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Enhancing Social Innovation Through Design Thinking, Challenge-Based Learning, and Collaboration in University Students

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Abstract: Comprehensive social development requires the coordinated cooperation of various actors in society. The university, as a transformative institution of knowledge, must integrate strategies that contribute to well-being. In Latin American universities, gaps still persist in the implementation of programs that foster entrepreneurship and social innovation, as well as in the adoption of active learning methodologies. The objective of this research is to demonstrate the importance of participating in innovation programs and collaborating with external entities to achieve a positive impact on society. The proposed methodology is based on collaborative learning strategies, collaboration with actors, design thinking, and challenge-based learning focused on social issues. A feedback survey was applied to the students to measure their opinion on the program, soft skills, and social commitment; these data were analyzed through the Jamovi 2.3 program. The results indicated an 80% satisfaction rate. This experience could serve as a precedent for the implementation of similar programs. Furthermore, the students involved in the study demonstrated a strong willingness to continue participating in innovation initiatives aimed at addressing social challenges, contributing significantly to the social dimension of sustainability.

Keywords: innovation; social engagement; soft skills; EQUIPU entrepreneur network; collaboration

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1. Introduction

It is recognized that, on a global level, humanity faces complex challenges that require innovative solutions and multidisciplinary approaches. In this context, the United Nations (UN) proposes addressing them through the Sustainable Development Goals (SDGs) [1].

In Ref. [2], Gajdzik et al. show that the transition to a sustainable society is achieved when all actors in society are involved and committed to these goals, highlighting strategic and active efforts. In this sense, academia emphasizes its leading role in sustainable development, as it stands as a transformative unit of knowledge. This is achieved through high-quality academic management, which includes research, innovation, and social entrepreneurship, as well as the implementation of educational methodologies that foster critical and creative thinking, along with pedagogical proposals that promote the development of soft skills in students [3].

In Latin America, the concepts of innovation and social entrepreneurship are often misunderstood, and as a result, their application and impact are not evident [4]. Filho et al. [5] point out that universities in Latin America have adopted disparate approaches to

social innovation and entrepreneurship, which is demonstrated by their lack of integration between curriculum, research, and social outreach. In this context, Miquelajauregui et al. [6] state that universities must reinforce their role as agents of change by incorporating activities that foster strategic alliances for effective cooperation, as well as creative innovation proposals in response to the constant social and economic changes that affect well-being and social development.

In Peru, as a developing Latin American country, significant disparities in access to quality services, including education, persist. The absence of robust public policies that foster an entrepreneurial culture from an early age further exacerbates these inequalities. Multiple barriers impede the development of entrepreneurial capacities, including a lack of funding institutions, insufficient entrepreneurial skills, and limited opportunities to implement and scale business ideas. These constraints hinder the creation of entrepreneurial projects with social innovation potential, reducing their impact on society [7].

Compounding this issue is the limited availability of universities that offer opportunities for developing, implementing, and executing projects focused on social well-being, equity, education, and community development. Addressing these gaps is essential for advancing social development and ensuring that higher education institutions can effectively contribute to societal progress through meaningful initiatives that engage with the realities of local communities.

In this context, the existence of interconnected networks in the social sphere allows for the combination and strengthening of actions by various entities, resulting in a collective capability that promotes innovation processes [8]. The articulation between the university and its social role is essential, especially in a context where the university is seen as a global knowledge industry. However, the challenge for these institutions is not limited to the production of knowledge but also includes their ability to link that knowledge with society, thereby structuring the social and cultural dimensions of the society [9]. Therefore, students must be trained to fully develop their skills with a sense of social responsibility, preparing them to be critical participants in a democratic society and promoters of changes that foster equity and justice [10]. Empowering students in this way ensures that universities do not only serve as centers of knowledge but also as engines of social transformation, actively addressing societal needs through innovative, impactful projects.

International studies demonstrate that training programs—also referred to as ecosystems—developed by universities contribute to fostering an entrepreneurial and innovative culture, driving transformation toward social development. In this context, the study by Gustafsson et al. [11] highlights that university ecosystems can facilitate the mobilization of resources through their support structures to promote social entrepreneurship. This, in turn, aims to offer social innovations as services to the community. The study emphasizes that social transformation occurs within a complex innovation governance system involving multiple stakeholders, where universities play a pivotal role in coordinating interinstitutional efforts to address social challenges.

In this framework, universities primarily enable the creation and development of enterprises, while social innovation enterprises are responsible for delivering services that generate social value. Furthermore, the study by Karahan [12] underscores the positive impact of sustainable university incubators on the sustainability of social projects. Universities that incorporate these incubators within their organizational structures are better positioned to enhance the long-term sustainability of social initiatives.

Building on this, the study by Macías-Prada et al. [13] points out that social entrepreneurship should be a core element within Latin American universities. However, persistent gaps hinder its effective implementation. In particular, Cordova et al. [14] identify that countries like Peru and Chile face significant challenges in promoting entrepreneurship, especially due to barriers such as limited access to financing. Despite these challenges, external networks have emerged as key resources for maintaining competitive strategies. Complementing this, the findings of Millones-Gómez et al. [15] highlight that funding

policies, combined with training and collaborative efforts, serve as effective strategies for fostering scientific production, including the development of patents.

Based on the outlined challenges, this study aims to showcase the initiatives undertaken by the Universidad Católica de Santa María (UCSM), in Arequipa, Peru, through its Vice-Rectorate of Research, which has been actively implementing extracurricular educational programs. These initiatives promote the holistic development of students by fostering interdisciplinary collaboration with a diverse range of social actors to design and execute innovative proposals that address societal needs.

This article specifically highlights the outcomes of the Innovation Challenge program at UCSM, where undergraduate students from various academic disciplines, supported by national and international professors and mentors, engaged in linking innovation initiatives to pressing social issues. Through the application of collaborative learning strategies, design thinking methodologies, and challenge-based approaches to social problems, students successfully developed and presented social innovation proposals. The Innovation Challenge serves as a model of how academic institutions can transcend traditional educational paradigms by integrating experiential learning with social impact. Students are empowered to become agents of change, developing solutions rooted in real-world contexts. Furthermore, the program exemplifies how a university can harness the creativity and critical thinking of its students to co-create solutions with community partners, aligning academic efforts with societal well-being and sustainable development goals.

The experience gathered through this program underscores the importance of embedding innovation within the educational process, not only to equip students with technical and interpersonal skills but also to cultivate a sense of responsibility toward community development. By involving students in interdisciplinary teams and real-world problem-solving, the program nurtures the entrepreneurial mindset required to generate sustainable social impact. This collaborative framework ensures that students are prepared to meet the challenges of both local and global contexts, contributing meaningfully to the advancement of their communities and society at large.

