Journal of Infrastructure, Policy and Development 2024, 8(13), 9193.
https://doi.org/10.24294/jipd9193

Article

Architecture for a technological observatory as an intelligent system for entrepreneurship in Latin America

Enrique Castro-Guzman[1,*], Ana Judith Paredes-Chacín[2], Eduardo Franco-Chalco[2], Jairo Lozano-Moreno[2]

[1] Universidad María Auxiliadora-Peru, Lima 15408, Peru
[2] Universidad Autónoma de Occidente-Colombia, Jamundí 764001, Colombia
*** Corresponding author:** Enrique Castro-Guzmán, enrique.castro@uma.edu.pe

CITATION

Castro-Guzman E, Paredes-Chacín AJ, Franco-Chalco E, Lozano-Moreno J. (2024). Architecture for a technological observatory as an intelligent system for entrepreneurship in Latin America. Journal of Infrastructure, Policy and Development. 8(13): 9193. https://doi.org/10.24294/jipd9193

ARTICLE INFO

Received: 18 September 2024
Accepted: 28 October 2024
Available online: 18 November 2024

Abstract: Technological management has promoted distinctive characteristics in the socio-productive development of the regions. Its usefulness in entrepreneurial activity is studied to design the architecture of a technological observatory as an intelligent system for entrepreneurship in Latin America. Using a descriptive-explanatory method, data obtained from the application of two instruments directed to 18 experts in information and communication technologies and 174 entrepreneurs distributed 92 in Lima-Peru and 82 in Santiago de Cali-Colombia are processed. The findings show informational and training barriers and a weak or non-existent technological platform for effective entrepreneurial development. Added to the low development of plans and alliances mediated by technologies, whose experience supports public policies that strengthen entrepreneurship as an emerging economy. The architecture supports the functional and operational aspects of the system. Its scalability in other regions dynamizes the services-processes required prior to the detection of needs directed towards the projection of sustainable entrepreneurship.

Keywords: technological observatory; intelligent system; business development; innovation; information technologies; software design; sustainable entrepreneurship

1. Introduction

The management of information and Communication Technologies has been highlighted, among other aspects, by the emergence of businesses related to the design and development of hardware and software commercialization. However, these are rarely directed towards supporting management associated with entrepreneurship. Although technological advancements and developments fall within the framework of activities conceived to consolidate new businesses, they have not been adequately directed towards the effective management and consolidation of entrepreneurial activities. Understanding the scope of this issue transcends the capacity to minimize technological gaps between Latin American regions and other regions with higher development levels.

As for ecosystems, these generate implications that deserve to be strengthened in parallel with IT investment decisions, for example, in terms of risks, long-term commitment and potential need for alignment with strategic objectives that generate tangible and intangible results in users or organizations (Mihale-Wilson and Carl, 2024). Among the development options, technology observatories are promoted as intelligent systems, gaining ground as a potential solution to overcome these gaps. Observatories are defined as "a set of organized actions aimed at interpreting realities" and generating valuable data to support decision-making (Albarracín et al., 2021).

Their viability is considered fundamental for projecting entrepreneurial activities, aligning with the idea that strengthening support resources is crucial to enhance socio-productive activities and mitigate unforeseen challenges affecting the stability and longevity of ventures. The viability of technology observatories is also based on the idea that they can serve as structured systems in the continuous search for high-quality information, which is essential for informed decision-making in entrepreneurship (Albarracín et al., 2021). This topic is scarcely researched, resulting in limited availability of literature.

Accordingly, the implications of these findings are profound, as they suggest that the establishment of technological observatories could play a key role in fostering a conducive environment for entrepreneurship in Latin America. It is emphasized that technological entrepreneurship can have significant local and global impacts, and that understanding the technological environment is crucial for identifying opportunities and uncertainties in business development (Yáñez-Valdés, 2022). This perspective reinforces the need for a comprehensive approach to integrate technology observatories into the business ecosystem, thereby enhancing the potential for sustainable business growth.

This scenario calls for the development of contributions based on the interactions between technology and entrepreneurial management, whose importance lies in overcoming barriers in the regions under study. Among the most significant are the need to strengthen interactions and communication between the State, Entrepreneurs, Stakeholders, and Customers. This approach involves determining the potential areas that must be strengthened to respond to the challenges of the study, including: a) bridging gaps to access the use of the Internet; b) low availability of technological resources to access information and knowledge; c) barriers to accessing training programs or consultancies; d) weak interaction with financial advisors; e) lack of knowledge about legislation and regulations to access markets; f) weaknesses in communication skills to promote an entrepreneurial spirit among employees; and g) a high rate of entrepreneurs requiring information and digital literacy programs.

Considering the above, research activity on the development and use of technological observatories is considered scarce, and literature related to entrepreneurial management is virtually nonexistent. For this reason, the foundation of this research allows for the exploration of new dynamics that contribute to the current literature, methods, and studies based on the detection of training and informational needs required for the development of intelligent systems. Furthermore, it highlights the contributions regarding the necessary resources that strengthen the technology-based ecosystem, which calls for the reinforcement and contributions from public contexts to redefine public policies, and from the private sector to consolidate partnerships that effectively facilitate interactions among actors-contexts-ICT in Latin America and related sectors.

This framework is based on validating that the scope and development of technological observatories are not conceived to assist entrepreneurs, as observed in the cases of Peru and Colombia. Despite considering that their scope and projection on a global scale offer a predominant alternative, as a strategy aimed at generating value to mediate the socioeconomic impact of entrepreneurial activity, this analysis is part of the strategy that should contribute to the strengthening of entrepreneurial development.

Consequently, overcoming the barriers that limit access to and availability of data and information about: a) market behavior; b) lack of alliances between the State-university-business-society-environment as part of a strategy for sustainable entrepreneurial development; c) significant weaknesses in accessing information and communication technologies and apps, as well as promoting the use of green technologies according to the nature of the ventures; d) validity and reliability of the information based on the origin of the sources generating it; e) interaction spaces with experts for the training and follow-up of ideation, creation, and innovation processes, considered the foundation of entrepreneurship; f) management of advisory services, programming, financing, projection, and follow-up as part of the strategy that contributes to the longevity of ventures.

This framework is based on one of the strategies for strengthening contributions to economic development, which has predominated through contributions to the gross domestic product (GDP), ranging between 20% and 35%. Similarly, it is reported that Latin American countries have an early-stage entrepreneurial activity rate exceeding 20%, considered high compared to the global scale (Global Entrepreneurship Monitor (GEM), 2023). This is further supported by the fact that 87.3% of self-employment rates are higher in low-income countries, as noted by the International Labour Organization (ILO, 2023).

Along the same lines, research, innovation and creation capabilities are prioritized within the framework of entrepreneurial projection as the foundation of the global economy. A process that is reaffirmed under effective knowledge transfer strategies that generate ABS and predict higher standards of innovation as a basis for comprehensive management and overcoming challenges (Paredes-Chacín et al., 2024).

For instance, data from the first quarter of 2023 revealed a significant decrease of businesses at the national level, attributed to various factors, including the economic crisis. This reduction is primarily associated with the decrease in companies with temporary suspension (National Institute of Statistics and Informatics, NIE-Peru, 2023).

Considering the above, there is also a pressing need to overcome the reliance on limited components such as access to technological and financial resources, which directly impact entrepreneurial activity. For instance, solely addressing the economic conditions could lead to a skewed understanding of the motivation and performance of entrepreneurial activities (Nguyen et al., 2021). In this context, the development of the technological observatory as an intelligent system is considered essential for generating the foundations for accessing and utilizing informational content, management, training, and the positioning of ventures through technological resources such as software and hardware.

