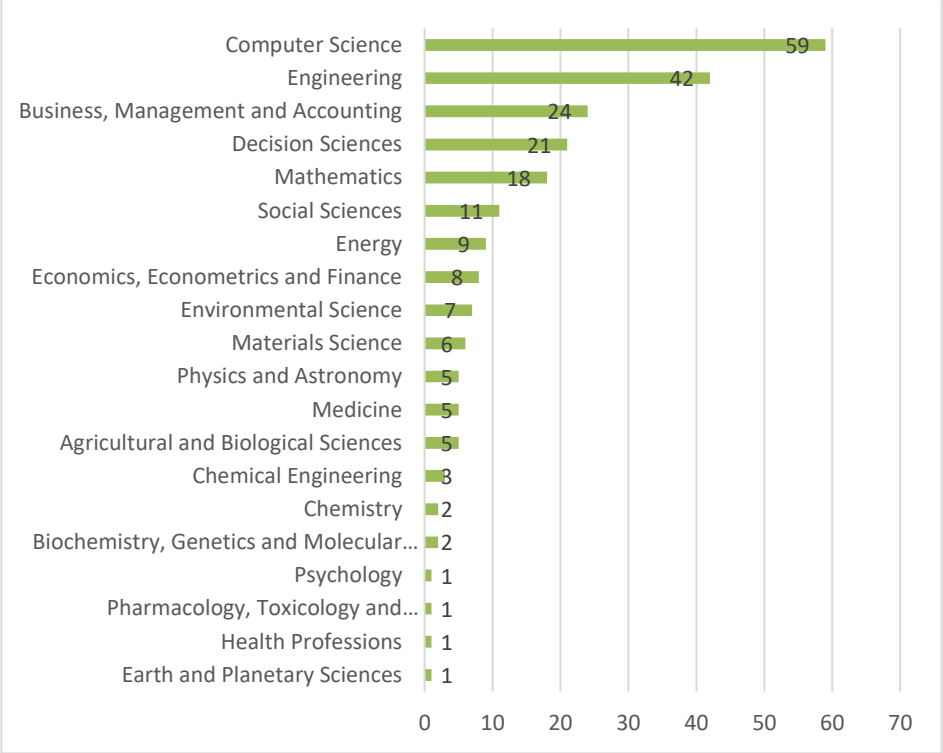

Figure 5. Distribution of scientific production by area of knowledge.

Source: Authors' own elaboration (2023); based on data provided by Scopus.

Computer Science was the area of knowledge with the highest number of publications registered in Scopus, with a total of 59 documents based on its variable methodologies BLOCKCHAIN & Supply Chain. In second place, Engineering with 42 articles and Business, Management and Accounting in third place with 24. The above can be explained thanks to the contribution and study of different branches, the article with the greatest impact was registered by the area of Computer Science entitled "Traceability of the Mexican avocado supply chain: a technological solution of microservice and blockchain" This article describes the characteristics of the Mexican avocado supply chain, It identifies the actors involved in the supply chain and emphasizes the problems that current players have when exporting them to the U.S. market. On this basis, we propose a technological solution system to automate the traceability process. The system was designed to meet the requirements of the authority and the consumer. It proposes a combination of the benefits of traditional data traceability using Microservices architecture with a new Blockchain audit layer that will add value to current and new players at every step of the supply chain. We contribute by proposing a model that adds value to the avocado supply chain with the following characteristics: Integrity, audit service, dual traceability, transparency and a trusted user-oriented front-end application. (López-Pimentel, 2022)

4.5 Type of publication

In the following graph, you will see the distribution of the bibliographic finding according to the type of publication made by each of the authors found in Scopus.