2. Literature Review

2.1. Innovation in Latin America and Peru

Innovation has emerged as a fundamental pillar for social and economic development, becoming increasingly relevant in academic literature and public policy formulation. According to Barcellos-Paula et al. [16], innovation is not an autonomous phenomenon but is embedded in a broader ecosystem that includes factors such as dynamic entrepreneurship, knowledge generation, skills development, and the implementation of strategic policies at the state level. This holistic approach implies that the impact of innovation on social development is the result of a complex interaction among various interconnected elements.

In Latin America, the situation is even more complex. As noted by Arciénaga Morales et al. [17], there is a significant gap between scientific production and its social application, a problem manifested in the weak connection between scientific research and national innovation strategies. This mismatch can be attributed to the absence of coherent policies aligning research with the needs of the productive sector, the lack of effective mechanisms for technology transfer, limited collaboration between universities, industry, and government—known as the triple helix—and insufficient investment in research, development, and innovation (R+D+I).

In response to these challenges, several Latin American countries, including Peru, have launched public interventions to strengthen research activities. These interventions often focus on increasing public investment in R+D+I, creating competitive funds for research projects, offering monetary incentives to companies investing in innovation, and developing training programs for advanced human capital. However, the effectiveness of these policies largely depends on how they are implemented and the capacity of institutions to adapt to them.

Within this framework, universities play a central role. According to Lavalle et al. [7], higher education institutions must adopt quality policies that promote both research and entrepreneurship. They identify three key factors: relevant teaching, which involves designing academic programs aligned with labor market demands and social challenges; research, understood as the production of new and applicable knowledge; and social engagement, which refers to the transfer of knowledge and technology to the productive sector and the broader community.

In Peru, the enactment of University Law 30220 [18] marked a turning point in efforts to improve the quality of higher education and promote research and innovation. Among the most important provisions of this law are the creation of the National Superintendence of University Higher Education (SUNEDU) to oversee educational quality, the establishment of minimum quality standards for university licensing, the creation of vice-rectorates for research in all universities to foster research, and the promotion of internationalization and academic mobility.

However, the implementation of these reforms has faced significant challenges. These include resistance to change in some university institutions, the lack of financial and human resources to carry out the reforms, the need to strengthen research management capacities in universities, and regional inequalities in the distribution of resources and research capacities [7].

2.2. Innovation and Skills Development

As industries transform and technologies advance, it becomes evident that higher education institutions must adapt to prepare students not only in theoretical terms but also in specific skills that enable them to face societal challenges. Innovative learning strategies play a crucial role in transforming educational experience. The implementation of cooperative, innovation-based learning experiences has proven effective in enhancing the cognitive and interpersonal skills of university students [19].

The gap in the implementation of educational methodologies that integrate digital and innovative technologies in Latin America is a phenomenon widely documented in recent literature. Despite an increase in the adoption of these technologies, challenges persist on multiple fronts. Among the main obstacles are insufficient technological infrastructure, limited availability of digital devices, low digital literacy among students and teachers, and a lack of adequate financial resources. Moreover, it has been noted that teachers have not been sufficiently involved in digitalization initiatives, resulting in pedagogical practices that are not effectively integrated into educational curricula. This mismatch between available technologies and their effective application in teaching highlights the need for a more inclusive and coordinated approach to the digital transformation of education [20].

In the study by Zapata-Cantu et al. [21], the need to strengthen human resource capacities is identified as a key challenge for driving innovation in sustainable development, particularly in Latin America. While governments are expected to foster innovation ecosystems that encourage investment in new solutions to address local challenges, significant limitations persist.

One of the main barriers lies in the insufficient development of technological skills, as well as critical and creative thinking among university students. These shortcomings restrict their ability to propose innovative solutions and contribute meaningfully to social development. Several factors underlie this situation, including the shortcomings of public policies aimed at promoting entrepreneurship, research, and innovation [22]. Additionally, the lack of funding has significantly impacted many universities, hindering their ability to implement programs and projects that foster essential skill development.

2.3. Collaborative Learning

Collaborative learning is an educational methodology based on student collaboration to achieve common goals, promoting not only cognitive development but also personal and

social growth. This methodology is characterized by several essential aspects that facilitate a deeper and more meaningful learning process [23].

According to Bjelobaba et al. [24], one of the pillars of collaborative learning is positive interdependence, where group members depend on each other to complete assigned tasks. The success of each individual is closely linked to collective success, fostering an environment of cooperation and mutual support. This dynamic reinforces the idea that teamwork is not merely a sum of individual efforts but a synergistic interaction that enhances educational outcomes. In this context, interpersonal skills gain particular importance. Students must develop social competencies such as leadership, decision-making, trust-building, and conflict resolution. These skills are essential not only for success in the academic environment but also for professional and personal life.

In Ref. [25], Li et al. assert that collaborative learning fosters an understanding of problems from different thematic perspectives, aiding in the resolution of complex issues.

In Latin America, universities have made significant progress in implementing collaborative strategies for entrepreneurship and social innovation [26]. However, these activities are mostly extracurricular, with limited integration into academic curricula [27].

2.4. Soft Skills

The development of soft skills in university students is a key component of their comprehensive preparation, as these competencies are fundamental for their contribution to social development and for facing the challenges of the contemporary labor market [28]. In an increasingly globalized and dynamic world, graduates' ability to communicate effectively, work in teams, solve problems, and demonstrate empathy is crucial for their professional and personal success [29].

For these soft skills to develop effectively, Magano et al. [30] indicate that training must be intentional and structured within the university curriculum.

According to Fernández-Arias et al. [31], universities should promote the development of soft skills among students. However, the perception of achievement in these skills varies based on students' geographical context. For instance, Cruz-Sandoval et al. [32] report that university students in Mexico exhibit a low perception of their competencies in social innovation and business management. In Peru, the study by Andrade-Chaico et al. [33] highlights that interpersonal and social skills are highly valued in the Peruvian labor market. However, students perceive themselves as being poorly prepared in these areas.

2.5. Design Thinking

According to Li et al. [25], design thinking is an innovative method that addresses problems in various fields by creating new solutions that align with societal needs, technological feasibility, and customer value. It is well known that this method involves five stages: empathize, define, ideate, prototype, and test. As Bender-Salazar [34] points out, this innovation model begins with research to generate ideas and concepts, culminating in applying these ideas to experiments for testing. Unlike a traditional research study, the result of design thinking is often a product or service co-created with the client.