These resources provide a structured approach to addressing the challenges faced by entrepreneurs in Latin America. By creating a centralized hub of information and resources, these observatories can help bridge the technological gaps that exist between regions. They emphasize the importance of technology in the entrepreneurial process, particularly in the creation and capture of value, suggesting that a well-structured observatory can significantly enhance these stages (Pathak and Muralidharan, 2020).

Furthermore, the implications of establishing technological observatories are profound, as they can help mitigate unforeseen conditions that may affect the stability and longevity of ventures. It is also noted that effective data management and analysis can lead to better decision-making processes, which are crucial for the sustainability of business activities (Tironi Rodo and Valderrama Barragán, 2023). Observatories not only provide a repository of information but also facilitate the development of a support ecosystem that fosters collaboration and knowledge exchange among entrepreneurs. Additionally, the goal is to overcome weaknesses affecting entrepreneurial management in the Peruvian and Colombian contexts, thereby strengthening local competitiveness and projecting it towards other Latin American regions.

The comprehensive vision of the architecture of the technology observatory is conceived to respond, from a forward-looking perspective to the development of an emerging economy that promotes the productive capacities of Latin American regions through entrepreneurial development. Its conception allows supporting entrepreneurial activity through information services, which are managed by the technological observatory, whose function is focused on observing and monitoring the behavior and the generation of value based on information and knowledge associated with innovation and entrepreneurship. These are considered as a basis for the definition, socialization and dissemination of information services portfolios that contribute to decision-making in entrepreneurs and users of associated services. Additionally, it seeks to strengthen the prospective and functional vision of evolutionary processes that will drive the entrepreneurial ecosystem, allied with emerging technologies such as the potential of artificial intelligence (AI) within the framework of the technology observatory.

Undoubtedly, the objective of designing the architecture of a technology observatory as an intelligent system for entrepreneurship in Latin America was based on testing the hypotheses: H_1—the architecture of a technology observatory positively underpins the design of an intelligent system for entrepreneurship in Latin America; and H_2—the conceptual-operational approach of the architecture of the technology observatory positively influences the development of the observatory as an intelligent system.

An empirical study was conducted to support the foundation of this work, with the goal of facilitating interactions between experts in software design and development, as well as advancing the process of identifying the training and informational needs of entrepreneurs located in Lima-Peru, and Santiago de Cali-Colombia. The content development is based on a literature review and the comparison of variables that guide the design of the architecture. This is followed by the methodological foundation, the analysis and discussion of results, which lead to the generation of value regarding the development and suggested structure of the technology observatory as an intelligent system, along with the conclusions and practical implications associated with the development and scope of the tool in the Latin American context.

Technological advances have transformed how companies and entrepreneurs manage information, leading to the development of intelligent systems like technology observatories. These observatories enhance decision-making through the collection and analysis of data, while models like the Project Observatories Model improve transparency and project management (Vieira et al., 2022, 2023). Urban sustainability observatories offer real-time data analysis applicable to entrepreneurial settings (Miller et al., 2021). Integrating AI into technology observatories optimizes entrepreneurial processes and strategic decision-making (Li and Yao, 2021). Open-source platforms promote collaboration, benefiting SMEs (Lin and Maruping, 2021), while collaborative networks ensure startup sustainability (Passaro et al., 2020). Overall, technological observatories enhance competitiveness, sustainability, and innovation in emerging economies.

2. Method

Through a descriptive-explanatory study, the necessary interactions that drive the flow between variables, which allow for an understanding of the design of the technology observatory as intelligent systems for entrepreneurship in Latin America, were verified. The study focused on two regions: Santiago de Cali, Colombia, and Lima, Peru. This process enabled the testing of the hypotheses, as well as the determination of the integration of components and the functionality of the structural requirements of the design.

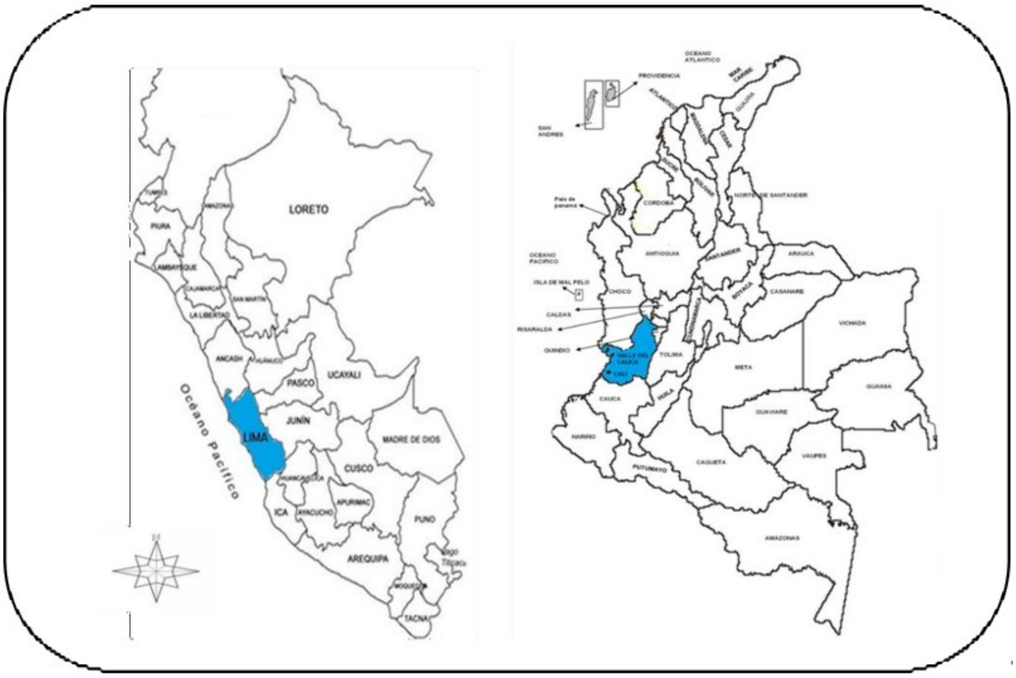

Figure 1. Geographic location of the selected regions for the study, in the context of Peru and Colombia: Left: Lima-Peru; Right: Santiago de Cali-Colombia

Sources: Educational maps of Peru. (s.f) & Maps to Color. (s.f). Colombia.

Subsequently, a questionnaire was administered to a sample composed of entrepreneurs responsible for decision-making, who played various roles, ranging from idea promoters to collaborators who contribute to the viability of the business venture. Given the focus on fostering entrepreneurial activity toward the development of an emerging economy, data collection was carried out during the last quarter of 2023. The questionnaire was administered in both digital and printed formats to ensure a higher response rate. The sample consisted of 174 units, geographically located in Lima, Peru, and Santiago de Cali, Colombia (see **Figure 1**).

The distribution by regions is represented in **Table 1**.

Table 1. Characterization of sample units in Lima-Peru and Santiago de Cali-Colombia.

Sample Unit Profile	Peru	Colombia
Entrepreneurs	92	82
Total sample units	174	

The selection criteria for the sample units are mentioned, which minimized possible bias or randomness of the units: a) entrepreneur profile located geographically in Lima-Peru, and Santiago de Cali-Colombia; b) entrepreneurial development over the past two years; c) knowledge of the use of environmentally friendly raw materials for the production of goods or services; d) awareness of the importance of innovation in entrepreneurship; and e) willingness to manage the instrument in digital or printed format. For data analysis, a qualitative approach was applied, highlighting: a) the different theoretical approaches through which empirical studies were verified; b) the analysis of intervention contexts, prioritizing the profile and informational needs of the real and potential users (entrepreneurs) of the observatory; and c) the theoretical perspectives contrasted with expert intervention to characterize the technological platform, as well as the software and hardware components that support the design architecture.

