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Synergy between Sustainable Development and Digital Transformation: A Scientific Approach

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Summary

A documentary review was carried out on the production and publication of research papers related to the study of the Sustainable Development and Digital Transformation 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 80 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 45 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 Sustainable Development and Digital Transformation variables was Social Sciences with 32 published documents, and the most used Publication Type during the period indicated above were Journal Articles with 46% of the total scientific production.

Keywords: *Sustainable Development, Digital Transformation, Latin America.*

1. Introduction

The parameter of globalization has resulted in the emergence of two transformative forces which have emerged as the epicenter for a better process and evolution in a modern world, where society grows at an accelerated pace, more volatile economic movements and a very changing environment. Sustainable development, with its deep commitment to meeting the needs of the present without compromising the ability of future generations to meet their own needs, converges with digital transformation, an epochal change driven by technological advances. As we digress on the complexities offered by these two forces in the middle of the century, understanding and analyzing their synergy is not a matter of choice but must also have a scientific approach.

The autocorrelation of this synergy stems from the compatibility between innovation and the processes that sustainable development uses as a transformative force in digitalization. Sustainable development, rooted in principles that seek to balance economic, social and

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environmental dimensions, finds an enthusiastic ally in the ability of digital transformation to reshape traditional paradigms through technological innovation. Together, they form a symbiotic relationship, fostering a dynamic and interconnected ecosystem that has the potential to address the pressing challenges of our time.

Although we know that there is a close relationship between economic growth and sustainable development, since the latter is based on seeking a balance between constant economic levels, social equity and caring for the environment. Digital transformation, on the other hand, catalyzes change by infusing cutting-edge technologies such as artificial intelligence, the Internet of Things, blockchain, and data analytics. In the pursuit of these goals, sustainability and digital tools, a new frontier of scientific exploration is emerging, requiring a multidisciplinary approach that unites the fields of environmental sciences, technology, economics and social sciences.

The scientific search between these two transformative forces reflects multiple possibilities, each contributing significantly to building an environment that is much more inclusive, resilient and aware of limited environmental resources. Digital technologies serve as accelerators to achieve sustainability goals by improving resource efficiency, optimizing processes, and fostering innovation in various sectors. Where state-of-the-art technologies in large cities allow optimizing energy consumption and at the same time promote a more sustainable agricultural environment in which it seeks to maximize productivity without damaging the environment, with which it is sought that this autocorrelation of these two would be synergistic and much more than theoretical constructions and which implies a much broader panorama of the real world.

However, the incorporation of digital technologies is not only focused on decision-making through the analysis of data and information, they are also generators of political and business decisions and consulting tools, which evaluate and project on a large scale the dynamism present in sustainable development economies. The scientific community plays a major role in unraveling the potential impacts, pitfalls and benefits of the synergy between sustainable development and digital transformation. Using empirical research, modeling, and analysis, scientists contribute to a nuanced understanding of the intricate connection between the technological age and sustainable outcomes. 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 Sustainable Development and Digital Transformation, as follows: 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 variables Sustainable Development and Digital Transformation 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 variables Sustainable Development and Digital Transformation. 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

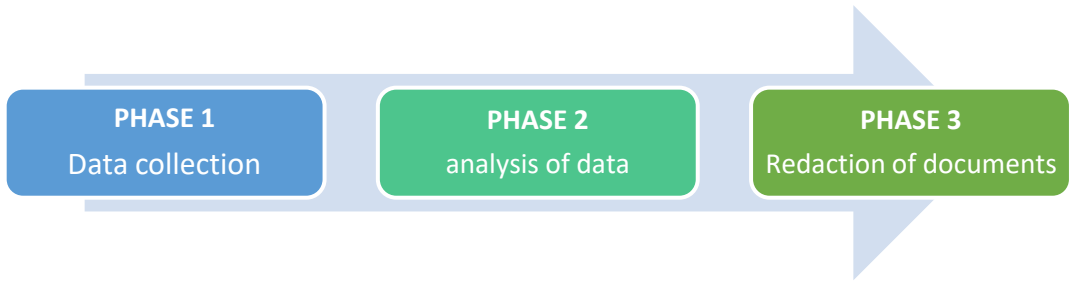

Figure 1. Methodological Design.
Source: Authors.