Melles et al. [35] add that this method represents an "open" problem-solving process and incorporates tools from various professions to analyze, synthesize, and generate new ideas. This justifies its multidisciplinary nature, which allows for balanced innovations.

This methodology is applied across different fields, including social sciences. As Bender-Salazar [34] notes, applying design thinking to problem-solving in education improves the effectiveness and innovative nature of proposed solutions.

Similarly, participation in innovation programs that use design thinking is crucial to addressing the complex sustainability challenges facing today's society. This methodology fosters interdisciplinary collaboration and creativity, thus allowing participants to develop innovative solutions to real problems. By focusing on an iterative process of design and questioning, design thinking facilitates the transformation of experiences into new skills and knowledge, essential for training change agents. For example, Stanford University's

"Change Leadership for Sustainability" program combines design thinking with a systemic perspective to prepare leaders to drive significant changes towards intergenerational well-being [36]. Similarly, the University College Dublin Innovation Academy program integrates design thinking with transformative learning to foster a sustainability mindset and creative confidence in participants, helping them to be more effective in co-creating sustainable solutions [37].

In universities across Latin America, particularly in Peru, successful strategies have been identified in the implementation of the design thinking methodology to foster innovative business ideas that also contribute to solving social challenges [38].

2.6. Triple Helix Model

According to Barrios-Hernández et al. [39], the University–Industry–Government triad (also known as the triple helix) represents an ideal alliance or articulation for developing innovations that address societal needs and opportunities. In a changing society, innovation becomes essential to ensure sustainability.

Kao et al. [40] highlight that in a globalized world, a synergy between these three actors is required for knowledge development. Universities have expanded their role in development by contributing to innovation and invention through collaborations with industry and government. Meanwhile, industries have recognized the value of well-founded knowledge provided by universities.

Globally, the triple helix model has been consolidated as a key strategy to drive innovation. This approach facilitates the creation of cooperation spaces such as Living Labs and technology transfer offices, which encourage co-creation and the exchange of knowledge between different actors. Such laboratories stand out for their ability to address economic, social, and environmental challenges, creating an open innovation environment in which ideas can evolve and develop together [41]. In addition, the triple helix enables the generation of hybrid organizations, such as business incubators and financial support networks, which not only help bring new technologies to market, but also act as catalysts for the creation of innovation ecosystems, fostering economic and social development [42].

In other contexts, the application of the triple helix model has proven to have significant impacts on socioeconomic development; an outstanding example is the case of the pisco production sector in Peru, where collaboration between universities, companies, and the government has strengthened the competitiveness of the local industry. This alliance has allowed not only to improve production processes, but also to facilitate the transfer of knowledge and technology, creating a more dynamic and competitive environment [43]. Likewise, in Korea, the KAIST social entrepreneurship MBA program has demonstrated how the training of social entrepreneurs can foster connectivity with various entities, contributing to the creation of innovative solutions to complex social problems [44].

As these experiences show, it is evident that strategies based on the triple helix can generate sustainable innovation ecosystems, capable of responding to both local needs and global opportunities.

2.7. Engagement with Stakeholders

Ayaviri-Nina et al. [45] argue that networking with key stakeholders plays a critical role in consolidating strategic alliances that bring social and even economic benefits. These alliances contribute to the formation of clusters and generate competitive advantages, as entrepreneurs who are part of a network have a higher probability of success. Robledo Giraldo et al. [46] add that networking spaces with different actors constitute an important resource for entrepreneurial activities, as they represent a combination of social relationships. In this context, stakeholders have become more aware of science–industry cooperation as an open platform, reaching out to society and aligning with policies; the importance of making research public and transparent is emphasized, considering it essential for the collaborative model [47].

2.8. Social Commitment

Social commitment involves a deep analysis of sustainability education criteria. As Solís-Espallargas et al. [48] point out, the 17 Sustainable Development Goals (SDGs) address the development challenges facing humanity, focusing on identifying key systemic barriers such as inequality, sustainable consumption patterns, weak institutional capacity, and environmental degradation. These issues must be addressed, which requires a radical transformation in the way we think and act. A clear example of this approach is the Students4Change Project, which highlights the need to formalize a curriculum specifically designed to promote social innovations and train universities in developing strategies based on strengthening participation, collaboration, and cooperation with society and their local communities [3]. In the face of current environmental and social challenges, education must be geared towards developing awareness, competencies, knowledge, skills, and essential attitudes that require significant transformations in university curricula, promoting a sustainable and innovative economy [49]. In this sense, universities not only train professionals, but also act as agents of change, promoting sustainable development and providing inclusive solutions that address specific social, economic, and environmental challenges, contributing to the achievement of the Sustainable Development Goals [50]. Through innovation and social entrepreneurship—key elements in today's academic world—universities are addressing complex societal problems. However, their integration into study programs and the way this knowledge is shared with society varies widely [3]. In this context, FabLabs have become powerful tools to promote social innovation in universities, driving sustainable development through collaboration and active engagement with the community [51].

3. Materials and Methods

The Innovation Challenge program is designed to promote a culture of entrepreneurship and innovation by forming multidisciplinary teams to develop solution proposals for challenges or issues posed by leading organizations in society [28].

The program is promoted by the EQUIPU network of entrepreneurs, created by the Pontificia Universidad Católica del Peru (PUCP), with membership from various higher education institutions at both the national and international levels. In 2024, 23 national institutions and 5 universities from South American countries—Ecuador, Colombia, Chile, Bolivia, and Uruguay—participated in the program.

The Universidad Católica de Santa María (UCSM), as a member of the EQUIPU entrepreneurial network, co-organized and participated in the program. Key benefits of the program include the formation of multidisciplinary teams, the strengthening of innovative culture, the development of networking opportunities, the chance to engage in challenge-based learning focused on social issues, training on innovation tools, participation in regional networks, and personalized mentorship.

In 2024, the Innovation Challenge program was structured into four phases: seed stage, discovery, training, and feedback [52]. These phases were based on the use of innovation tools like the design thinking method.

In Peru, citizen insecurity represents a significant challenge that affects social development and the well-being of the population. One of the most worrying crimes in this context is kidnapping, often linked to child trafficking. This problem is concentrated mainly in cities with high poverty rates, further aggravating the situation of vulnerability in these communities [53]. Despite the seriousness of the problem, there is a considerable gap in terms of the human and logistical resources needed to guarantee citizen security. Recognizing this limitation, the Presidency of the Council of Ministers of Peru (PCM), proposed the following as a challenge 2024, which tasked the teams with finding innovative solutions to address a critical issue facing the Ministry of the Interior of the Peruvian government: How can we provide early alerts for the disappearance of minors?