To study and validate the variable associated with technological dimensions as the foundation for the design of the technology observatory, an expert judgment technique was applied, involving the interaction of eighteen (18) experts—10 in Lima, Peru, and 8 in Santiago de Cali, Colombia. Selection criteria for experts included: a) expertise in tele informatics; b) software developers; c) experience in designing support infrastructures for technological platforms, and lastly, an interest in participating in the process of generating value for the functional and operational viability of the technology observatory design.

Quantitative data collection from the experts was conducted using six (6) items, with five response options based on a Likert scale where (1) is "Strongly Disagree" and (5) is "Strongly Agree." The variable studied by the experts was associated with the management of technology observatories, with indicators related to human resource expertise and technological aspects, such as software and hardware.

The documentary review technique was applied, which allowed associating experiences based on the utility of software engineering as a service (Al-Obaidy et al., 2024). In turn, its projection and development are linked through the application of the Agile SCRUM Methodology (Castillo-Anzules et al., 2024). A content analysis matrix was designed to organize and record the information, allowing for the comparison between theory and empirical study. Additionally, graphical representations were created to illustrate the interactions between the various components that support the architecture of the technological observatory design.

The perception of the entrepreneurs was assessed through a questionnaire directed at them. It consisted of 20 items aimed at determining the study of variables such as knowledge production and entrepreneurship. Based on the results obtained from both qualitative and quantitative approaches, comparisons were made with the theoretical frameworks that underpin the research. The results were processed using factor analysis, which allowed the identification of underlying structures within the item sets from the surveys.

Furthermore, categorical data were rigorously processed to provide accurate factor estimates without assuming multivariate normality. This revealed latent factors representing common dimensions of the respondents' perceptions. Given the ordinal nature of the survey items, the minimum residual estimator (MRE) was chosen for exploratory factor analysis (EFA). An oblique rotation was applied to allow correlations between the identified factors, reflecting the interconnected reality of dimensions such as sustainable entrepreneurship and technology, which are rarely independent.

Regarding the selection of the number of factors to extract from each survey, the Scree Plot and eigenvalues greater than 1 (Kaiser Criterion) were used. Before performing the EFA, the sample adequacy was evaluated using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. These tests are critical to confirm whether the dataset is suitable for EFA. During the EFA, some items were identified as not correlating adequately with others. These items were excluded from the analysis to ensure clarity and interoperability of the resulting factors. In general, the analyses were performed using Jamovi, an open-source statistical software known for its accessibility and ability to handle a variety of complex statistical analyses. The combination of these strategies allowed for deep and reliable insights into the attitudes and perceptions of both the experts and entrepreneurs regarding the design of technology observatories.

3. Analysis of results

Based on the data obtained, the results that underpin the determination of the structural dimensions for the design of technology observatories as intelligent systems for managing competitive entrepreneurship in Latin America—specifically in Lima-Peru and Santiago de Cali-Colombia—allowed for the consolidation of an integrated analysis of the results. Regarding Hypothesis (H_1), the architecture of a technology observatory positively supports the design of an intelligent system for entrepreneurship in regions of Peru and Colombia (Latin America).

Through the exploratory factor analysis applied, common dimensions were identified regarding entrepreneurs' perceptions of the stated hypothesis. For this purpose, the latent factors for each analyzed context are specified below (see **Tables 2** and **3**).

Table 2. Latent factors and their scope in Colombia.

Identified Latent Factors in Colombia	Scope
Factor 1: Strategic support and development of sustainable entrepreneurship	Relevance of services as a strategic factor for innovation and sustainability in entrepreneurship.
Factor 2: Optimization of platforms for business intelligence and knowledge accessibility	Required to ensure the effectiveness of the technology observatory and the efficiency of informational services. It serves as the basis for strategic decision-making and the dissemination of information and knowledge.
Factor 3: Sustainable entrepreneurship mediated by ICTs	Projected to leverage ICTs for the monitoring and management of sustainable and socially responsible practices in entrepreneurial activities, as well as the usability of the observatory's service portfolios.
Factor 4: Strategic economic management and market adaptability	Aimed at tracking knowledge-based economic management and the ability to adopt and transform business practices according to market conditions.
Factor 5: Content management and relevance as intelligent systems contributing to competitiveness	Focused on content management (relevance and timeliness) as the basis for the service portfolio, according to the detected entrepreneur profile.
Factor 6: Environmental sustainability and responsible entrepreneurial practices	An integral vision between the technological platform, content management, sustainable practices, real and potential users of the technology observatory, and consumers.

Table 3. Latent factors and their scope in Peru.

Identified Latent Factors in Peru	Scope
Factor 1: Information management and accessibility in technology observatories for entrepreneurship	Prioritizes users' perception of the observatory's effectiveness, as well as the accuracy and relevance of the information for innovative and sustainable entrepreneurial development.
Factor 2: Ecological innovation and social responsibility in entrepreneurship	Highlights the priorities given by entrepreneurs to environmental sustainability practices and social responsibility in the planning, development, and management of their businesses.

The data presented in **Table 4** show measures of central tendency and dispersion for six latent factors, as well as their interrelations through Spearman correlations. Entrepreneurs displayed strong overall agreement on all factors, with mean scores higher than 4 out of 5, indicating positive alignment with the statements of each factor. Strategic support and sustainable entrepreneurship development (Factor 1) received the highest mean score, closely followed by the perception of the importance of sustainable entrepreneurship and social responsibility (Factor 3), and environmental sustainability and responsible entrepreneurship practices (Factor 6).

Additionally, positive correlations between the factors suggest that entrepreneurs who value one aspect of the observatory also recognize the importance of other interrelated aspects. Specifically, the factors associated with platform optimization for business intelligence and knowledge accessibility (Factor 2) showed strong correlations with strategic support (Factor 1) and knowledge management and relevance in technology observatories (Factor 5), highlighting an integrated view of the observatory's resources as catalysts for innovation and strategic decision-making.

These results reflect a comprehensive appreciation of the multifunctionality of the technology observatory, viewing it not only as a tool for supporting sustainable entrepreneurship but also as a central axis in promoting business intelligence and integrated sustainability.

In addition to the above, results on the perception of the surveyed profiles—experts and entrepreneurs—are presented (see **Table 4**), showing frequency representation based on the responses obtained.

Table 4. Descriptive statistics and Spearman correlation matrix between factors observed in the survey of Colombian entrepreneurs.

	M	**SD**	**Spearman Correlations**					
			1	**2**	**3**	**4**	**5**	**6**
Factor 1	4.25	0.62	-	-	-	-	-	-
Factor 2	4.10	0.73	0.67***	-	-	-	-	-
Factor 3	4.23	0.788	0.48***	0.52***	-	-	-	-
Factor 4	4.04	0.674	0.44**	0.52***	0.30**	-	-	-
Factor 5	3.88	0.938	0.34**	0.55***	0.48***	0.44**	-	-
Factor 6	4.11	0.726	0.48***	0.46***	0.31**	0.32*	0.20**	-

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Regarding the frequencies and percentages of responses from information technology experts in Santiago de Cali, Colombia, as observed in **Table 5**, the data indicate that a high percentage of experts (75%) agree or strongly agree with the statement that designing advancements for the development of information systems supporting the structure of the technological observatory is important.

