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VALUATION ATTRIBUTED BY PROJECT PRACTITIONERS FROM PMI - LIMA CHAPTER TO THE INTEGRATION OF SUSTAINABILITY CRITERIA IN THE PUBLIC INVESTMENT PROJECT (PIP) IN PERU

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Abstract. All countries are committed to Sustainable Development Goals, seeking a balance between economic growth, environmental conservation, and social welfare, however, it seems that there is a risk of not achieving them or making very little progress by 2030. Public investment projects (PIP) due to their high impact, could be the engines to achieve them; and PIP practitioners play an important role as agents of change. The present study; quantitative, cross-sectional, and descriptive, carried out through self-administered surveys; sought to answer, from the perception of experienced practitioners, members of Project Management Institute (PMI) - Lima Chapter, the following questions concerning PIPs in Peru: 1) To what extent are sustainability criteria considered? 2) Do the criteria corresponding to any of the dimensions of sustainability tend to be more considered? and 3) What are the main barriers to the integration of sustainability criteria? The results show the ranking of the 12 criteria considered in the study, of which the criteria of the social dimension are taken into account more than the criteria of the economic and environmental dimensions. Likewise, the main barriers identified for the integration of sustainability criteria in PIPs were grouped into the following topics: Regulatory framework; Corruption, bribery, and transparency; The investment system; Capacities and competencies; and Promotion, dissemination, awareness, and values. This study represents a contribution as a baseline for the action of the State, organizations, and academia.

Keywords: Sustainability, Public Investment Projects, Sustainable Development, Sustainability criteria.

VALORACIÓN ATRIBUIDA POR LOS PROFESIONALES DE PROYECTOS DEL PMI – CAPÍTULO DE LIMA A LA INTEGRACIÓN DE CRITERIOS DE SOSTENIBILIDAD EN LOS PROYECTOS DE INVERSIÓN PÚBLICA (PIP) EN PERU

Resumen. Todos los países están comprometidos con los Objetivos de Desarrollo Sostenible, buscando el equilibrio entre el crecimiento económico, la conservación del medio ambiente y el bienestar social, sin embargo, parece que se corre el riesgo de no alcanzarlos o avanzar muy poco al 2030. Los proyectos de inversión pública

(PIP) por su alto impacto, podrían ser los motores para alcanzarlos; y los profesionales de PIP juegan un papel importante como agentes de cambio. El presente estudio; cuantitativo, transversal y descriptivo, realizado mediante encuestas autoadministradas; buscó responder, desde la percepción de los profesionales con experiencia, miembros del Project Management Institute (PMI) - Capítulo de Lima, las siguientes preguntas en relación a los PIP en Perú: 1) ¿En qué medida se consideran los criterios de sostenibilidad? 2) ¿Los criterios correspondientes a alguna de las dimensiones de sostenibilidad tienden a ser más considerados? y 3) ¿Cuáles son las principales barreras que para la integración de los criterios de sostenibilidad? Los resultados muestran el ranking de los 12 criterios considerados en el estudio, de los cuales se tienen más en cuenta los criterios de la dimensión social que los criterios de las dimensiones económica y ambiental. Asimismo, las principales barreras identificadas para la integración de los criterios de sostenibilidad en los PIP se agruparon los siguientes temas: Marco normativo; Corrupción, soborno y transparencia; El sistema de inversión; Capacidades y competencias; y Promoción, difusión, sensibilización y valores. Este estudio representa un aporte como línea base para la acción del Estado, las organizaciones y la academia.

Palabras clave: Sostenibilidad, Proyectos de Inversión Pública, Desarrollo Sostenible, Criterios de sostenibilidad.

Introduction

One of the main challenges involving human beings is Sustainable Development, which seeks a balance between economic growth, environmental conservation, and social welfare, raised in 1983 in the United Nations Report *Our Common Future*, which served as the basis for Agenda 21 in 1992, the Millennium Development Goals in 2000 and the World Agenda 2030 with the 17 Sustainable Development Goals (United Nations, 2015). However, despite the global consensus on sustainability importance, the truth is that it is complex to ground these concepts in daily human activities. Likewise, although sustainability began to gain relevance in business in the 1990s with the creation of the Business Council for Sustainable Development Forum and the publication of the book *Changing Course*, emphasizing corporate responsibility for sustainable development, this approach does not finish landing, until the beginning of the new millennium. Sabini, Muzio & Alderman(2019) reviewed 770 publications from the last 25 years on sustainable projects, finding that 73% of them correspond to the last 4 years.