The program established specific requirements for the proposed solution:

- The proposal must involve a digital service focused on minors;

- The solution must involve the citizenry in locating missing minors, helping to find them quickly;
- Teams were instructed not to develop mobile applications (apps) due to challenges such as device download capacity;
- The solution must incorporate market testing to identify improvement opportunities based on the user experience.

In addition to the workshops and lectures provided by the program, UCSM offered continuous support to its students and organized complementary activities to help them develop realistic and innovative proposals. Figure 1 shows the four phases of the program, considering the activities promoted by the EQUIPU network of entrepreneurs, as well as the additional contributions provided by UCSM, through EQUIPU Santa María, for the success of the program in its institution.

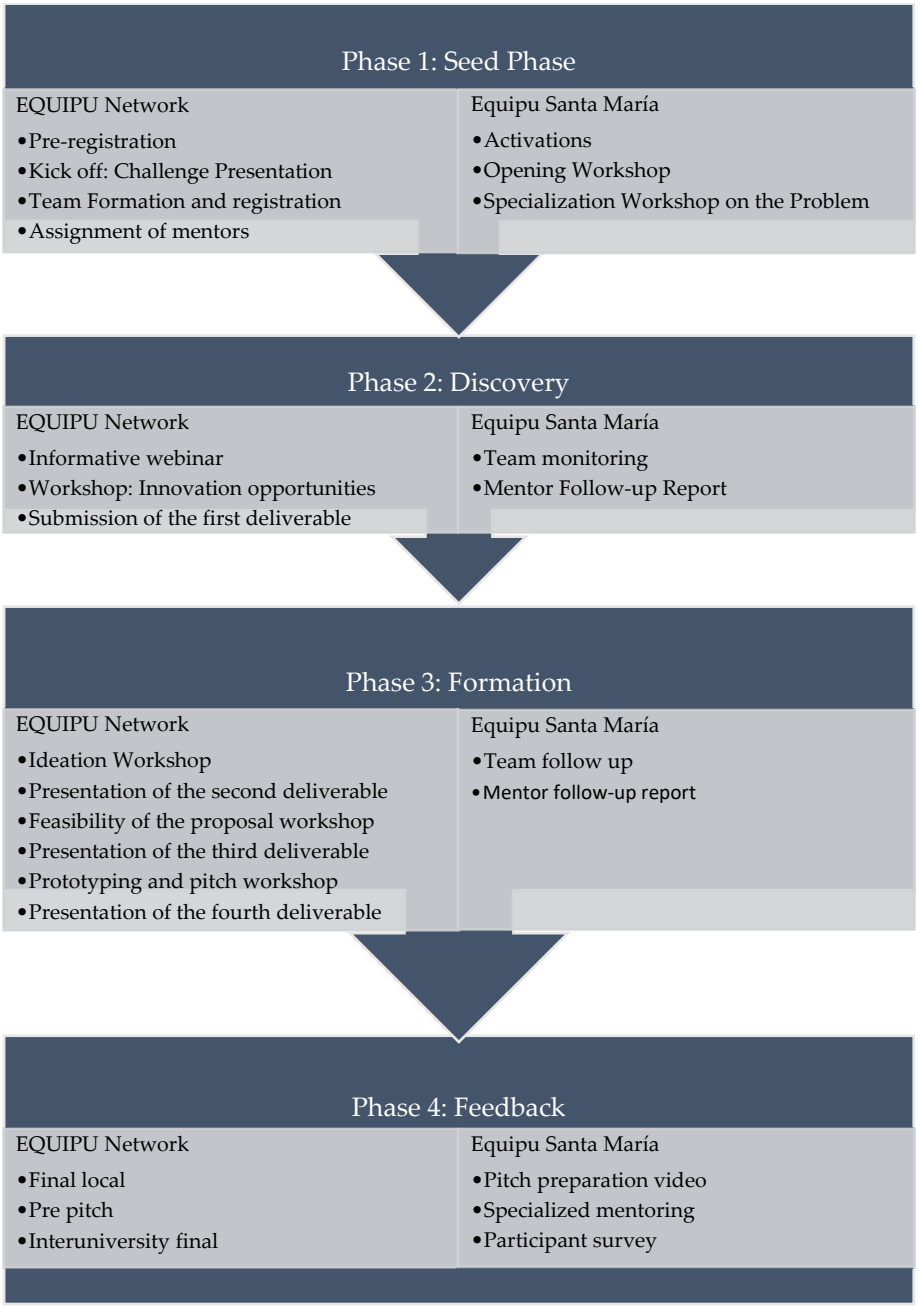

Figure 1. Process of all phases carried out.

3.1. Seed Phase

This phase involved the pre-registration of students for the program, the kick-off event, team formation and registration, and the assignment of mentors.

At UCSM, the program was promoted through digital platforms, and as a first initiative, two activation events were held to explain the benefits of the program and the advantages for participants. The results are shown in Figure 2.

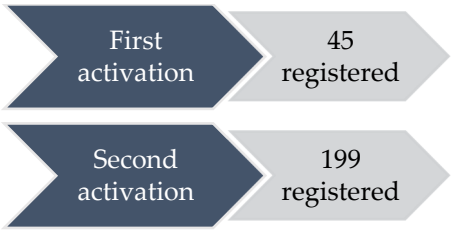

Figure 2. Result of activations.

The second initiative of UCSM was to conduct an opening workshop to motivate students, encourage them to get to know each other, and form multidisciplinary teams, fostering collaborative learning and networking.

A third initiative was to provide specialized information relevant to the proposed challenge. To this end, EQUIPU Santa María collaborated with the Criminal Investigation Division of the National Police of Peru (DIVINCRI), the national body responsible for the search for missing persons, who provided a talk with useful information for the participants, also answering their questions. The institution sent two competent members on the topic.

Finally, for this phase, the assignment of mentors was considered, who accompanied, advised, and guided the teams in the development of their deliverables. In the case of UCSM, competent professionals were selected in advance, who could be faculty members from the same institution or external specialists. As Li et al. [54] point out, "mentoring relationships positively predict innovation performance". This underscores the importance of mentor support in the development of their proposals.

3.2. Discovery

This phase included the development of an informative webinar, the first workshop titled "Opportunities for Innovation", as well as the presentation of the first deliverable.