3.1.1 Phase 1: Data Collection

Data collection was carried out from the Search tool on the Scopus website, where 80 publications were obtained from the following filters:

TITLE-ABS-KEY (sustainable and development, AND digital and transformation) AND PUBYEAR > 2016 AND PUBYEAR < 2023 AND (LIMIT-TO (AFFILCOUNTRY , "Brazil") OR LIMIT-TO (AFFILCOUNTRY , "Colombia") OR LIMIT-TO (AFFILCOUNTRY , "Mexico") OR LIMIT-TO (AFFILCOUNTRY , "Chile") OR LIMIT-TO (AFFILCOUNTRY , "Ecuador") OR LIMIT-TO (AFFILCOUNTRY , "Peru") OR LIMIT-TO (AFFILCOUNTRY , "Cuba") OR LIMIT-TO (AFFILCOUNTRY , "Argentina") OR LIMIT-TO (AFFILCOUNTRY , "Venezuela") OR LIMIT-TO (AFFILCOUNTRY , "Guatemala")

- Published documents whose study variables are related to the study of the variables, Technology and Business Transformation.
- Limited to the years 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.

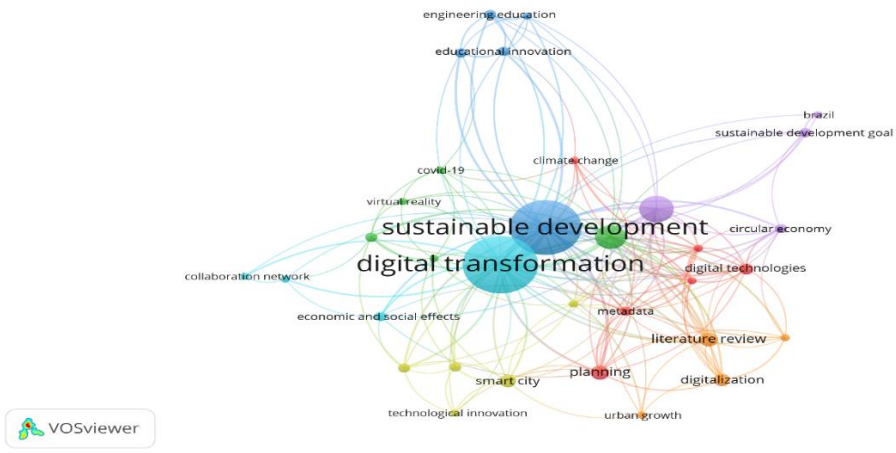

Figure 2. Co-Occurrence of Words.
Source: Authors' Own Elaboration (2023); Based on Data Exported from Scopus.

Sustainable development 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. Digital Transformation is among the most frequently used variables, associated with variables such as Sustainability, Digital Technology, Circular Economy, Sustainable Global Development, Innovative Technology, Economy and Social Effect. This scientific approach also requires an exploration of ethical considerations, as the rapid deployment of digital technologies raises questions about privacy, fairness, and the unintended consequences of innovation. As we delve deeper into the scientific examination of this synergy, ethical frameworks must be put in place to ensure that digital transformation aligns with the principles of justice, inclusion and equity inherent in sustainable development. On this journey of scientific exploration, the synergistic dance between sustainable development and digital transformation unfolds as a path to a more harmonious future. As we navigate the challenges and seize the opportunities presented by this convergence, the scientific community is at the forefront, equipped with the tools to analyze, understand, and guide the evolution of this transformative partnership. Together, sustainable development and digital transformation invite us to forge a future where progress is not measured only in technological advances, but is intrinsically linked to the well-being of our planet and the prosperity of all its inhabitants.

4.2 Distribution of Scientific Production by Year of Publication

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

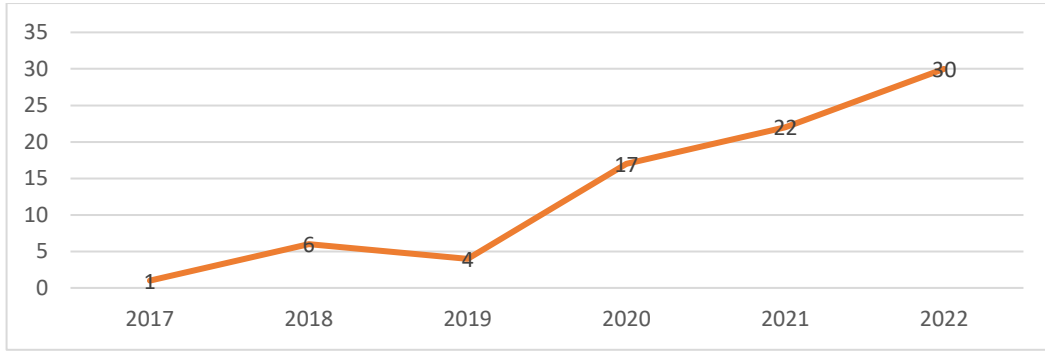

Figure 3. Distribution of Scientific Production by Year of Publication.
Source: Authors' Own Elaboration (2023); Based on Data Exported from Scopus.