Although the integration of sustainability concepts in projects is still in its initial stages, the shared consensus is that projects are one of the main mechanisms to generate organizational change toward sustainable development (Silvius & Schipper, 2020; Castellani, Olarreaga, Paniza & Zhou; 2019), in this line of thought, specifically public investment projects (PIP) play a predominant role in responding to the needs and priorities of each country with great impacts, closing the gaps to achieve the Sustainable Development Goals by 2030. In Peru, several gaps have been identified that need to prioritize many of them because of inefficiencies in public investment (IDB, 2018; IDB, 2020a; IDB, 2020b; Centro Nacional de Planeamiento Estratégico, 2018 and 2020). Likewise, the National Infrastructure Plan for Competitiveness (Gobierno del Perú – Ministerio de Economía y Finanzas, 2019) - the first effort of the Peruvian State to define vision and objectives, prioritize projects, and articulate investments - is recognized that to achieve a "country developed, competitive and sustainable, it is necessary to improve the quality of life of the population, with a social and decentralist vision and at the same time advance in the closing of infrastructure gaps and enhance all our productive capacities", however, the methodology prioritized was focused mainly on economic indicators, without considering a comprehensive and standardized concept of sustainability, the environmental component being the most absent. The weighting was based on 60% productive impact (economic potential, competitiveness, and implementation), 30% social impact (poverty-population), and 10% financial impact (ability to attract private investment).

On the other side, there are some studies to address sustainability in projects, especially in the construction sector, proposing indicators or criteria based on recognized references or certifications models like LEED, LBC, BREEAM, GREEN GLOBES, EDGE, Barcelona Urban Ecology Agency, or Economic Commission for Latin America and the Caribbean (Aguilar, 2016; Alvarado & Saenz, 2018; Lecca & Prado, 2019; Cabrera & Paredes, 2016).

In 2000 the National Public Investment System was created to optimize public resources for investment, which was replaced in 2016 with the new National System for Multiannual Programming and Investments Management hoping to improve the weak aspects of the previous system such as the investments' disconnection with the closing of gaps and the budget allocation, insufficient quality of the project due to lack of capacities, and disorder or slowness in management (Torres, 2019; IDB, 2019; Diaz, 2017). While there may be multiple stakeholders involved in responsibility for integrating sustainability into PIPs (Sabini et al., 2019), the project practitioners play a preponderant role in all stages of the public investment cycle because they are responsible for the projects or can influence /impact in them, seeking that they are formulated, evaluated, executed, and operated according to the settle down criteria. So, the question arises, To what extent is sustainability considered or taken into account in Public Investment Projects in Peru, as perceived by project practitioners experienced in those projects? Do the criteria corresponding to any of the dimensions tend to be more considered? And in any case, what barriers have been identified for it?

The results provide a first approximation to the state of the art on the subject as a baseline for the academy for further research and the identification of training gaps and to the national public investment system executives for decision-making concerning the integration of these criteria, through normative and guidelines.

Method

The present research is quantitative, cross-sectional, and descriptive. The data was collected through a self-administered questionnaire applied on the Survey Monkey platform. The questionnaire was validated by 05 expert project practitioners with results greater than 90% in validity, objectivity, and reliability; and over 92% of Pearson or Spearman coefficients for each sustainability dimension.

The study variable *Valuation of the sustainability integration in PIP* is evaluated in its three dimensions (social, environmental, and economic), each one includes four criteria with their respective sub-criteria and questions. There are 12 criteria, 41 sub-criteria (see Table 2), 116 close questions (Likert alternative responses with 4 levels), and 05 open questions.

The PMI Lima – Peru chapter is the representative organization that brings together practitioners from different areas committed to improving organizations through the application of good project management practices, which is why it was considered the source for determining the population and the sample to be interviewed. The pre-established selection criteria were: *Project practitioner who has experience in the formulation, evaluation, or execution of at least one public investment project in Peru*. To determine the population that meets the established criteria, an initial survey was carried out among all members, identifying a population of 64 practitioners who met the established criteria (of 159 people who responded), of which 58 were willing to participate in the study of research. Therefore, the random sample corresponding to 50 practitioners was calculated and taken, with a confidence level of 95%. Table 1, shows the relevant characteristics of this sample.

The data was collected between May and June 2021, and were evaluated using the statistical packages IBM SPSS Statistics. To describe and analyze the data, the results are presented by the mean of the answers scored from 1 to 4 scale, where 1=never, 2=Sometimes, 3=Most of the time, and 4=Always. McDonald's Omega test and Cronbach's Alpha test were applied to each of the twelve criteria and the three dimensions, finding coefficients of 0.83 to 0.96; and 0.84 to 0.93, respectively, values considered good or excellent (Frías-Navarro, 2021). The student t-test for independent samples and the one-way Anova test were carried out to compare the means of the social, environmental, and economic dimensions with each of the variables from Table 1 that characterize the sample (e.g., age, academic level, experience, PIP type in which they have participated, etc.) finding no significant differences between the subgroups of these categories. The paired sample t-test was applied for the social vs. economic dimension, social vs. environmental dimension, and economic vs. environmental dimension, finding significant differences in the two first cases. Finally, the t-test or Wilcoxon's signed-rank test for related samples was applied to each criterion data depending on their different distribution finding.

Finding

The findings are presented in two parts: The first part intends to answer the two first questions: 1) To what extent is sustainability considered in Public Investment Projects in Peru, as perceived by project practitioners experienced in those projects? 2) Do the criteria corresponding to any of the dimensions tend to be more considered? The second part intends to answer question 3) What are the main barriers that the interviewees have identified regarding the integration of the criteria proposed in the formulation, evaluation, or execution of the PIPs in Perú?