First Deliverable

The defined content to be included consisted of the following:

1. Problem Tree: As noted by Hernández-Hernández et al. [55], this tool allows for the generation of creative ideas to identify the causes and consequences of the problem, with the trunk representing the main problem, the roots representing the causes, and the branches representing the effects. This tool is used for the design and development of products;
2. Problem Statement: This should include a description with statistical information about the problem;
3. Persona Definition: This involves considering data, needs, positive and negative thoughts, fears and hopes, concerns, and opportunities of the target person;
4. Experiment Definition: This includes proposing market testing, an approach to society to gain insight into their perspective on the proposal, and from there, drawing conclusions based on their recommendations.

3.3. Training

This phase involved Workshops 2, 3, and 4 on Ideation, Proposal Feasibility, Prototyping, and Pitching, respectively. It also included the presentation of three deliverables upon the conclusion of each workshop.

3.3.1. Second Deliverable

The content should encompass the following:

- A review of products;
- Application of the SCAMPER model. Hassan [56] states that this model uses questions that stimulate ideas to propose an adjustment or addition to something already existing, encouraging thinking from another perspective and generating a flow of ideas;
- Definition of the Minimum Viable Product (MVP) as a proposed solution to the challenge, which, as noted by Llamas Fernández et al. [57], means creating a product with minimal features that provide value to the customer while also allowing for the collection of as much information as possible.

3.3.2. Third Deliverable

The defined content should include the following:

- Everything defined in Deliverables 1 and 2;
- The value proposition map;
- Development of the Lean Canvas. According to Mejía-Giraldo [58], this model presents a canvas where the first step is identifying a problem that needs to be solved, for which a solution will be proposed through a feasible product or service that someone is willing to invest resources in;
- Logos of the proposed idea;
- Validation filter.

3.3.3. Fourth Deliverable

The fourth deliverable did not have a defined format and could be prepared in an open format since it was intended for the pitch presentation. However, it was recommended that the following 11 points be included: cover page, problem, client, current status, introduction, solution, business model, benefits, projection, team, and conclusion.

Each of these points was part of the final presentation to be used in the local final, which had to last up to 3 min. As Miranda Jhonattan [59] points out, the pitch is a short speech, widely popular in the entrepreneurial ecosystem, aimed at delivering a significant, memorable, and motivational solution.

As the challenge required the development of a digital service, this phase of the program also included four complementary talks related to technological development concepts:

- Basic programming concepts;
- Challenges of the missing persons search system;
- Innovating at the speed of artificial intelligence;
- Technological ecosystem 4.0: AI as the engine of innovation and progress.

3.4. Feedback

This phase included the local final, which had to be held at each higher education institution to select the winning team that would represent them in the interuniversity final. It also included the pre-pitch as the final preparation before competing among institutions, as well as the interuniversity final held in Lima at the Pontificia Universidad Católica del Peru (PUCP).

The same evaluation rubric was used for both the local and interuniversity finals and was standardized across all participating institutions. Scoring was based on a Likert scale from 1 to 5, where 1 was poor and 5 was excellent. Table 1 presents the evaluation criteria considered.

At this stage, UCSM carried out complementary activities for the benefit of its participating teams. First, each team was asked to submit a pitch video as preparation for the local final. In the local final, the jury consisted of three members:

- A specialist from the UCSM Directorate of Innovation and Development;

- An innovation and SDG (Sustainable Development Goals) specialist (external national consultant);
- An entrepreneurship specialist (external international expert from Tecnológico de Monterrey, Mexico).

Table 1. Evaluation criteria for participating teams.

Evaluation Criteria	Percentage
Innovation and Solution Approach	20%
Problem Identification (social and geographical context)	20%
Economic Viability and Sustainability	20%
Social Impact	15%
Scalability of the Solution	15%
Pitch Presentation	10%

Second, after selecting the winning team at UCSM, three mentoring sessions were held to prepare the finalist team for the interuniversity final. For this, UCSM worked in collaboration with the following:

- Two specialists from the INNICIA Business Incubator;
- A pitch specialist from Tecnológico de Monterrey, Mexico.

Finally, a survey was conducted among students who participated in the Innovation Challenge 2024 program at UCSM. This survey was distributed via email to all participants one week after the program concluded. It included 27 questions and was divided into the following sections: general data, opinions about the Innovation Challenge 2024 program, soft skills, and social commitment. Additionally, complementary questions were posed to the winning team.

The survey was structured in two types of response: a Likert scale, used to measure participants' satisfaction with the program; and a dichotomous format (yes/no), designed to evaluate the presence and approach of topics related to social innovation.

3.5. Program Development

At the Catholic University of Santa Maria, the Innovation Challenge program was developed. A project was formulated and submitted to the rector's office to grant 1.5 extracurricular credits to students who participated and successfully completed the program. The project was approved through Resolution N°30289-R-2024. A massive call for participants was made via official social media channels, along with activation events within the university, resulting in over 100 interested and registered participants.

By the end of the training sessions, 21 teams completed the submission of all four deliverables. This led to a pre-evaluation process, which allowed the selection of 9 teams to participate in the UCSM local final.

The winning team, Trajet Technology, was composed of students from the Schools of Systems Engineering, Law, and Medicine. Their project, called Rescue Eyes, involved developing innovative software designed to quickly disseminate alerts for missing minors through digital screens and totems in universities. By utilizing microservices technology, the software is able to classify and transmit real-time alerts based on specific locations, ensuring community participation [60]. The project is scalable, with potential future expansion to digital screens in financial institutions and shopping centers.

After winning the UCSM local final, the team underwent three mentoring sessions. These sessions were facilitated through collaboration with both internal and external stakeholders, which significantly improved the team's technical capabilities and pitch presentation. This preparation helped them win first place in the interuniversity final held in Lima, where they competed against national and international higher education institutions. The team was awarded a cash prize of 5000 (local currency/PEN).

3.6. Instrument Validation Survey

The research, as previously mentioned, evaluated the satisfaction of participants in the Innovation Challenge program and the effectiveness of the mentoring sessions offered to the winning team. Data collection was carried out through a survey addressed to both the general participants of the program and the members of the team that achieved first place. A Likert scale from 1 to 5 was designed, with items focused on key aspects of the program and the quality of support received through mentoring. For the winning team, additional questions are included to measure the impact of the mentoring sessions on their performance and preparation for the interuniversity final, thus allowing an analysis of how these sessions contributed to their success, from a technical as well as a strategic perspective.

This approach provides a clear and structured overview of participants' experiences and opinions, identifying strengths and areas for improvement of the program to guide the future development of similar initiatives, highlighting the importance of participating in innovative programs and collaborating with external entities to achieve a positive impact on society, thus ensuring more effective management and a greater drive for innovation and collaboration.