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 30 documents published in journals indexed on this platform. This can be explained thanks to articles such as the one entitled "Life Cycle Assessment and Relationships with the Triple Bottom Line in Meat Production: A Systematic Approach to Cleaner Production" The objective of this research was to make a scientific map on Life Cycle Assessment (LCA) and Triple Outcome (TBL) in slaughterhouse areas, seeking Cleaner Production practices with the aim of recognizing strategic issues to maintain the sustainability of production systems. , in accordance with the development of sustainable practices and productive evolution in slaughterhouse areas. Design/methodology/approach: The literature analysis was based on a general approach, with steps adapted from the study phases and activities of the preferred reporting elements for the systematic review and the Meta-Analysis Recommendation Guide (PRISMA) for conducting a systematic review of the literature. The activities were subdivided to discuss the results into two types of analysis: quantitative and qualitative. Findings: The main findings of our study reinforce the importance of LCA in slaughterhouses to promote Cleaner Production, so that the main measures suggested and/or adopted by different authors include the substitution of raw materials for feed, with the adoption of cereals, protein supplements with less environmental impact on the composition of the feed and changes in the processes seeking better energy efficiency and optimization of the consumption of Water in meat processing.(Fritsch Denes, 2022)

4.3 Distribution of Scientific Output by Country of Origin

Figure 4 shows how scientific production is distributed according to the country of origin of the institutions to which the authors are affiliated.

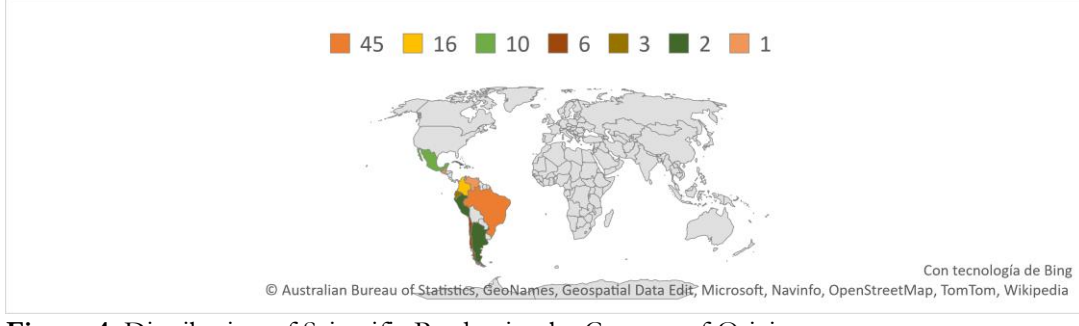

Figure 4. Distribution of Scientific Production by Country of Origin.
Source: Authors' Own Elaboration (2023); Based on Data Provided by Scopus.

Within the distribution of scientific production by country of origin, the records 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 45 publications in total. In second place, Colombia with 16 scientific documents, and Mexico occupying the third place presenting to the scientific community, with a total of 10 documents among which is the article entitled "AGRO 4.0: A POSSIBILITY OF IMPROVEMENT IN THE VENEZUELAN COUNTRYSIDE OR A SOLUTION FOR AGRICULTURE IN VENEZUELA?" The objective of this article was to characterize and analyze the Venezuelan situation regarding the use of these technologies, and then formulate a proposal for their management, with the ultimate goal of ensuring that these benefits reach the different agri-food chains in Venezuela. Previous studies conducted by the team verified that agricultural producers are indeed in the best position to face the AGRO 4.0 paradigm, including the management of their water resources and productive activities, in order to have environmentally friendly production. The analysis of the current situation and prospects for the implementation of AGRO 4.0 technologies indicates that pressure on water resources can be reduced (Sustainable Development Goal 6.4.2), as well as improve the profitability of agri-food sector activities and increase governance. In the specific case of the study of the situation in Venezuela with respect to the use of these technologies, the economic and technological limitations available and the lack of technological training of users are the main reasons that led to the formulation of a proposal for their management. . Its purpose is for these benefits to reach the different chains through a structure that allows the use of technology by rural producers, incorporating aspects of implementation of a shared technological infrastructure, technological literacy schemes and a management proposal that allows the sharing of limited resources. , including water resources in a more transparent way.(Chacón Ramírez, 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.