Moreover, a significant 87.5% agree that promoting the development of information systems with interrelated options is crucial for consolidating technological observatories (TO) as intelligent systems. This requires the development of processes to detect information needs (DNI) among entrepreneurs as real and potential users of the observatory. Additionally, experts highly value the importance of selecting technological platforms that ensure the operational functionality of the OT. These results suggest a consensus among experts on the relevance of these areas for the success of the technology observatory in sustainable entrepreneurship.

Table 5. Results on the perception of entrepreneurs associated with technological observatories (TO) in Colombia.

	f	**%**
Designing advancements for the development of information systems that support the structure of the technological observatory		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%
Promoting the development of information systems with interrelated options that support the design of TO as intelligent systems		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%
Identifying the detection of information needs of entrepreneurs as real and potential users of the OT		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%
Selecting technological platforms that guarantee the operability of the OT		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%

Regarding the results obtained from the experts in the Peruvian context, **Table 6** shows the frequencies and percentages, where the findings reveal strong agreement among experts on several key aspects, especially on the requirement for technological platforms, with 87.5% indicating its relevance for effective data transmission and accessibility. It is also important to highlight the characterization of the software, whose design must ensure the interoperability of the available contents in the TO. This aspect is conditioned by the development of software under accessibility standards (Open Access).

Table 6. Results on the perception of experts associated with technological observatories (TO) in Peru.

	f	%
Consolidate data transmission to be accessed by TO users		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%
Contribute to ensuring the interoperability of the contents available in the TO		
Strongly disagree	1	12.5%
Somewhat agree	2	25.0%
Strongly agree	5	62.5%
Support the development of software under accessibility standards (Open Access)		
Strongly disagree	1	12.5%
Somewhat agree	2	25.0%
Strongly agree	5	62.5%
Form part of the technological resources that guarantee the connectivity of TO services		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%

On the perceptions of information technology experts on fundamental aspects of software development in the first phase, see **Table 7**. A broad consensus is observed on the importance of defining processes for ideas, creation, design, deployment, and compatibility in software development, with 87.5% of experts expressing agreement. This high percentage is consistent with the valuation of the identification of the design architecture and management of the information system for the technological observatory (TO) and the characterization of usage options and distinctive services of the TO system, underlining the importance experts place on these areas for the success and functionality of the software.

Table 7. Results on the perception of the foundation for software development.

	f	%
Definition of processes for ideas, creation, design, deployment, and compatibility for software development		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%

Table 7. (*Continued*).

	f	**%**
Structuring data and information holistically, considering the life cycle of the developed system		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%
Identification of design architecture and management of the TO information system		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%
Characterization of usage options and distinctive services of the TO system		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%

Moreover, the structuring of data and information to be provided through the TO should be promoted holistically, considering the system life cycle as another critical component, with 75% of respondents agreeing. This holistic approach to software development ensures that all phases of the system life cycle are prioritized, from the initial development idea to deactivation, thus ensuring the design of a system capable of managing the intelligence, knowledge, and potential services that contribute to the competitiveness of the TO.

The coherence between these elements highlights experts' perceptions of the importance of assertive planning for software development conceived under trends that support intelligent information systems.

Consequently, for the second phase, complementary characteristics required for the development of TO are proposed (see **Table 8**). In light of the progress described in the results for the second phase of software development, aspects related to compatibility—determined by interactions linked to design as well as software options—have been prioritized. This strategic action, valued by the majority of experts, emphasizes the importance of interoperability and integration with key components in software development. It is also a key factor in the comprehensive system design and life cycle considerations required for TO development. These considerations guarantee a user-centered design and development approach, encompassing the functional-operational phases of TO as well as its conceptualization, preventive maintenance, and corrective maintenance.

Table 8. Results on the perception of experts to support TO development.

	f	**%**
Prioritizing software compatibility based on interactions between design and software options		
Strongly disagree	1	12.5%
Neither agree nor disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	5	62.5%

Table 8. (*Continued*).

	f	%
Designing interaction options for the system with a holistic view, considering the TO life cycle		
Strongly disagree	1	12.5%
Neither agree nor disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	5	62.5%
Prioritizing TO system interactions by emphasizing the relevance of available content in the TO observatory		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%
Establishing compatibility between process and service options to generate value for the OT system		
Strongly disagree	1	12.5%
Neither agree nor disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	5	62.5%

Undoubtedly, the interactions of the TO system are prioritized, emphasizing the importance of the available content, which underscores the relevance of accessible and valuable content for the observatory's users. Additionally, the compatibility between process and service options to generate value for the TO system is key.

This consensus supports the idea that value creation for TO users and stakeholders is part of an intelligent system that requires integrated processes and effective service portfolios, driven by assertive inter-organizational partnerships. These findings suggest a clear preference among experts for the development of a comprehensive, interactive TO software system focused on the value and quality of the content and services offered.

The previously described findings are dependent on the innovation and development capacities under which intelligent information systems are enabled (see **Table 9**). The management of intelligent information systems that promote the competitiveness of entrepreneurial ventures in Latin America must be based on the detection of both informational and educational needs (DNI + F) of users. This emphasizes a user-centered approach to innovation in information technologies. The assertiveness of these results leads to promoting the renewal of information systems to generate distinctive characteristics through the creation of the TO service portfolio. Additionally, it suggests the adoption of programming languages aligned with current trends that support intelligent information systems, enabling the dynamism of technological applications. This consensus indicates strong support for continuous updating and adaptation to new trends as crucial elements for effective software innovation.

Table 9. Results on the perception of experts regarding software innovation.

	f	%
Creating the design of intelligent information systems is based on prior detection of user needs		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%
Promoting the renewal of information systems to generate distinctive features in TO services		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%
Renewing the use of programming languages based on trends to energize technological applications		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%
Developing information systems within the framework of accessible and inclusive systems		
Strongly disagree	1	12.5%
Strongly agree	7	87.5%

Another distinctive characteristic is the development of the TO supported by an effective intelligent information system, capable of responding to the characteristics of accessible and inclusive systems that facilitate the creation of a user-friendly interface. This fosters a participatory environment where users feel empowered to contribute to the observatory's objectives (Chincoya-Benítez and Barrón-Villaverde, 2023). From this perspective, there is a clear appreciation of accessibility and inclusion in the design of information systems as part of innovative practices in the field. These results emphasize the relevance of innovation focused on accessibility, technological updates, and adaptation to user needs.

As previously discussed, control management is a determining factor and underpins the comprehensiveness of an TO conceived as an intelligent system capable of contributing to competitive entrepreneurial development (see **Table 10**). Control management is conceived within the comprehensive framework of regulations governing the use and management of information technologies at a global level. These regulations are essential to ensure that observatories operate within ethical and legal boundaries while effectively managing the large amounts of data they handle. The integration of intelligent information systems into these observatories is particularly significant, as it enhances their ability to respond to the complexities of data management and regulatory compliance. For instance, it examines how management techniques can be adjusted to meet the specific demands of observatories, emphasizing the importance of having clear objectives and a structured approach to data management (Chincoya-Benitez and Barrón-Villaverde, 2023). This structured approach is crucial for fostering a culture of compliance and accountability within observatories. Legal and regulatory adoption plays a predominant role in defining the service portfolio and the content to be provided and shared through the TO. This agreement highlights the importance of legal compliance in the management of observatory content.