To ensure the reliability of the survey, the constructs are subjected to statistical tests; internal consistency coefficients are calculated, specifically the Cronbach and McDonald Omega coefficients. These coefficients were used to evaluate the validity and reliability of the measurement instrument, ensuring that the constructs included were accurately and consistently reflected, with data collected via an online survey and analyzed by using JAMOVI 2.3 software packages [61,62].

Cronbach's alpha coefficient, based on the rating between the items, indicates that a high rating reflects that the items are coherent and reliably measure the construct in question, being a useful tool to ensure that the ratings obtained consistently reflect the construct. Complementing this analysis is McDonald's omega coefficient, which is considered a more robust alternative to alpha, particularly for the analysis of Likert-type scales, since it considers the variations such as the covariances between the items, which allows for offering a more precise measure of internal consistency and an evaluation of the construct's validity [62,63].

4. Results

4.1. Validation of the Instrument

The instrument demonstrated a reliability score of 0.96, indicating that the formulation of the items is reasonable (see Table 2) [64].

Table 2. Survey viability.

Cronbach's Alpha (α)	McDonald's Omega (ω)
0.96	0.965

The values obtained in these analyses confirmed the validity of the tools used to measure the participants' perceptions, supporting the accuracy and robustness of the conclusions obtained about the effectiveness of the program and the impact of the mentoring sessions.

4.2. Characteristics of the Surveyed Participants

A total of 112 respondents participated in the survey, of which 60.7% were male and 39% were female (see Table 3).

The professional career with the highest participation was Systems Engineering (58%), which can be attributed to the program's requirement that the solutions be digital. This context underscores the critical role of technological skills in crafting innovative solutions to social challenges. Programming has emerged as a cornerstone in an increasingly digitized job market, with demand for programmers expected to rise by 65% in the coming years.

Beyond offering well-paid and flexible career opportunities, programming fosters creativity, innovation, and a commitment to continuous learning [65]. As Caratozzolo et al. [66] point out, companies must prepare—or are already preparing—for a digital evolution in the workplace, driven by the tech-savvy Gen Z. Moreover, it would be valuable to explore how Gen Z's knowledge and leadership skills influence and are passed on to future generations.

Table 3. Gender of the participants.

Gender	Frequency	Percentage
Female	44	39.3%
Male	68	60.7%

Additionally, the participation of various academic programs allowed teams to adopt a multidisciplinary approach and generate ideas from different perspectives (see Table 4).

Table 4. Professional careers of the participants.

Criteria	Frequency	Percentage
Architecture	1	0.9 %
Social Communication	1	0.9 %
Accounting	1	0.9 %
Law	9	8.0 %
Economics and Finance	1	0.9 %
Pharmacy and Biochemistry	3	2.7 %
Environmental Engineering	1	0.9 %
Biotechnology Engineering	1	0.9 %
Civil Engineering	2	1.8 %
Commercial Engineering	6	5.4 %
Mining Engineering	1	0.9 %
Systems Engineering	65	58.0 %
Industrial Engineering	2	1.8 %
Human Medicine	6	5.4 %
Veterinary Medicine and Zootechny	2	1.8 %
Obstetrics and Childcare	1	0.9 %
Dentistry	1	0.9 %
Psychology	7	6.3 %
Advertising	1	0.9 %

4.3. Innovation Challenge Program

The Innovation Challenge program received a rating of 4.02 out of 5, highlighting the work and management of EQUIPU Santa María (4.36). This result can be attributed to the personalized support provided to the participating teams, which allowed them to address queries and concerns while providing relevant information about the program (see Table 5).

Table 5. Satisfaction with the Innovation Challenge program.

Criteria	Average	Percentage
How would you rate the work and management of EQUIPU Santa María?	4.36	87.2%
How would you rate the usefulness of the extra activities provided by EQUIPU Santa María (UCSM)?	3.99	79.8%
How would you rate the usefulness of the complementary talks provided by EQUIPU in the Innovation Challenge 2024 program?	3.94	78.8%

Table 5. *Cont.*

Criteria	Average	Percentage
How would you rate the usefulness of the workshops provided by the EQUIPU network in the Innovation Challenge 2024 program in providing you with the necessary tools and knowledge for developing your ideas?	4.03	80.6%
If you visited FabLab, do you consider it was useful for the Innovation Challenge program?	3.85	77.0%
Total	**4.02**	**80.4%**

Overall, the satisfaction results indicate that participants have positively valued the activities carried out in the program, which enabled them to develop their ideas in a collaborative environment with access to the appropriate resources.

4.4. Soft Skills

The participants' results show that the program not only promotes innovation but that more than 50% of the participants believe their soft skills significantly improved, particularly in areas such as commitment, critical thinking, and collaboration/teamwork (see Figure 3).

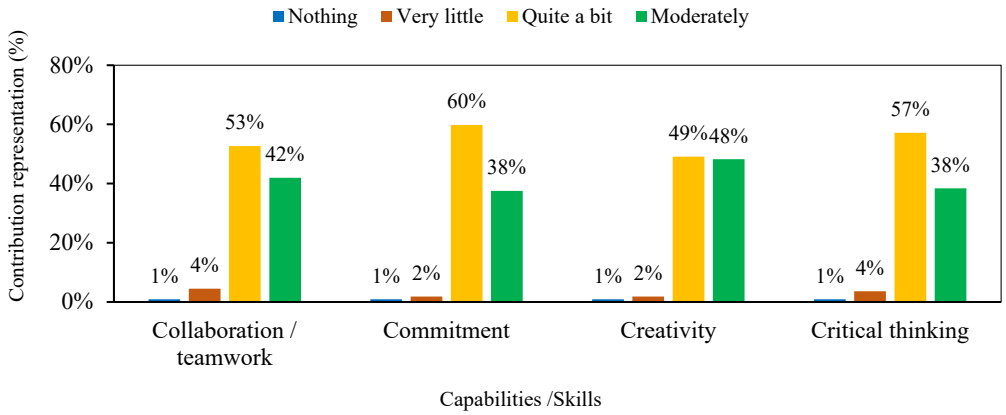

Figure 3. Soft skills improved by the program.

4.5. Social Commitment

The results in Table 6 show that over 90% of respondents believe the program is aligned with social engagement. Notably, 97% of participants indicated that the program addresses significant societal challenges, while 96% believe it can have a positive impact on society. Additionally, 95% of participants consider that the program addresses the Sustainable Development Goals (SDGs).

Table 6. Program's relationship with social commitment.