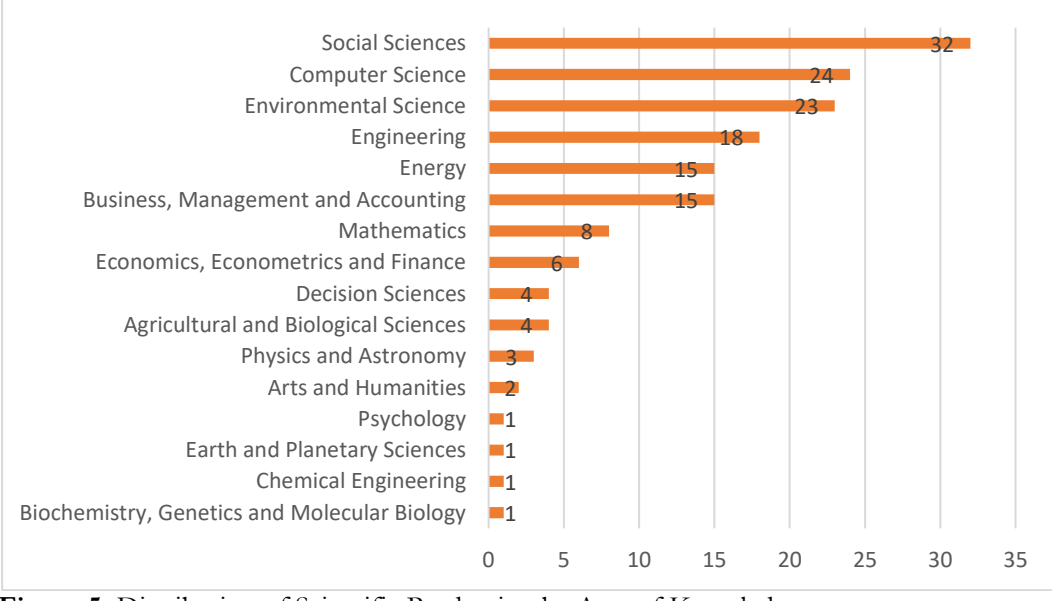

Figure 5. Distribution of Scientific Production by Area of Knowledge.
Source: Authors' Own Elaboration (2023); Based on Data Provided by Scopus.

Social Sciences was the area of knowledge with the highest number of publications registered in Scopus with a total of 32 documents that have based its methodologies Sustainable Development and Digital Transformation. In second place, Computer Science with 24 articles and Environmental Sciences in third place with 23. The above can be explained thanks to the contribution and study of different branches, the article with the greatest impact was registered by Social Sciences entitled "A framework of digital technologies for the circular economy: digital functions and mechanisms" This article aims to address this knowledge gap by conducting a systematic review of the literature. After examining 174 articles, creating 782 original codes and 259 second-round codes, the study identifies 13 critical functions of digital technologies that are most relevant to circular economy strategies. The paper then proposes a framework that reveals seven mechanisms of how these digital functions can enhance different circular economy strategies. The framework also reveals which combinations of digital functions and circular economy strategies have already been extensively studied and where gaps may exist. This indicates which digital functions are most mature in terms of possible implementation for the circular economy, as well as which missing links exist in empirical and theoretical research. The study advances the synergies between digital technologies and the circular economy paradigm through the lens of digital functions. The proposed framework and mechanisms build a theoretical foundation for future research, and we highlight five areas of research for further study. This study also provides a structured way for managers to explore the digital functions appropriate to their EL strategies, in order to identify the required digital technologies and the creation of new value through digital functions.(Liu, 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.