Table 10. Results of experts on control management in intelligent information systems (IIS).

	f	%
Ensuring the operability of the TO as an intelligent information system is conceived under the regulations governing intellectual property rights		
Strongly disagree	1	12.5%
Somewhat agree	2	25.0%
Strongly agree	5	62.5%
Establishing management indicators to monitor the frequency of use of information services in the framework of information and ICT democratization		
Strongly disagree	1	12.5%
Somewhat agree	2	25.0%
Strongly agree	5	62.5%
Ensuring content accessibility in the TO system		
Strongly disagree	1	12.5%
Neither agree nor disagree	1	12.5%
Somewhat agree	2	25.0%
Strongly agree	4	50.0%
Monitoring the quality of the selected technological platform		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%
Validating compliance with standards regulating the use of software, hardware, and intellectual property rights of content		
Strongly disagree	1	12.5%
Somewhat agree	1	12.5%
Strongly agree	6	75.0%

In this regard, aspects associated with content accessibility, visibility, usability, and consumption require monitoring and control as a basis for ensuring equitable and timely access for users. Finally, monitoring the quality of the selected technological platform and validating compliance with the standards regulating the use of software, hardware, and intellectual property rights of content are distinctive aspects requiring continuous monitoring. Thus, quality standards, regulatory compliance, and the sustainability of the TO as an intelligent and competitive information system are projected.

Based on the results of the empirical study, it was possible to structure, from a technical-operational approach, the phases that underpin the design of a technological observatory as an intelligent system for competitive entrepreneurship in Latin America, as specified below:

Phase I: Technological architecture of the observatory as an intelligent system

The technological architecture is conceived under a web design protocol. The main attributes for its technical-operational functioning are supported by a technological infrastructure that anticipates the optimization of data management and the means to ensure interoperability between technological platforms. Among the key technical-functional and operational aspects considered, renewed methods for monitoring and adding value to public policy guidelines stand out, aimed at strengthening the development of Science-Technology-Innovation-Entrepreneurship (STI&E) in the regions, within the framework of driving toward an emerging economy.

In this regard, among the contributions defined to ensure access, use, and consumption of information and knowledge, **Figure 2** presents the interactions of the socio-technical components to guarantee the functioning of the TO Emprende.

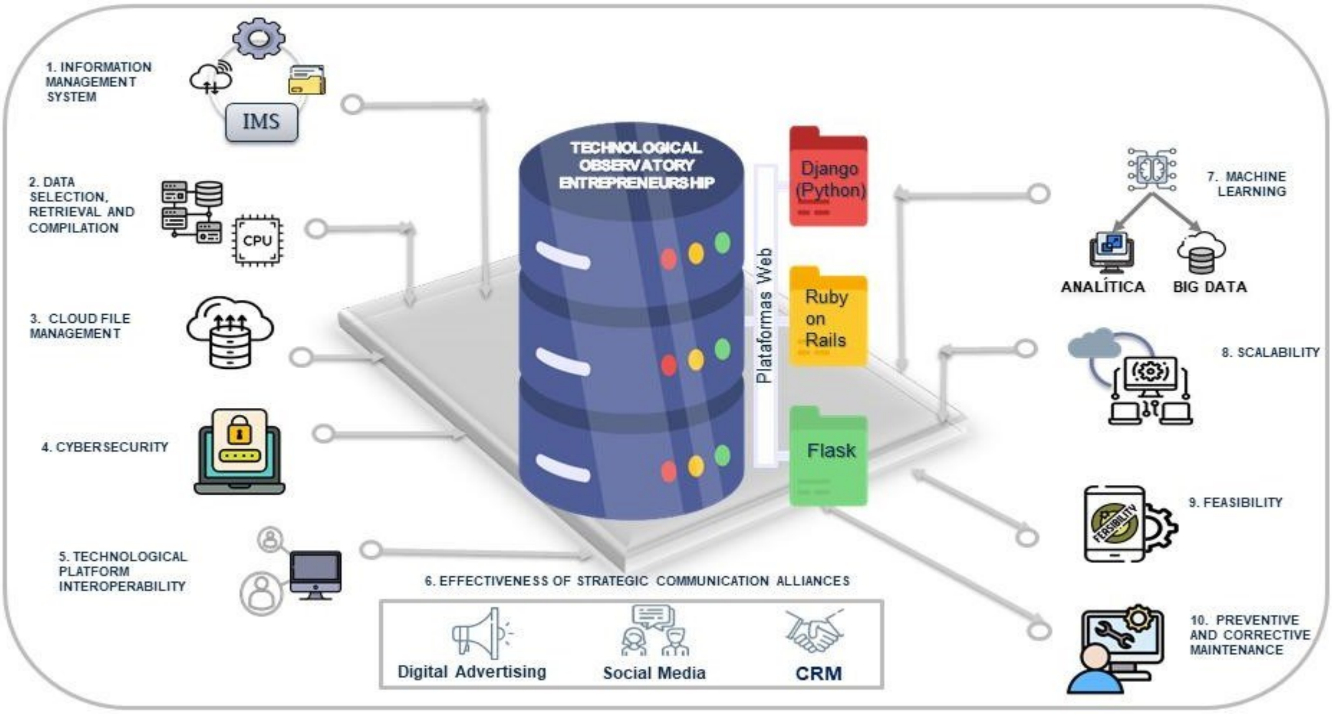

Figure 2. Interaction of socio-technical components of TO Emprende.

The interrelation of the components that support the design provides a response to the described hypothesis. For this purpose, the system is conceived from a socio-technical approach, focusing on the capacities that support its conception as an intelligent system. See **Table 11** for the characterization of the components, with human interaction highlighted as a strategy for effectiveness.

Table 11. Characterization of socio-technical components of the proposed architecture.

Components	Description
Web Platform	Conceived with options like Django (Python), Ruby on Rails, or Flask, through which accessibility, interoperability, and usability of the platform are ensured. The selection guarantees the development of the technology observatory as an intelligent system that prioritizes the detection of needs.
Information Management System (IMS)	Supported by database selection, including MySQL and PostgreSQL, for effective content storage and accessibility management.
Cloud Storage	Selection is based on market conditions. Among the most usable options: Google Cloud, One Drive, and Amazon S3. Criteria considered include security, and effective and timely data management.
Interoperable Design (APIs)	Enables connectivity with different platforms and is required for functionality across various technological devices. It also prioritizes the use of accessible software according to the user profile.
Data and Information Selection and Compilation	Python is suggested, with its platform's data analysis utility. Its scope is supported by libraries such as Pandas and NumPy. For visualization: tools like Matplotlib or Seaborn are mentioned as the basis for data management and projection.

Table 11. (*Continued*).

Components	Description
Machine Learning	Supported by the adaptation of algorithms that facilitate the systematization and management of data for use and projection. Prioritizes AI-mediated interactions, as part of the challenge to promote new knowledge through content transformations and data analysis.
Scalability	Based on the development of the proposed architecture using open-source code, with the capacity to expand coverage and the required service portfolio.
Feasibility Testing and Digital Literacy	Technological feasibility is prioritized to address the processes of detecting educational and informational needs considered in the initial phase of technological development. Socially, it is grounded in the interaction of real and potential users of the observatory. The simultaneous scheduling of processes for training and digital literacy of entrepreneurs is expected.
Preventive and Corrective Maintenance	An inherent activity of the design architecture (software and hardware), ensuring the operational and technical viability of the observatory.
Cybersecurity	Supported by protection protocols and standards, ensuring data confidentiality, integrity, and security. Actions are based on global legislation and regulations.
Communication and Interorganizational Alliances	It is based on the projection of alliances that requires interoperable observatory processes and its capacity for communication interaction through horizontal, vertical and professional Social Media platforms. Likewise, digital advertising platforms: Meta business, Google, Ads and user management platforms, CRM: Salesforce, Hubs Pot, among others. It also includes the consolidation of alliances between information management organizations, knowledge generators and service providers for entrepreneurs.