Criteria	No	Yes
Do you believe the Innovation Challenge program connects with key societal stakeholders?	8%	92%
Do you believe the Innovation Challenge program can have an impact on society?	4%	96%
Do you believe the Innovation Challenge program addresses the challenges faced by society in our country?	3%	97%

Table 6. *Cont.*

Criteria	No	Yes
Do you believe the Innovation Challenge program addresses the Sustainable Development Goals (SDGs)?	5%	95%
Total	5%	95%

In Table 7, a shift in participants' involvement in social impact activities can be observed. A comparison was made of their participation in voluntary activities before and after having participated in the program. Previously, 62% of surveyed students participated in volunteer activities, such as animal shelter support, assistance to homeless shelters, help in orphanages, among others. However, after their participation in the program, 89% expressed a desire to be part of social initiatives in the future. This increase reflects that not only did the program enhance skills, but it also raised participants' awareness and fostered a greater commitment to social engagement.

Table 7. Participation in social impact activities before and after the program.

Criteria	No	Yes
Before the Innovation Challenge program, were you involved in volunteer work or initiatives with social impact?	38%	62%
After participating in the Innovation Challenge program, would you like to be part of social initiatives?	11%	89%
Total	**25%**	**75%**

4.6. Winning Team

In terms of the mentoring sessions received by the winning team, the results reflect the positive impact these mentoring sessions had on the team's performance. Notably, the complementary mentoring provided by EQUIPU Santa María (an internal area within UCSM) stood out with a score of 4.93 out of 5 (see Table 8). These sessions significantly contributed to their preparation for the interuniversity final.

Table 8. Satisfaction of the winning team.

Criteria	Index
Do you consider that the mentoring sessions provided by EQUIPU SANTA MARIA were useful and significantly contributed to your preparation for the interuniversity final?	4.93
Do you consider that the PRE-PITCH mentoring provided by the EQUIPU network was effective in your preparation for the interuniversity final?	4.80
Regarding the mentoring received from the EQUIPU network in Lima, do you generally consider it to have been useful for your preparation for the interuniversity final?	4.40
Total	**4.71**

In summary, satisfaction rates exceeding 80% and participant scores above 3.8 demonstrate a well-structured program designed across its four phases: seed, discovery, training, and feedback. These phases ensured continuous support and training throughout the process, resulting in the development and presentation of innovative solutions. Additionally, collaboration with entities such as DIVINCRI and interaction with field professionals provided relevant and valuable insights, leading to more realistic solutions with a societal impact.

4.7. Comparison of the Years 2023 and 2024

In Figure 4, it can be observed that in 2024 there was an increase of over 50% in student participants compared to 2023.

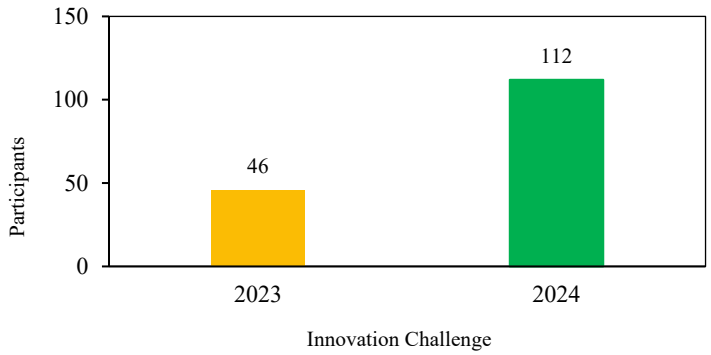

Figure 4. Comparison of participants in the Innovation Challenge program 2023 and 2024.

In Table 9, the various fields participating in the Innovation Challenge program can be seen, with the field of Science and Engineering having the highest percentage in both years, at 16% and 44%, respectively.

Table 9. Fields participating in the Innovation Challenge program.

Area	Frequency	Percentage
2023	**46**	**29.11%**
Health Sciences	6	3.80%
Science and Engineering	26	16.46%
Law and Business Sciences	13	8.23%
Social Sciences	1	0.63%
2024	**112**	**70.89%**
Health Sciences	13	8.23%
Science and Engineering	71	44.94%
Law and Business Sciences	18	11.39%
Social Sciences	10	6.33%
Total	**158**	**100.00%**

5. Discussion

Social innovation is not limited to competitiveness and productivity but addresses the creation of social welfare and the impact on quality of life [8]. Therefore, this type of innovation allows the creation of social value, defined by Guzmán Vásquez et al. [67] as changing the lives of individuals for the better, through the achievement of socially desirable objectives. In this sense, social innovation must seek to achieve the Sustainable Development Goals (SDGs) established by the United Nations (UN), presented as the agenda for the coming years that requires the participation of all actors.

The results of the article reveal that more than 95% of the students involved consider that the program has an impact on society, addresses the country's challenges, and contributes to the achievement of the SDGs. However, the program itself also contributes to the goals of some of the SDGs, such as SDG 5 on gender equality [68]. The applied survey shows that although 60.7% of the participants in the innovation program were male and 39% female, women are gradually increasing their participation in the innovation area. The Ministry of Science, Innovation, and Universities, in its 2024 report on Women and Innovation [69], mentions that out of every 100 inventions, approximately 20 are created by women. In addition, in recent years, women have increased their participation in newly founded companies, reaching a current total of 20%. Several research studies have shown the existence of barriers that limit women's participation in science and technology, such as restricted access to capital, lack of support networks, and limited mentoring opportunities,

which inhibit their ability to thrive in this sector [70]. This is reflected in their underrepresentation in science and technology entrepreneurship, where only one in four high-growth entrepreneurs is female, despite higher participation in low-income regions [71].

On the other hand, the study reveals that there was an increase in students who decided to participate in this program (more than 50% between 2023 and 2024). This contributes to SDG 4 on educational quality [72], which seeks to ensure that all students acquire the theoretical and practical knowledge necessary to promote sustainable development, as well as everything necessary to access employment and entrepreneurship. Kao et al. [40] emphasize the importance of developing interdisciplinary curricula that foster innovation and the integration of transformative skills in education. As Solís-Espallargas et al. [48] assert, education is no longer an end in itself but becomes a tool for promoting the necessary changes to ensure sustainable development, as universities must contribute to achieving the Sustainable Development Goals (SDGs). Furthermore, student participation in innovation programs is aligned with SDG 8 on decent work and economic growth, which aims to promote policies aimed at development, entrepreneurship, creativity, and innovation [73]. In this regard, the OECD (Organization for Economic Cooperation and Development) indicates that jobs in 2030 will require profiles related to STEM disciplines. In Latin America, digital STEM lessons were introduced in schools [66], developing methodologies such as design thinking [74], CREA, among others [75].