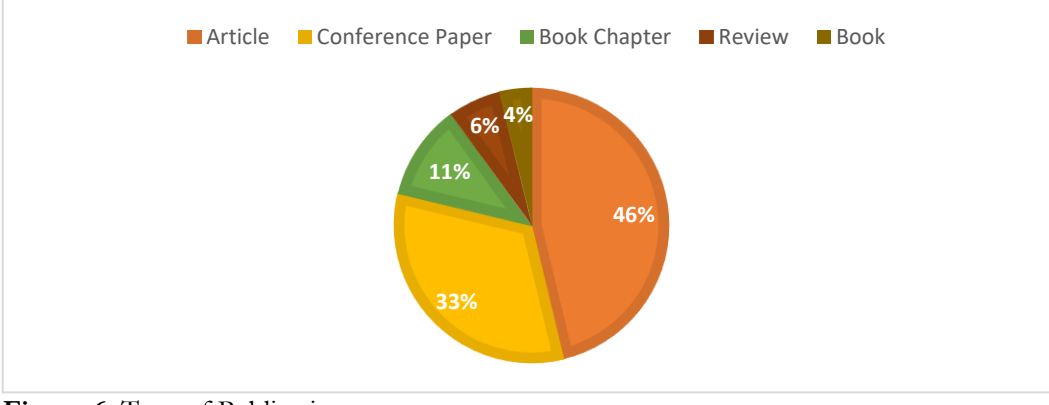

Figure 6. Type of Publication.
Source: Authors' Own Elaboration (2023); Based on Data Provided by Scopus.

The type of publication most frequently used by the researchers referenced in the body of this document was the one entitled Journal Articles with 46% of the total production identified for analysis, followed by Session Paper with 33%. Journals are part of this classification, representing 11% of the research papers published during the period 2017-2022, in journals indexed in Scopus. In this last category, the one entitled "SolarSPELL: Digital library for the teaching of climate change in rural communities" stands out. This article presents an educational research carried out with the aim of generating information on the use of the SolarSPELL Digital Library, as an educational innovation strategy for the teaching of climate

change in rural communities of the Fiji Islands. SolarSPELL is powered by power generated by an integrated solar panel and provides access through its own Wi-Fi network. It offers a variety of open educational resources, selected for their potential to strengthen educational practices and the achievement of the Sustainable Development Goals of the 2030 Agenda. Based on the research question, a case study was selected, as it allows an intensive study of a complex phenomenon in a short period of time and analyzes the object of study in a specific context. The DIAPASON instrument was applied in community or school libraries participating in the pilot programme. The results show that SolarSPELL contributes to the digital transformation of educational practices and the value of librarians having access to a greater number of bibliographic resources on climate change. Currently, the "Schools that Learn Post COVID-19" project took up these results to carry out a pilot in rural communities in Chiapas, Mexico. The results emphasize the need for the librarian of the future to incorporate into their work actions focused on improving the quality of education that allow them to enhance the sustainable development of their communities, improve collective knowledge and generate awareness about this phenomenon.(Gómez Zermeño, 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 face of the variables Sustainable Development and Digital Transformation. With a total of 45 publications in the Scopus database. In the same way, it was established that the application of theories framed in the area of Social Sciences, were used more frequently in the incorporation of the two evolutionary forces as a result of globalization, sustainable development and transformation, which together aims to implement policies of equity, environmental care and economic development of the countries. With this scientific approach, it represents a paradigm shift that harnesses the power of scientific advances, technological innovation, and environmental management to create a harmonious and resilient future. the Sustainable Development Goals (SDGs) which meet the needs of today without compromising the capacity of future generations. These aspirations are perfectly interconnected with digital transformation, which has a holistic approach to maximizing technological resources, which seeks to take advantage of them, manage them, improve efficiency and address the existing difficulties brought about by globalization. Together, these two transformative forces represent a vision of productivity for society, where more inclusive, equitable and environmental forms are projected. Digitalization serves as an estimate for sustainable development by offering unprecedented tools and methodologies for monitoring, analyzing, and mitigating the impact of human activities on the environment. One of the tools offered by digitalization is the arrival of artificial intelligence, since these with their advanced interface allow the analysis of large amounts of data and real-time monitoring of ecosystems, which allows better data-driven decision-making, which would balance economic development. Simulations, powered by digital technologies, contribute to better understanding and predicting the consequences of various development scenarios, facilitating the formulation of policies that prioritize environmental sustainability. The democratization of information and connectivity through digital technologies improves the inclusivity of sustainable development initiatives, since one of the benefits consists of access to knowledge and large amounts of data and information which individuals actively achieve in decision-making processes. and they can be judges when it comes to evidencing the progress that sustainability has contributed to development and that this in turn is fair for society.

To finalize the scientific approach these two forces based on sustainability and digital transformation requires thorough research, active collaboration, and decision-making based on scientific evidence. Scientists, engineers, environmentalists, and policymakers must work hand-in-hand to develop and implement solutions that are technologically advanced and environmentally conscious. Research skills contribute a crucial step in the scale of evolution as it constantly refines and adapts strategies, technological landscape and takes into consideration the dynamism in ecosystems that are constantly developing.

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