Table 1
Sample Characterization

Variable	Ranges	Percentage (%)
Age	35 - 55	62
	≤ 35	20
	≥ 56	18
Highest academic level	Master's or doctorate	60
	Bachelor, Specialization, or diploma	40
Project certifications	PMP	70
	Others	28
	none	2
Practitioner's experience in projects (years)	≥ 10	70
	< 10	30
PIP number in which they have worked	≥ 5	54
	1-<5	46
The position they have held in work experience	At the operational level	38
	At a strategic or tactical level	24
	Others	38
Largest PIP in which they have participated (Millions of US \$)	≥ 10	66
	<10	34
Sectors in which they have worked	Transport and communication	40
	Housing and Development	32
	Agriculture, fishing, or industry	30
	Education, culture, or sport	28
	Energy or mines	26

Integration of sustainability criteria in PIPs in Peru

Table 2 summarizes the results globally as averages (means) at the level of the sub-criteria, criteria, and dimensions of sustainability. Most of the sustainability criteria (10 out of 12) have been rated between 2 and 3, and only 2 criteria reached values slightly higher than 3: *C3-Human rights* and *C4-Ethical behavior*, which are significantly different from all the other criteria but not with each other. Likewise, it was found that the *C6-Energy* criterion is the lowest with a value significantly different from all the other criteria. The values of the criteria corresponding to the Social Dimension stand out from the criteria of the other two dimensions, which leads to the following ranking by dimension: Social Dimension (2.86), Economic Dimension (2.59), and Environmental Dimension (2.47). There are no significant differences between the means of the economic dimension and the environmental dimension, however, each of these two dimensions has statistically significant differences concerning the social dimension.

The criteria corresponding to the social dimension are the criteria most considered and taken into account. Of the 4 criteria that make up the dimension, 3 of them have the highest

score of the 12 criteria: *C3-Human Rights, C4-Ethical behavior, C2-Society, clients, and consumers*, however, the *C1-Labor practices, and decent work* is one of the lowest criteria among all. This last criterion considers 6 sub-criteria, of which the following brought the average down: *Local competence development, Employment and staffing, Training and education, and Organizational learning* (See Table 2 and Figure 1).

The criteria corresponding to the environmental dimension are the criteria least considered and taken into account. The evaluation ranking of the criteria is as follows: *C7-Land, air, and water, C5-Transport, C-8-Consumption, C6- Energy, presenting significant differences between them, except C5-Transport and C8-Consumption*. Criterion *C6- Energy*, which has the lowest score and differs significantly from all other criteria, includes the following sub-criteria, all with low scores: *SC-Energy consumption, SC-CO2 Emission, SC-Clean, and renewable energy*. In addition to the sub-criteria corresponding to criterion 6, the following were evaluated at low levels: *SC-Logistics; SC-Recycling, reuse, and waste generation, SC-Water consumption, and sanitary water displacement* (see Table 2 and Figure 1).

The criteria corresponding to the economic dimension, are considered practically the same as the environmental criteria (there is no significant difference between them). The evaluation ranking of the criteria is as follows: *C9-Business case analysis and investment evaluation, C10-Effectiveness and efficiency of the processes, and C12-Economic stimulation*; which are statistically equal; and finally, there is *C11-Business agility*, which is significantly different from the other 3 criteria of this dimension. C11-criterion includes *SC-Flexibility/Optionality*, related to opportunities to adjust the requirements to achieve a higher degree of sustainability and creative ideas are sought to generate additional benefits.

C9-criterion included *SC34-Project evaluation and selection and SC35-Indicators* used in the evaluation and selection of projects, which were investigated through multiple-choice questions. The results show that PIPs are predominantly evaluated and selected based on the fund's availability to invest (58%) and the social and political pressure (50%). Likewise, the indicators predominantly considered are the Cost-Benefit Ratio (70%), Net Present Value (70%), and Internal Rate of Return (62%).

Main identified barriers to the integration of sustainability criteria in PIPs

At the end of each block of questions corresponding to the social, environmental, and economic criteria, an open question was asked in the survey, investigating which are the two main barriers that limit the integration of the sustainability criteria that had been assessed in the PIPs. The responses, corresponding to the three dimensions, were grouped and classified, by association, into the following five topics:

1. The regulatory framework, including barriers like:
 - The inflexible applicable regulatory framework. including mainly the law on contracting with the state by the *lump sum* contracting system;
 - The lack of state incentives to manage the projects with a global sustainability approach;
 - Insufficient state supervision for compliance with sustainability criteria included in sector regulations (for example, labor regulations).
 - There is no regulatory framework to require or promote sustainability criteria throughout the supply chain.
2. Corruption, bribery, and transparency, which include the following issues:

- Informality, corruption, bribery, unequal commercial conditions, and other types of collusion distort processes or policies and incorporate bureaucratic barriers.
- Limited transparency mechanism of the state contracting system.
- Anti-corruption regulations are not sufficiently publicized.
- Little interest in some companies meeting sustainability criteria if it reduces the project profitability.
- Bad political practices between authorities.
- Relaxation of society in the face of corruption at all levels.