Following the specification of the outlined components, the contrast of H_2 (the conceptual-operational approach of the technology observatory architecture positively impacts the development of the observatory as an intelligent system) has been analyzed. This analysis prioritized the architecture of the technology observatory into two phases: I) technical-operational and II) functional, as specified in **Figure 3**, to comprehensively address the educational and informational needs of real and potential users of the OT as an intelligent system.

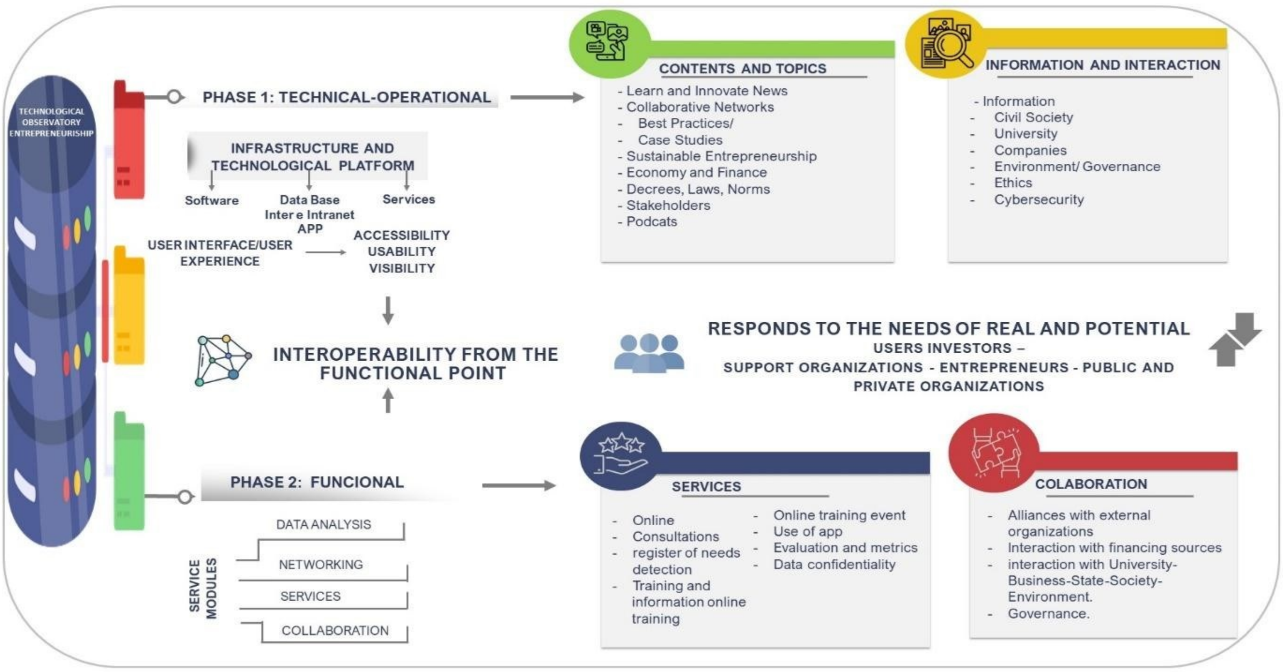

Figure 3. Phases technical-operational and functional.

The interrelationship of the components focuses on a conceptual-operational vision of the design phases, as seen in **Table 12**.

Table 12. Conceptual-operational approach of the technology observatory architecture.

Design Phases	**Scope**
Detection of real and potential users' needs	Responds to the evaluation of environments that integrate the entrepreneurial ecosystem. It prioritizes information/resources and technological trends as market opportunities.
Characterization of user profiles	Highlights profiles and demographic data to characterize real and potential users of the OT. Prioritizes entrepreneurs, investors, government institutions, academic institutions, among others.
Consolidation of alliances	Defines the scope and results of alliances with stakeholders for the development of the online service portfolio and global connectivity.
Comprehensive data and content management	Selection of sources or content providers according to the service portfolio: In Put: selection of data, information, knowledge; Management: transformation-systematization of data; Out Put: management of services conceived through information, knowledge, and resources.
Service portfolio based on detection of educational and informational needs (DNFI)	Prioritized services: • Know//Innovate: database of national and international general and specialized information. Technological impacts and trends – AI. • News/Alerts: selection of content, including local and global news. • Learn programming of activities and training events according to user profiles and needs (project management and financial feasibility). • Networks: interactions with social and academic network providers (impact and new developments). AI. • Case/Sustainable: records of entrepreneurial development behavior, local and international (best practices, areas for improvement and consolidation). Sustainable entrepreneurship developments and contributions to the SDGs. • Economy/Finance: interaction with financing networks and organizations. Analysis of local and international markets based on entrepreneurship. Progress in the socio-productive economy. • Stakeholders: space to promote sustainable business under the principle of durability and access to raw materials and resources that facilitate entrepreneurial action. • Podcast: platform for promoting and disseminating experiences and best practices that can be replicated or considered for strengthening, financing, and scalable consolidation.
Technological infrastructure	Basis for the comprehensive development and viability of the technology observatory. Promotes information and digital literacy programs through Intranet and Internet modalities, including software, hardware, databases, servers, storage platforms, security management, and ensuring data management validity and protection.
Design and interface based on user profiles	Ensures the viability of the design, considering usability standards, interoperability, inclusive language, and favorably projecting the User Interface (UI) and assertive User Experiences (UX).
Characterization of functions that support operations	Defined by search options, data presentation, notifications, monitoring, data visualization options, interaction through responses, among others. Includes experiences and records from incubators, accelerators, innovation labs, and related events.
Information security and confidentiality	Adopts global and local legal and regulatory frameworks on accessing and using information and knowledge, as well as user data from the OT.
Feasibility testing	Conducted over uninterrupted periods, from data and information collection to defining metrics to evaluate the effectiveness and improvement of the OT as an intelligent system.
Projection and execution	The OT design represents the first phase leading to feasibility testing and subsequent development and execution, transitioning into the OT as an intelligent system. Includes the program for promotion and dissemination for OT use and management.
Quality management and continuous maintenance	Based on a system of continuous improvement and control, adhering to standards that ensure effective platform management. Includes metrics to evaluate the relevance of informational content and the usability of the technological platform. Additionally, monitors the frequency of use across different means of accessing the observatory (mobile, interactive web, academic, social, and collaborative networks that strengthen strategic alliances).

4. Discussion

The presented results reflect the dynamics of two regions in Peru and Colombia, where the effectiveness of the process of detecting the educational and informational needs of entrepreneurial communities allows for characterizing the challenges related to the viability and scope of the comprehensive management of the observatory as an intelligent system. Consequently, overcoming the barriers that limit its effectiveness leads to the definition of feasible, viable, and measurable strategies, involving the regional contexts under study.

It is emphasized that the proposed architecture responds to the assessment of the process of detecting educational and informational needs (DNFeI), through which it is significantly corroborated that the H_1 associated with the architecture of a technological observatory positively supports the design of an intelligent system for entrepreneurship in Latin America, which is proven from the foundation and rigor of the method developed in the research. This is followed by the criteria that determine the capacities for interoperability and accessibility, considered key characteristics for effectiveness and strategic planning to minimize barriers that may limit future integration and accessibility on large platforms and systems.

Additionally, the development of distinctive features arises from effective innovative processes that generate value and advancements in the development of intelligent information systems, where the assertiveness of methods and techniques supports the effectiveness of the TO design. The importance of methodological approaches to evaluate the effectiveness of innovation development in companies is emphasized, particularly regarding technological modernization and the use of advanced software and machinery (Voloshchuk, 2020). Moreover, the use of artificial intelligence and intelligent systems in business management has become a crucial practice for decision-making and efficient management of complex business processes (Odrekhivskyi et al., 2022).