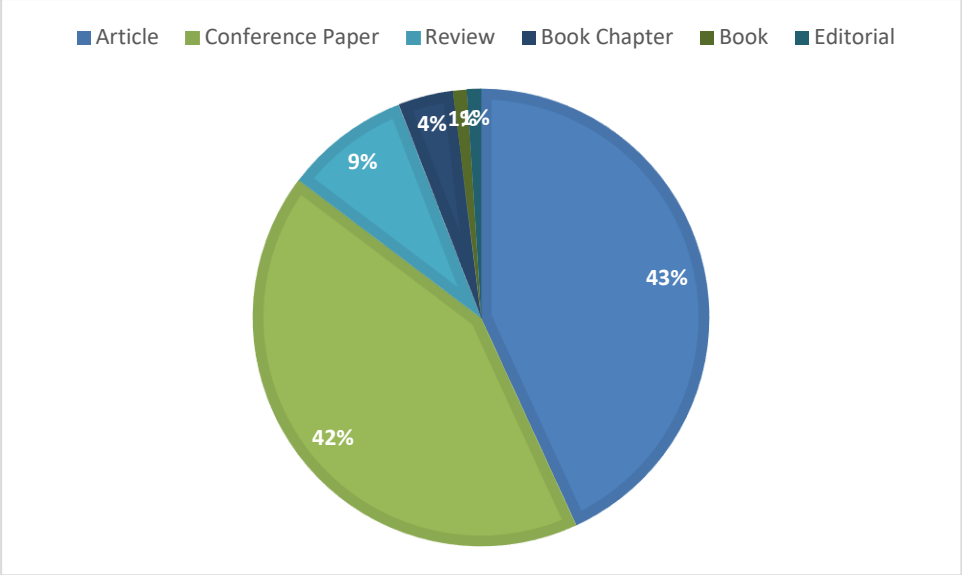

Figure 5. Type of publication.

Source: Authors' own elaboration (2023); based on data provided by Scopus.

The type of publication most frequently used by the researchers referenced in the body of this document was the one entitled Journal Articles with 43% of the total production identified for analysis, followed by Session Paper with 42%. Journals are part of this classification, representing 9% of the research papers published during the period 2017-2022, in journals indexed in Scopus. In the latter category, the one entitled "Being Digital and Flexible to Weather the Storm: How Digital Transformation Improves Supply Chain Flexibility in Turbulent Environments" stands out. This study aims to analyze how the intelligent supply chain (i.e., a supply chain enabled by digital transformation) contributes to supply chain flexibility and operational performance in environments surrounded by customer uncertainty and suppliers. We adopt the theory of organizational information processing to explain the fit between information needs to reduce these uncertainties through increased supply chain flexibility (sourcing, delivery, and manufacturing) and the information capabilities provided by three main dimensions of the Intelligent Supply Chain (digital transformation strategy, digitally-based technologies and digital user interface technologies). We relate this alignment of information processing between intelligent supply chain and flexibility to the boundary conditions of environmental uncertainty and improvements in operational performance. These relationships are analyzed using moderation and mediation regression tests based on 379 surveyed manufacturing firms. Our findings show that Smart Supply Chain has a statistical association with operational performance through the sequential mediating role of the three dimensions of supply chain flexibility. (Enrique, 2022)

5. Conclusions

Through the bibliometric analysis carried out in this research work, it was possible to establish that Brazil was the country with the highest number of records published in the BLOCKCHAIN and Supply Chain variables. with a total of 50 publications in the Scopus database. In the same way, it was established that the application of theories framed in the area of Communication Sciences, were used more frequently in the impact of Blockchain on the efficiency of the modern supply chain since its main function lies in its ability to create unique and immutable ledgers provided by all participants. This decentralized ledger ensures that all stakeholders have real-time access to the same data, reducing inconsistencies, errors, and the need for time-consuming reconciliations. As a result, this real-time visibility into the supply chain allows for faster decision-making and more

responsive operations. In addition, blockchain's smart contract capabilities have made it possible to automate various processes, from tracking shipments to verifying product authenticity. These self-executing contracts automatically enforce predetermined rules, reducing the need for intermediaries and speeding up transaction execution. This efficiency not only reduces operational costs, but also reduces the risk of fraud and error, making the supply chain more reliable. Blockchain transparency is another important factor. Every transaction recorded on the blockchain is timestamped and immutable, creating auditable traceability of each product's journey from the producer to the end consumer. This transparency promotes trust between stakeholders and allows consumers to make informed decisions about the products they buy, especially in industries such as food and pharmaceuticals where traceability is essential. This level of security is especially important in a world where data breaches and cyberattacks are on the rise. By protecting supply chain data, blockchain ensures the integrity of the entire ecosystem.

References

Bettín-Díaz, R. R.-M. (2022). Traceability of the Colombian coffee supply chain through a Blockchain implementation. BOGOTA, COLOMBIA .

Enrique, D. V. (2022). Being Digital and Flexible to Weather the Storm: How Digital Transformation Improves Supply Chain Flexibility in Turbulent Environments. BRAZIL.

López-Pimentel, J. C.-R.-M.-B. (2022). Mexican Avocado Supply Chain Traceability: A Microservice and Blockchain Technology Solution. MEXICO.