Table 2

Consolidated results on the degree to which sustainability criteria are taken into account to be integrated into PIPs (Practitioners' perspective)

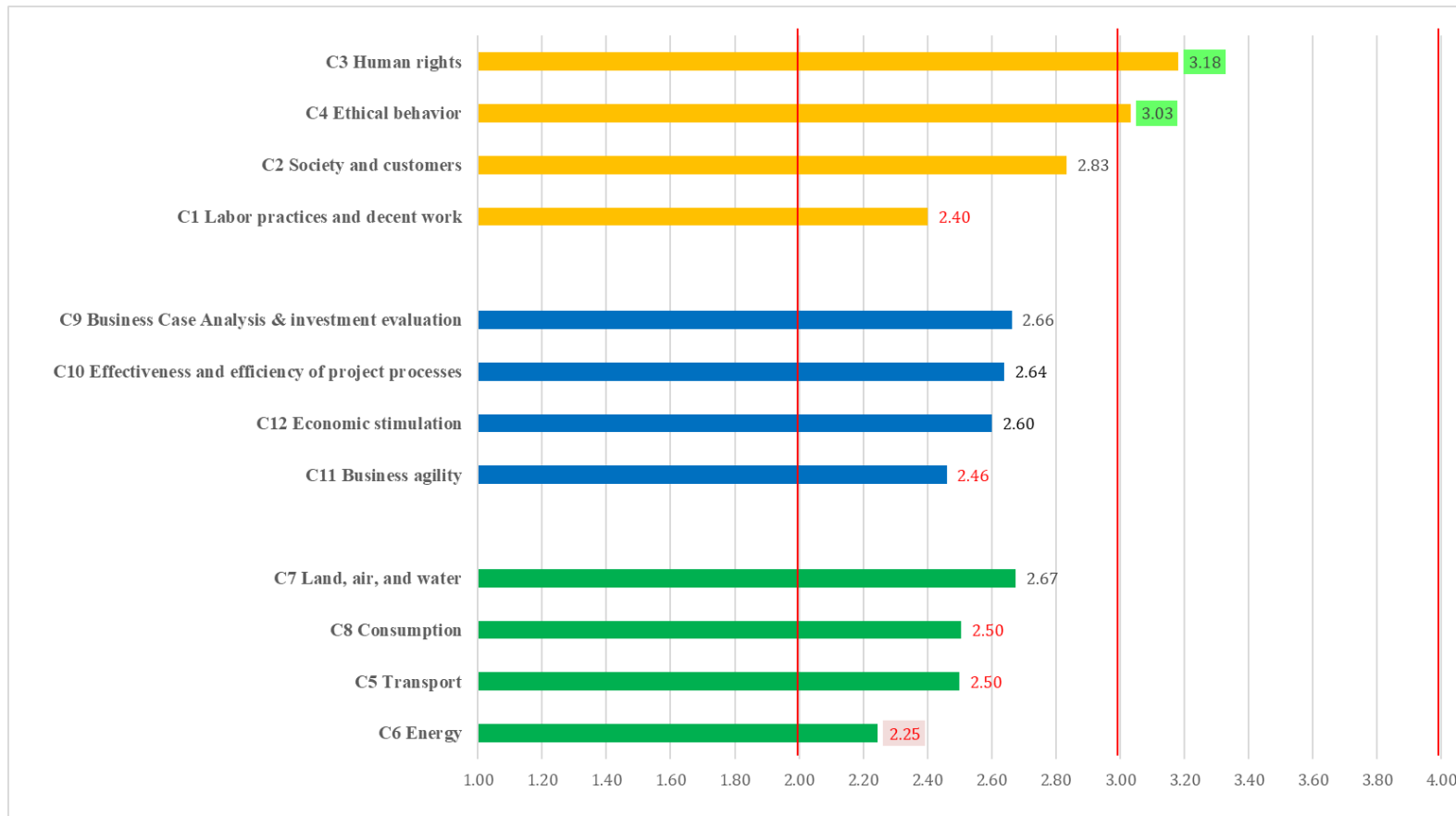
Sub-criterion (SC)	SC Mean	Criterion	Criterion Mean	Dimension Mean
Employment and staffing	2.39	C1 Labor practices and decent work	2.40	2.86*
Project health and safety	2.60			
Training and Education	2.23			
Organizational learning	2.19			
Diversity and equal opportunity	2.59			
Local competence development	2.39			
Community support	2.44	C2 Society and customers	2.83	Social dimension
Public policy/ Compliance	2.94			
Protection for local peoples	2.73			
Customer health and safety	2.95			
Customer Privacy	3.02			
Property and livelihoods	2.92			
Non-discrimination	2.93	C3 Human rights	3.18**	
Age-appropriate labor	3.54			
Voluntary labor	3.06			
Procurement practices	2.87	C4 Ethical behavior	3.03**	
Anti-corruption	3.09			
Fair competition	3.14			
Local procurement	2.87	C5 Transport	2.50	
Traveling and communication	2.42			
Logistics	2.21			
Energy consumption	2.38	C6 Energy	2.25*	2.47
CO2 emissions	2.16			
Clean and renewable energy	2.20			
Biological diversity	2.67	C7 Land, air, and water	2.67	Environmental dimension
Water and air quality	3.02			
Water consumption and sanitary water displacement	2.34			
Recycling, reuse, and waste generation	2.24			
Disposal	2.58	C8 Consumption	2.50	
Contamination and pollution	2.69			
Financial analysis	2.78	C9 Business Case Analysis and investment evaluation	2.66	2.59
Modeling and simulation	2.67			
Benefits	2.55			
				Economics dimension