Furthermore, the relevance of implementing legislation and regulations that govern the design and inclusion of users with diverse biopsychosocial conditions is highlighted, emphasizing the need to integrate technological and regulatory innovations that support digitalization and inclusive processes, as seen in key activities such as manufacturing and industrial sustainability (Shinkevich et al., 2021).

Similarly, the design and development, conceived from a collaborative and communicative vision. It is constituted as a key success factor that promotes distinctive features based on collaborative work and assertive management of knowledge and experiences. From this perspective, the adoption of digital innovations and automation tools is considered essential for improving operational efficiency and reducing costs in digital business transformation (Sotnyk et al., 2020).

Regarding the use and viability of technological platforms, both study regions, Lima-Peru and Santiago de Cali-Colombia, recognize the importance of using open-source software and adopting Open Access standards to promote accessibility and knowledge dissemination. The integration of open educational platforms has proven to be an effective way to improve accessibility and disseminate knowledge in underserved communities, including the use of open-source tools and free licenses to ensure global accessibility (Khribi et al., 2022; Velychko et al., 2021).

These shared views reflect a common understanding of the importance of developing technological observatories that are not only technically advanced but also inclusive, ethical, and oriented toward the dynamics that govern the use of information and communication technologies globally, mediated by accessibility and legality, in line with the evolution of tools like Open Course Ware, which prioritize customization and accessibility for users with different capabilities (Elias et al., 2020).

From what was exposed in H2, the conceptual-operational approach of the architecture of the technological observatory positively influences the development of the observatory as an intelligent system, the results determine the influence and relevance on the above, which in addition to the positive results that support the hypothesis, corroborate that the importance of the interactions between the components that are to support the design of the TO as an intelligent information system. Consequently, its projection is conceived as part of the dynamics that promote the competitiveness of entrepreneurial activities. Without a doubt, the aspects valued in both the empirical study and the theory constitute the technical-operational and functional projection of the phases that guarantee the feasibility of the proposal and the development of intelligent systems based on information technologies. The use of open platforms has been key to improving competitiveness and efficiency in various productive sectors (Khribi et al., 2022; Odrekhivskyi et al., 2022). Additionally, in the study by Khattak et al. (2024), it is emphasized how digital transformation, moderated by the organization's digital culture, drives the competitive performance of SMEs, especially in emerging economies, where managerial overconfidence plays a key role in the adoption of technological innovations.

From this perspective, intersectoral cooperation is identified as a crucial factor for promoting the development of inclusive technological and educational platforms, thus strengthening entrepreneurial capacities in various regions (Law et al., 2020; Pichugina and Artemenko, 2022). Consequently, promoting entrepreneurial development in Latin American regions requires the direction of intersectoral actions, in addition to the development of public policy guidelines that demonstrate the interactions between the State, University, Business and Society, the latter represented by entrepreneurs and the markets associated with entrepreneurship.

5. Conclusion

Among the conclusive aspects, it is highlighted that the architecture for a technological observatory as an intelligent system for entrepreneurship in Latin America requires integrated functional and operational viability. Added to the strengthening of intersectoral relations: Universities, Governments, Entrepreneurs, who contribute to the management of content and technological resources. Likewise, supported by the promotion of public policies that govern its operation in the contexts of studies and projection in the Latin American order. Actions that allow contributing to the entrepreneurial development of the regions and therefore to the strengthening of an emerging economy, capable of transforming unsustainable conditions that generate barriers in the entrepreneurial community, especially due to the lack of ways to access content and services that enhance their work.

Additionally, based on the analysis of the hypotheses, important factors were identified related to the lack of processes and practices that facilitate entrepreneurs in strengthening or renewing initiatives that ensure the consolidation and sustainability of their ventures. Without a doubt, conceptualizing the architecture of the technological observatory based on an empirical study, focused on the detection of educational and informational needs allows us to assess significant experiences that contribute to a real approximation to the effective characterization of the technological observatory. This aspect fosters a favorable environment for the projection of sustainable businesses and ventures, benefiting entrepreneurs by overcoming barriers that limit access to information, as well as technological gaps that weaken entrepreneurial initiatives.

In terms of practical implications, these are associated with the strengthening of technological literacy among entrepreneurs, whose results will not only project the growth and stability of their ventures but also ensure their sustainability. This process requires the development of content and a service portfolio that provides both technical-operational assistance to the ventures and the enhancement of the cognitive and infrastructural capacities required by entrepreneurs.

In the same order, under the technological architecture and the identification of the components and phases of the system that supports the technological observatory, the definition of metrics to monitor the management of the TO, as well as the frequency of use of information services, is foreseen. This process is part of the strategies whose measurement leads to the continuous improvement and effectiveness of the TO as an intelligent system.

From a technological perspective, the first phase projects interactions between higher education institutions, with a view toward strengthening State organizations that, through intersectoral collaboration, ensure the viability of the technology observatory. This observatory would assist real and potential entrepreneurs who contribute to the development of emerging economies in Latin American regions. In this context, strengthening the definition or adaptation of policies and support programs, including tax incentives, preferential credit lines, and business training, becomes a determining factor for entrepreneurial activity, recognizing the importance of entrepreneurship.

Author contributions: Conceptualization, AJPC; methodology, AJPC; software, ECG; validation EFC, AJPC and JLM; formal analysis, AJPC and ECG; investigation, JLM and EFC; resources, AJPC and ECG; design and phases of the technological observatory architecture, AJPC; data curation, EFC and JLM; writing—original draft preparation, AJPC; writing—review and editing, ECG and AJPC; visualization, EFC and JLM; research review, AJPC; project administration, AJPC and ECG. All authors have read and agreed to the published version of the manuscript.

Funding: Funding for this research was provided by Universidad Autónoma de Occidente-Colombia and Universidad María Auxiliadora-Peru. Research approved according to resolutions: No. 7823 (UAO-Colombia) and No. 070-UMA-Peru. 2022.

Conflict of interest: The authors declare no conflict of interest.

References

Adner, R. (2017). Ecosystem as Structure. Journal of Management, 43(1), 39–58. https://doi.org/10.1177/0149206316678451

Albarracín, C. E. M., Salgado, W. E. B., & Salgado, N. M. G. (2021). Information source observatories: Concepts and theoretical review. Journal of Business and Entrepreneurial Studie, 5(3). https://doi.org/10.37956/JBES.V5I3.187

Al-Obaidy, H., Ebrahim, A., Aljufairi, A., Mero, A., & Eid, O. (2024). Software Engineering for Developing a Cloud Computing Museum-Guide System. International Journal of Cloud Applications and Computing, 14(1), 1–19. https://doi.org/10.4018/ijcac.339200

Castillo-Anzules, M., & Guaña-Moya, J. G.-M. (2024). Kanban: An agile methodology for efficient workflow management in software development, a systematic review (Spanish). Revista Ingenio Global, 3(1), 17–30. https://doi.org/10.62943/rig.v3i1.68

Chincoya-Benitez, L. I., & Barrón-Villaverde, D. (2023). Using analytical methods as part of strategic planning for an astronomical observatory housed in a public research institute. DYNA, 90(228), 152–158. https://doi.org/10.15446/dyna.v90n228.108585

Educational maps of Peru. [Maps of Peru]. Recovered: December 2023. Available: http://mapasenpdf.com/didacticos/peru

Elias, M., Ruckhaus, E., Draffan, E. A., James, A., Suarez-Figueroa, M. C., Lohmann, S., Khiat, A., & Auer, S. (2020). Accessibility and personalization in opencourseware: An inclusive development approach. Proceedings - IEEE 20th International Conference on Advanced Learning Technologies, ICALT 2020, 279–283. https://doi.org/10.1109/ICALT49669.2020.00091

Global Entrepreneurship Monitor. GEM Report review. (Spanish) Informe GEM España 2022-2023. (n.d.). https://doi.org/10.22429/euc2023.003.