5.1. University and Social Commitment

The results presented in this article demonstrate the success of applying an innovation program through collaborative work and articulation. The Innovation Challenge at UCSM involved students from 19 professional schools, promoting multidisciplinary approaches in the formulation of proposed solutions and demonstrating that, after their participation, 89% of students would like to become involved in social initiatives.

A study was conducted at a university in Peru on the deficiencies in the development of social awareness among students, concluding that students show a notable indifference towards poverty and a low willingness to show solidarity [76]. This situation highlights the need to strengthen their professional and humanistic training through awareness-raising experiences and solidarity action, with the aim of enhancing their social commitment. Thus, the importance of training that contributes to a professional performance committed to improving the community is reaffirmed.

Similarly, the study by Schröder et al. [77] on social innovation as a driver of new educational practices explains that new governance structures are needed to integrate and promote social innovations and develop the potential of all social sectors to improve education. This includes a more active and new role of universities in research into social innovation and thus guarantees a broad and comprehensive vision of solutions in a set of similar initiatives, allowing them to work together, learn from what works in other areas, and promote new innovative ideas.

Many organizations have understood the importance of their social commitment and that is why there are different social competitions like the world's largest social competition for university students, the Hult Prize, where each year, challenges related to the SDGs are proposed, and the main prize is project funding of 1 million dollars [78]. Today, universities are increasingly seen as key players in social innovation [79]. Another international university competition is The Solar Decathlon, organized by the U.S. Department of Energy, which highlights interdisciplinarity to successfully develop high-performance sustainable proposals [80]. Similarly, the IEEE HAC (Humanitarian Activities Committee) applies technology to solve humanitarian problems in different parts of the world, offering funding for solutions [81]. Additionally, there are hackathons like The 24 h of Innovation, where teams have 24 h to develop innovative solutions to a specific challenge with multidisciplinary teams [82]. In Peru, through the EQUIPU entrepreneur network, there is an effort to integrate more universities from South America, with the goal of proposing real problems so that interdisciplinary teams can offer solutions to issues occurring in South American

countries. The Innovation Challenge program developed at UCSM is aligned with the aforementioned programs that focus on helping society with innovative proposals based on the challenges posed by various institutions.

5.2. Benefits of Innovation Programs

As García Castanedo et al. point out, a successful idea marathon not only enhances the institution's reputation but also increases students' employability through the improvement of their skills and interaction with real institutions [83]. According to the above, the results of this article reveal that 50% of the students indicate that, after their participation in the program, they perceive their soft skills of commitment, critical thinking, collaboration and teamwork, and creativity as better. In this regard, Rijnsoever et al. [84] argue that students develop an empathetic mindset through socially engaged learning, which encourages them to create value with their peers, teachers, and societal stakeholders through a learning process characterized by uncertainty in the face of challenges. In fact, the authors propose a model for training change agents, where students develop an entrepreneurial mindset for the benefit of society.

5.3. Key Activities of the Innovation Program and Its Applications for Practice

Innovation in Latin America remains a significant challenge for governments, as they need to boost innovation and entrepreneurship, with partnerships between universities and businesses being necessary [85]. Chile is a prime example, with its state funding program (Startup Chile) since 2010 [86], and improved entrepreneurship policies have led to an increase in interest in the entrepreneurial ecosystem, making it one of the leading countries in Latin America today [87]. In contrast, Peru, while also having entrepreneurship policies, still faces sustainability challenges due to national informality, hindering economic growth compared to neighboring countries like Chile. However, one of the goals of the EQUIPU entrepreneur network, through programs like Innovation Challenge, is to link with the government and companies to foster trust in academia and develop innovative solutions, aiming to strengthen the innovation and entrepreneurship ecosystem at the national level. Morawska-Jancelewicz, J. [8] states that if universities want to build an effective system of cooperation with the social and business environment, they must create adequate structures and mechanisms that support the development and implementation of social innovations in a region, thus contributing to the practical application of university social responsibility. This article points out that 92% of students consider that the program allows them to connect with key actors in society. In this sense, in addition to what is provided by the EQUIPU network, UCSM coordinated with institutions such as DIVINCRI, which allowed interaction and obtaining first-hand information. Additionally, the talks and workshops given by specialists allowed the development of real proposals.

The innovation program developed at UCSM required the participation of multidisciplinary teams and assigned mentors to each of the participating teams. The above is considered a key activity, since as Kao et al. [40] highlight the importance of support from a teacher or mentor, as well as peer collaboration, to optimize learning outcomes. In addition, for the representative team in the interuniversity final, specialized mentoring was provided thanks to the articulation with national and foreign specialists.

It is important to create opportunities for more women to be involved in innovation, as it offers several opportunities for modern economic transformation. This is not only based on individual talent but also on the knowledge acquired in various fields, to increase participation in creative solutions to current problems. Although there are not yet many universities in Peru offering partnerships that provide master's programs to promote the creation of new tech-based ventures, there are cases like the one proposed by Portuguez Castro et al. that present good practices that should be emulated by other Latin American countries [88].

5.4. Limitations

This study examines the implementation of a training program on innovation and social entrepreneurship at a private Peruvian university. Participants were undergraduate students from various academic disciplines who voluntarily enrolled in the program. However, a significant limitation was the lack of pre-assessment, making it difficult to evaluate changes in participants' behavior or measure the program's potential long-term effects.

While this article highlights the importance of participating in innovation programs and collaborating with external entities to create a positive societal impact, it does not consider the experiences or outcomes of non-participants. This gap presents an opportunity for future research to explore and compare the perspectives of those who did not engage in the program.

6. Conclusions

The program has proven to be effective in fostering innovation and entrepreneurship among participants, as 89% expressed their desire to be part of social initiatives in the future, addressing social problems through a collaborative and multidisciplinary approach that enriches the formulation of solutions and prepares students to face transformative challenges with greater confidence, creativity, commitment, and critical thinking.

Also, the program's ability to integrate methodologies such as design thinking in the development of its phases, and learning based on social challenges, which allowed participants to develop critical skills for the presentation of their proposals, is highlighted, which demonstrates that this model can be replicable for future presentations and in various contexts.

Regarding program satisfaction, 80% of participants highlight the work of EQUIPU Santa María and the effectiveness of the activities and resources offered that encourage innovation and the development of ideas, which demonstrates the importance of having an efficient support team to facilitate the innovation process.

Furthermore, it was observed that the integration of entrepreneurship and innovation in the University reinforces the crucial role it plays in the development of significant and sustainable social changes that allow achieving the Sustainable Development Goals. This result is consistent with the commitment assumed by the University to be a change manager, which, combined with the skills and knowledge acquired in this type of experience and the collaboration between different key actors in society, turns the student into an agent of change.

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