Effectiveness	2.68	C10	
Efficiency	2.70	Effectiveness and efficiency of project processes	2.64
Project progress	2.54		
Flexibility /optionality	2.46	C11 Business agility	2.46
Local economic impact	2.72	C12	
Indirect benefits	2.48	Economic stimulation	2.60

Note. These criteria summarize those proposed by literature, such as Gareis, Huemann & Martinuzzi (2010), Tharp (2011), Silvius, Schipper, Planko, Van den Brink & Köhler (2012), Morfaw (2014), Martens & Carbalho (2016), Silvius (2019), Green Project Management (2019). A modified Likert scale of 1-4 was used. *Significant statistical difference compared to the other criteria or dimensions as appropriate. ** Significant statistical difference compared to the other two criteria but not each other.

Figure 1

Sustainability criteria ranking by dimension on the degree to which they are taken into account to be integrated into PIPs (Practitioners' perspective)



Note: First group (orange) is the social dimension; the second group (blue) is the economic dimension; the third group (green) is the environmental dimension.

3. Corruption, bribery, and transparency, which include the following issues:
 - Informality, corruption, bribery, unequal commercial conditions, and other types of collusion distort processes or policies and incorporate bureaucratic barriers.
 - Limited transparency mechanism of the state contracting system.
 - Anti-corruption regulations are not sufficiently publicized.
 - Little interest in some companies meeting sustainability criteria if it reduces the project profitability.
 - Bad political practices between authorities.
 - Relaxation of society in the face of corruption at all levels.
4. The investment system: A large number of sustainability barriers are included here:
 - The PIPs are not aligned with international standards, for example, there is no Project Management Office (PMO), which manages projects within programs to achieve synergies, so management is pragmatic with a series project approach, selected and executed according to political pressures and social.
 - The sustainability criteria, such as new technologies for clean and renewable energies, are not taken into account in the formulation and evaluation stage, where the requirements are given making it practically impossible to integrate them in the following stages without increasing cost and budgeting. For some interviewees, the main criteria at this stage are the availability of resources, cost minimization, and profitability.
 - Project management deficiencies: poorly developed management plan (e.g., missing scope, costs, risk analysis); disruptive tools are not incorporated for the investment programming stage, which limits the solutions; failure in investment planning and programming; insufficient emphasis on monitoring and meeting goals at each stage; the performance of the project in execution is not analyzed; The collaborative work that would make the use of resources more efficient is not yet applied; lack of registration of suppliers that comply with international environmental protection standards.
 - Lack of alignment between the different activities or elements of project management, for example, the provisions of the pre-investment formulation are not always fulfilled during the investment phase, a high time lag between the PIP formulation and the project execution, the investment is not made within the established deadlines, lack of coordination of the different areas involved prevents aligning or standardizing criteria; there is a large gap between estimated and actual social benefits.
 - Conflicts between the different stakeholders from project formulation to closure; integration between the community, the company, and the government are not built.
 - Change of local authorities and high turnover of management personnel and officials in public entities.
 - Lessons learned from previous projects are not taken into account (there is no base or record of lessons learned); ex-post evaluations are not carried out in most cases, and it is not evaluated whether the financial-economic expectations are maintained in the project's execution (in many cases, the project's viability is lost due to the changes that occur), difficulty in quantifying benefits, the models focus on quantifying costs.

5. Capabilities and competencies: Within this topic, the following barriers have been grouped:
 - Lack of knowledge, experience, awareness, and training especially at the level of public officials in the different stages regarding the subjects: procurement law and the integration of sustainability criteria in projects, including norms and procedures; best practices, technologies, and efficiency techniques.
 - Lack of social studies, ignorance of the culture of the population, and lack of knowledge of the environment and society where the project is developed.
 - Lack of specialized technical professionals and a multidisciplinary team. The public officials of the different state entities do not have adequate knowledge and management of procurement law. The work teams are dedicated to the technical development of the projects, there are neither personnel nor resources that allow a parallel sustainability analysis to be carried out.
 - Local markets are not sufficiently developed to provide services to large projects. A limited supply of providers in rural areas causes executors to contract providers from other areas. Communities are not prepared to assume more responsibility.
6. Promotion, diffusion, awareness, and value: Within this topic, the following barriers have been grouped
 - Lack of a culture of environmental protection, indifference, little interest, little appreciation, lack of commitment and involvement, lack of awareness, lack of responsibility, and resistance to change (of general people, business, and state) are barriers identified by the interviewees.
 - Lack of promotion, communication, and awareness about environmental policies, new techniques, e impact on the environment, and the added value that PIPs generate in society when they take care of sustainability criteria.