International Labour Organization (2023). World Employment and Social Outlook. ILO. https://doi.org/10.54394/szdi5436

Khattak, M. S., Wu, Q., Ahmad, M., & Hattab, I. (2024). The role of managerial overconfidence in digital transformation and sustainable competitive performance in emerging SMEs: The role of digital culture. Business Strategy & Development, 7(3), e403. https://doi.org/10.1002/BSD2.403

Khribi, M. K., Othman, A., & Al-Sinani, A. (2022). Toward Closing the Training and Knowledge Gap in ICT Accessibility and Inclusive Design Harnessing Open Educational Resources. Proceedings - 2022 International Conference on Advanced Learning Technologies, ICALT 2022, 289–291. https://doi.org/10.1109/ICALT55010.2022.00093

Law, P., Page, A., & Storrar, R. (2020). Using an Open Educational Resources Platform to Support Underserved Groups. 25, 51–72. https://doi.org/10.1108/S2055-364120200000025005

Lerman, L. V., Benitez, G. B., Müller, J. M., de Sousa, P. R., & Frank, A. G. (2022). Smart green supply chain management: a configurational approach to enhance green performance through digital transformation. Supply Chain Management: An International Journal, 27(7), 147–176. https://doi.org/10.1108/scm-02-2022-0059

Li, J., & Yao, M. (2021). New Framework of Digital Entrepreneurship Model Based on Artificial Intelligence and Cloud Computing. Mobile Information Systems, 2021(1), 3080160. https://doi.org/10.1155/2021/3080160

Lin, Y. K., & Maruping, L. M. (2021). Open Source Collaboration in Digital Entrepreneurship. Https://Doi.Org/10.1287/Orsc.2021.1538, 33(1), 212–230. https://doi.org/10.1287/ORSC.2021.1538

Maps to Color. (s.f). [Maps of Colombia]. Recovered: December 2023. Available: https://www.mapasparacolorear.com/colombia/mapa-colombia.php

Mihale-Wilson, C., & Carl, K. V. (2024). Designing incentive systems for participation in digital ecosystems—An integrated framework. Electronic Markets, 34(1). https://doi.org/10.1007/s12525-024-00703-5

Miller, H., Clifton, K., Akar, G., Tufte, K., Gopalakrishnan, S., MacArthur, J., Irwin, E., Ramnath, R., & Stiles, J. (2021). Urban Sustainability Observatories: Leveraging Urban Experimentation for Sustainability Science and Policy. Harvard Data Science Review, 3(2). https://doi.org/10.1162/99608F92.2025202B

National Institute of Statistics and Informatics (2023). National production decreased by 0. 43% in the first quarter of 2023. https://www.comexperu.org.pe/articulo/produccion-nacional-disminuyo-un-043-en-el-primer-trimestre-de-2023

Nguyen, B., Schinckus, C., Canh, N. P., & Thanh, S. D. (2021). Economic Policy Uncertainty and Entrepreneurship: A Bad for a Good? The Journal of Entrepreneurship, 30(1), 81–133. https://doi.org/10.1177/0971355720974819

Odrekhivskyi, M., Pshyk-Kovalska, O., Zhezhukha, V., & Ivanochko, I. (2022). Intelligent Management of Enterprise Business Processes. Mathematics 2023, Vol. 11, Page 78, 11(1), 78. https://doi.org/10.3390/MATH11010078

Paredes-Chacín, A.J., Díaz-Bejarano, S., Marín-González, F., & Vega-Ramírez, E. (2024) Relationship between knowledge transfer and sustainable innovation in interorganizational environments of small and medium-sized enterprises. Journal of Entrepreneurship, Management and Innovation, 20(1), 47-64. https://doi.org/10.7341/2024201

Passaro, R., Quinto, I., Rippa, P., & Thomas, A. (2020). Evolution of Collaborative Networks Supporting Startup Sustainability: Evidences from Digital Firms. Sustainability 2020, Vol. 12, Page 9437, 12(22), 9437. https://doi.org/10.3390/SU12229437

Pathak, S., & Muralidharan, E. (2020). A two-staged approach to technology entrepreneurship: Differential effects of intellectual property rights. Technology Innovation Management Review, 10(6), 5–13. https://doi.org/10.22215/TIMREVIEW/1364

Pichugina, M., & Artemenko, L. (2022). Project development of open education platform for the company competitiveness. Serbian Journal of Management, 17(2), 321–332. https://doi.org/10.5937/sjm17-31970

Puente Márquez, Y. (2016). Social Observatories: Information Science Research Notebooks. (Spanish). 1, 80–100. https://doi.org/10.34295/cuinci.vi1.8

Shinkevich, A., Lubnina, A. A., & Raiskiy, I. A. (2021). Trends of innovative development of processing industries. Izvestiya of Samara Scientific Center of the Russian Academy of Sciences, 23(4), 51–56. https://doi.org/10.37313/1990-5378-2021-23-4-51-56

Sodhi, S., & Dwivedi, A. K. (2024). Differently Abled Entrepreneurs: A Systematic Literature Review on Fifty Years of Research—Exploring Thoughts and Debate with Reference to Entrepreneurship. The Journal of Entrepreneurship. https://doi.org/10.1177/09713557241234022

Sotnyk, I., Zavrazhnyi, K., Kasianenko, V., Roubík, H., & Sidorov, O. (2020). Investment Management of Business Digital Innovations. Marketing and Management of Innovations, 1, 95–109. https://doi.org/10.21272/mmi.2020.1-07

Tariq, N., Alsirhani, A., Humayun, M., Alserhani, F., & Shaheen, M. (2024). A fog-edge-enabled intrusion detection system for smart grids. Journal of Cloud Computing, 13(1). https://doi.org/10.1186/s13677-024-00609-9

Tironi Rodo, M., & Valderrama Barragán, M. (2023). From copper mining to data extractivism? Data worth making at Chile’s Data Observatory Foundation. Https://Doi.Org/10.1177/02637758231183719, 41(3), 411–432. https://doi.org/10.1177/02637758231183719

Velychko, V., Omelchenko, S., & Fedorenko, O. (2021). Open Access to ICT and Electronic Educational Resources as a Guarantee of Sustainable Development of Society. 79–85. https://doi.org/10.2991/ASSEHR.K.210120.017

Vieira, J. K. M., de Farias, I. H., & de Moura, H. P. (2023). Evaluating a Conceptual Model for Projects Observatories through a Survey. ACM International Conference Proceeding Series, 380–387. https://doi.org/10.1145/3592813.3592928

Vieira, J. K. M., Farias, I. H. De, & Moura, H. P. De. (2022). Evaluating and Evolving a Conceptual Model for Projects Observatories. ACM International Conference Proceeding Series, Par F180474. https://doi.org/10.1145/3535511.3535540

Voloshchuk, V. (2020). Methodological approaches to determining the effectiveness of innovative development of enterprises. innovative economy, 0(7–8), 72–79. https://doi.org/10.37332/2309-1533.2020.7-8.10

Yáñez-Valdés, C. (2022). Technological entrepreneurship: present conditions and future perspectives for Latin America. Management Research, 20(1), 25–38. https://doi.org/10.1108/MRJIAM-09-2021-1230/FULL/XML