Singh, R. S. (2022). Horticulture 4.0: Adoption of Industry 4.0 technologies in horticulture to achieve sustainable agriculture. MEXICO.

Longarini, C. (2011). The RACI Matrix, a tool to organize tasks in the company. Retrieved from https://ayb.pe/wp-content/uploads/2016/12/LA-MATRIZRACI.pdf

Loosemore, M., McCarthy, C.S. (2008). Perceptions of contractual risk allocation in construction supply chains. Journal of Professional Issues in Engineering Education and Practice, 134(1), 95-105.

Loosemore, M., Raftery, J., Reilly, C., & Higgon, D. (1993). Risk Management in Projects. New York, USA. Taylor & Francis.

Mahmood, S., Azhar, S., & Ahmand, I. (2002). Evaluation of the risk management practices of Florida general contractors. Journal of Construction Engineering, 17(1), 4-10.

Martínez, G., Moreno, B., & Rubio, M.C. (2012). Risk Management in Engineering Projects. The Case of the PTS University Campus. University of Granada (Spain). DYNA, 79(173), 7-14.

Mass, E. (2018). We are a country that is more Opex than Capex. Chemical industry. Retrieved 07/30/2019, https://www.industriaquimica.es/descargar_documento/Ayming1.pdf

Peixoto, J., Tereso, A., Fernandes, G., & Almeida, R. (2014). Project Risk Management Methodology: A Case Study of an Electric Energy Organization. Procedia Technology,16, 1096-1105.

Perera, B.A.K.S., Rameezdeen, R., Chileshe N., and Hosseini, M.R. (2014) Enhancing the effectiveness of risk management practices in Sri Lankan road construction projects: A Delphi approach. International Journal of Construction Management, 14(1), 1-14.

Perez, D., Gray, J., and Skitmore, M., (2017) Perceptions of risk allocation methods and equitable risk distribution: a study of medium to large Southeast Queensland commercial construction projects, International Journal of Construction Management, 17(2), 132-141.

Plata, D. (2006). Theoretical approach to holistic research as a methodological tool in the university context. Revista Multiciencias, 3,6, 244-249)

Project Management Institute. (2013). A guide to the project management body of knowledge (PMBOK guide). Newtown Square, Pa: Project Management Institute.

Project Management Institute. (2017). A guide to the project management body of knowledge (PMBOK guide). Newtown Square, Pa: Project Management Institute.

Project Management Institute. (2001). Practice standard for project risk management, Philadelphia, PA: Project Management Institute.

Radujkovic, M., Sjekavica, M. (2017). Project Management Succes Factors. Procedia Engineering, 196, 607 – 615.

Royal Spanish Academy (2018). Definition of Risk - DLE. Retrieved December 2019, https://dej.rae.es/lema/contratista

Rincon, J.C., Bravo, C., Torres, W. (2016). Design of Budget Scheme and Earned Value Method for the cost control of the company Megaobras Ingenieros Ltda. School of Military Engineers, Bogotá D.C.

Rodrigues-da-Silva, L.H., Crispim, J.A. (2014). The Project Risk Management Process, a Preliminary Study. Procedia Technology, 16, 943-949.

Romero, F. (2016) Which is best for my project: EPC, EPCM, Turnkey, D&B, BOT, Other? Contract Strategy for my Project. Retrieved from http://www.pmi.cl/pmi/que-is-best-for-my-epc-epcm-turnkey-project-db-bot other-contract-strategy- for-my-project/

Standards Associaction of Australia. (1999). AS/NZS 4360:1999. Risk Management. Strathfield, NSW. Australia.

Turley, F. (2010) "The PRINCE2® training manual." United Kingdom, Office of Government Commerce.

University of Economics Ktowice. (2012). Plan Risk Response as a Stage of Risk Management in Investment Projects in Polish and U.S. Construction – Methods, Research. Scientific Annals of the Alexandru iona Cuza University of Lasi Economic Sciences, 59(1), 201-212.

Velasco R. (2019) ¿What is the PMBOK? Recovered of https://gestiondeproyectosplus.com/que-is-PMBOK/

Ward, S., Chapman, C. (2003). Transforming Project. Risk Management into Project uncertainty management. International Journal of Projects management. Vol 21 N2, pp. 97105.

Wideman, M, R. (1995). Criteria for a project-management body of knowledge. International Journal of Project Management, 13(2), 71-75.