Discussion

From the perception of public investment project (PIP) practitioners, the criteria of the social dimension are the most valued to be integrated into the stages of formulation, evaluation, and execution of PIP followed by economic and environmental criteria. These overall results were somewhat surprising at first since trends similar to those of other studies were expected, were the most valued/prioritized criteria were those corresponding to the economic dimension followed by the social and environmental dimension (Yuan, 2017; Martens and Carvalho, 2016); then we need to focus on each criterion and sub-criteria.

Within the Social dimension are the two best-valued criteria (statistically different from all 12 others): *C3-Human Rights* and *C4-Ethical Behavior*. The C3 criterion is associated with basic regulated legal issues like Non-discrimination, Not forced work, and Work according to age, whose non-compliance would mean sanctions and exposition to public scrutiny. This result validates the affirmation given by the interviewees in the identification of the barriers: "*if the criterion is regulated, it is fulfilled*". The C4 criterion includes Anti-corruption, anti-bribery, Fair competition, and Procurement practices. These issues are very sensitive in Peru, in recent years there have been several cases of corruption and bribery, giving rise to administrative and judicial processes with sanctioned, and even imprisoned authorities, reaching the highest levels of public administration, such as the same presidents. PIPs are also associated with social conflicts, although their origins lie in other issues such as land tenure or environmental impacts.

For example, by the end of December 2021, the Ombudsman's Office (Defensoría del Pueblo, 2021), reports a total of 202 cases of social conflicts, of which 129 (63.9%) correspond to socio-environmental conflicts, of which 86 (66.7%) are related to the Mining activity, followed by the activities of Hydrocarbons (18.6%) and Waste and sanitation (6.2%). Generally, these sensitive situations (corruption, bribery, and social conflicts) go together and possibly are the reason because the high score of interviewers for C4-Ethical Behavior.

This dimension also includes the second last valued criterion: *C1 – Labor practices and decent work*, with the following sub-criteria that bring down the average: *Employment and staffing*, *Local competence development*, *Training and education*, and *Organizational learning*. Concerning *Employment and staffing*, it includes payment of living wages, equal pay for equal work, and adequate employment conditions (health care, vacations, parental care, fair dismissal, and healthy work-life balance and personal), all of them corresponding to the relationship between the worker and the state provider that executes the PIP. These aspects are related to the high rate of informal work, which in 2020 corresponded to 3 out of 4 Peruvians (INEI, 2020). The other sub-criteria, include the identification and development of skills and competencies of the project team and the personnel who will operate or maintain the services of products generated by the project, incorporating lessons learned from past projects, and engaging with stakeholders to promote organizational learning of local communities for project resource planning and incorporating local employment targets into supplier contracts. The low ratings for these criteria are aligned with the barriers identified by the same interviewees that have been grouped in the Capabilities and competencies, for example, lack of knowledge, experience, awareness, and training, especially among the investment system officials usually due to high turnover making it difficult to close complete cycles of application of policies, guidelines or regulations that allow evaluations and feedback. Some interviewees indicated that "*adequate ex-post evaluations are not carried out*" and that "*there is no record of lessons learned*". After the survey of this work, the General Methodological Guidelines for the Ex post Evaluation of Investments were issued, where one of its objectives is "to generate knowledge to provide feedback on the phases of the investment cycle and the management of investments for future planning of investment initiatives" (MEF-DGPMI, 2021), indicating that the recommendations and lessons learned from the ex-post evaluation "should be sent to the entities involved in the phases of the investment cycle and other related organizations so that they can be used and are applied". It would also be important that the process contemplates as a requirement, in the formulation and evaluation stage, the review of the lessons learned in similar projects, to identify risks and promote the cycle of continuous improvement based on the experience that is generated as part of the same system.

The Environmental dimension includes the lowest valued criterion: *C6 – Energy* which includes new topics to Peru's context that requires national politics, capacity development, technology, innovation, and therefore greater investment. Among them are, for example, the use of energy-efficient materials, renewable energies, design principles that prioritize energy efficiency, carbon footprint, alternative energy solutions, products/services designs that emit less CO₂, and offsetting CO₂ when residual emissions occur. Likewise, the other criteria from this dimension include issues like carbon footprint reduction, use of materials and chemical products that do not harm the planet, reuse, recovery/recycling and minimizing waste, circular economy, water, and air quality, restoration of livelihoods, and biological diversity.

The low scores are aligned to the identified barriers like the design of projects that do not incorporate new technologies, lack of multidisciplinary teams that include environmental professionals, lack of international environmental standards implementation, and lack of knowledge of new sustainable and efficient practices, technology, and techniques. These results are associated with the diagnostic data presented in Decreto Supremo N°023-2021-MINAM

that approve the National Environmental Policy by 2030, where it is indicated that only in the year 2019, the state has invested 2102.52 million soles in budget programs aimed at solving environmental problems. Among the identified problems underlying the Environmental Policy are, for example, intensive use of low-efficiency and carbon-intensive technology; insufficient incentives for the implementation of eco-efficient and sustainable businesses; limited use of renewable energies and use of clean fuels; inefficient and unsustainable use of water resources; breach of environmental obligations; inadequate management of chemical substances; environmental liabilities with limited attention; inadequate solid waste management; high discharges of residual waters; high emissions of polluting gases; Insufficient environmental technological and scientific knowledge for environmental management, innovation and sustainable development; among others.

According to the General Guide for the Identification, Formulation, and Evaluation of Investment Projects (MEF-DGPMI, 2022), the PIP evaluation process includes seven elements, including the sustainability analysis, which is defined as the process that seeks “measure the capacity to produce goods and services planned, uninterruptedly throughout the useful life of the Project”, being a “particularly important aspect of sustainability to analyze the financial capacity of the Project to cover its operation and maintenance costs”. This approach is more economical, but also includes the social evaluation and the estimation of social profitability indicators through cost-benefit or cost-effectiveness, but little or nothing explicitly related to the environmental dimension is included. However, recently practically these environmental criteria considered in this study have been incorporated into the methodology for prioritizing the 72 infrastructure projects for the period 2022-2025 (Gobierno del Perú - Ministerio de Economía y Finanzas, 2022). These are resilience and adaptation to climate change; disaster risk management; natural infrastructure and nature-based solutions; Improving and monitoring environmental quality (air, water, and soil); Efficient use of resources and circular economy; Water and energy efficiency; Waste management and recycling, and GHG quantification. The impact of these new regulatory guidelines will be seen in the coming years.

The Economics dimension includes the third lowest criterion: C11: *Business agility*, which includes recognizing that changes are inevitable and decisions are carried out at the appropriate time that allows flexibility in the execution of the project and whether requirements are adjusted to achieve a higher sustainability degree, and finally if creative ideas are sought to generate additional profits. The low score is consistent with the following identified barriers: inflexible regulatory framework; the investment system does not incorporate disruptive tools for the investment programming stage which limits the solutions; current regulations do not recognize contingency amounts for adequate risk management; there is not only concurrent participation of the Comptroller's Office, but also as an issuer of recommendations, so any modification of the project may be questioned and lead to civil or criminal sanctions.

The rigid regulatory framework includes the law on contracting with the state, where most investments are managed through a budget based on the lump sum contracting system, which applies "when the quantities, magnitudes, and qualities of the provision are defined in the technical specifications, in the terms of reference or the case of works, in the plans, technical specifications, descriptive memory or respective work budget..." (Decreto Supremo N°344-2018-EF), therefore, the price factor prevails during the adjudication of State tenders. This condition generates that, if the sustainability criterion is not defined as requirements of the work, product, or service, it is not considered by the bidders so as not to generate additional expenses that could put them at a disadvantage compared to their competition. According to Sologuren (2017), in some sectors, such as in the case of works, more than 70% of selection processes are carried out by lump sum, presenting recurring events in which deficiencies, omissions, defects, or gaps are identified that prevent the proper execution of the work, giving

rise to the executor assuming costs of activities not contemplated in the technical file and the fact that public entities do not recognize it and therefore determine arbitration processes. According to interviewees, there should be incentives by the state, for example by a policy deployed in the regulations, so that the sustainability criteria were integrated from its conceptualization of the PIP and become operational in the technical file.

The Economic dimension also includes the *SC-Indirect benefits* valued with a low score (≤ 2.5), related to additional risks and opportunities and additional costs and benefits (see Table 2). These results are related to the identified barrier like the *lack of a PMO* to manage projects into a program so exploit synergies achieving greater benefits; or the *lack of alignment between different activities or elements of the PIP cycle*, leading to inefficiency which, according to the IDB (2019, p.6) is because countries cannot meet the quantity and quality of necessary investment or according to Garcés (2021) because the problem was not only in the Peruvian internal investment system but in the seven external systems such as the National Multiannual Programming and Investment Management System, the Budget and Indebtedness System, Supply System, the Treasury System, the Human Resources System, and the National Control System; therefore, to improve the effectiveness of the process, is necessary to look at the macro system as a whole, so that everything flows just in time. In the last National Plan for Sustainable Infrastructure for Competitiveness 2022-2025, the importance of PMOs has also been recognized as a lesson learned (already included in 2022 regulations such as DL N°1543 for Public Private Partnership projects) as well as the need to implement measures to standardize and optimize critical procedures.

Several of the weak sustainability criteria identified in this study have also been identified in similar studies from other contexts, such as low scores for aspects related to waste management, promotion of diversity and equal opportunities, improvement of the social and cultural values of local communities (Michaelides, Bryde & Ohaeri; 2014); lack of sustainability knowledge, lack of awareness and concern at project practitioner, companies and public level, high implementation cost, insufficient research and development, limited knowledge transfer, and finally inadequate policy and legislation (Zuofa & Ochieng (2016) where a state strategic role could significantly impact to achievement of the goals committed in the framework of the United Nations agreements (IDB, p.10, 2019).

The IDB proposes a common vision of sustainability by establishing the meaning of the sustainability criteria for the economic and financial, environmental and climate, social and institutional resilience dimensions, through 14 sub-dimensions with areas of action (IDB, 2019). Being precisely the IDB that provided technical assistance to Peru for the preparation of the National Plan of Sustainable Infrastructure for Competitiveness 2022 – 2025 (Gobierno del Perú - Ministerio de Economía y Finanzas, 2022), this plan now includes significant changes in favor of sustainability. In principle, it is recognized, as a lesson learned from the previous plan, that in Peru there is no definition of sustainable infrastructure, whose approach is included in the public and public-private investment systems, with prioritization indicators like those of IDB; so the new plan seeks to incorporate an approach based on the development of sustainable infrastructure, where the "projects are planned, designed, built, operated and dismantled in a way that guarantees economic and financial sustainability, social, environmental (including climate resilience) and institutional throughout the life cycle of the Project". Likewise, it seeks to align with "international infrastructure sustainability standards included in the Organization for Economic Cooperation and Development and the United Nations Sustainable Development Goals" (Gobierno del Perú - Ministerio de Economía y Finanzas, 2022, p. 7 - 8). This model seeks to cover the entire life cycle of the project, also considering that these dimensions are already part of the investment analysis and risk management of creditors, investors, and insurers around the world. Therefore, in this plan 2022 -2025, the indicators for the prioritization,

monitoring, and evaluation of projects in strategic sectors, include 07 indicators of the financial-economic component with a weight of 36.4%, 6 indicators of the social component with a weight of 32.4%, 2 indicators of the institutional with a weight of 10.2% and 5 indicators of the environmental component (which includes climate resilience) with a weight of 21.1%.

Although it has been a significant advance incorporating these new components, to provide a more comprehensive approach to sustainability, however, it is still necessary to continue complementing the measures in an accelerated manner to achieve the essential impact on the SDGs. For example, it is needed to establish similar applicable criteria, for the selection, monitoring, and evaluation of the other types of PIP that allow them to be compared with each other and even better if they are aligned with international criteria that allow us to compare ourselves with other countries.

It is also important to take into account that there are two approaches to target sustainability, one through the results of the PIP, for example, the construction of a solar photovoltaic plant to diversify energy sources; and the other approach is by sustainable management of each of the PIP that are carried out, considering sustainability criteria like the evaluated in the present study. National strategies, through PIPs, can deploy in both ways, but of course with specific methodologies and evaluation tools.

Finally, just as it is important to establish a mechanism to assess to what extent sustainable PIPs and the sustainable management of PIPs close the gaps for the achievement of the SDGs, in the same way it is important to have baselines to be able to monitor progress. and measure the effectiveness of strategies. The results of this study, coming from the perspective of practitioners with experience in PIPs, can serve as a basis to be related or contrasted with other studies that consider other types of primary sources, either before or after the implementation of sustainability criteria in the different types of PIPs.

Conclusion

From the 12 criteria studied, *C3-Human rights*, and *C4-Etichal behaviors*, are the most valued with scores over 3 (1 to 4 scale), while the other 10 were valued between 2 and 3, where criterion *C6-Energy* was the lowest one; which means that there is needed policies, provisions, and work plans to promote them.

The trends found were that the criteria of the social dimension are integrated to a greater degree than the criteria of the other two dimensions: economic and environmental.

Finally, there were very interesting barriers identified by the practitioners interviewed, those were grouped into six topics: Regulatory framework; Corruption, bribery, and transparency; Capabilities and competencies; and Promotion, diffusion, awareness, and values.

The results contribute to a baseline for taking action, for example, to the academy, several fronts of studies are proposed: 1) best instrument for measuring the integration of sustainability in PIPs, considering the best practices, the different phases of the investment cycle, the different kinds of public investments, and the framework and criteria proposed by the BID for sustainable infrastructure or by National Plan of Sustainable Infrastructure for Competitiveness 2022 - 2025; and 2) To measure the integration of sustainability into PIP from the formulation, evaluation, or execution data projects from *invierte.com* web. For the Peruvian state, this study sheds light on the main sustainability criteria that can be prioritized in a strategy to integrate sustainability in the PIPs for the achievement of the Sustainable Development Goals by 2030.

Limitations

One of the main limitations of the study is the population since there is no list of all the practitioners who work in PIPs in Peru, for which the organization, formally most representative in project management was identified, the PMI Lima Peru chapter. Nor was there a list of all the practitioner members of this organization who meet the criteria of the population (who have experience in at least one PIP), so an initial survey was carried out to identify them, presenting a probable bias since we worked from those who responded indicating that they met the criteria established for the population.

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