


Public investment in technological development and infrastructure of the education sector in Lima Provinces period 2014-2023

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ABSTRACT

Public investment in technological development and education sector infrastructure ensures that students and teachers become familiar with emerging technologies and acquire digital skills. The objective of the study was to determine the budget allocation in the education sector of the regional government of Lima Provinces and to analyze the percentage of this investment in the technological development and infrastructure of this sector during the period 2014-2023. The study was developed under a quantitative perspective of descriptive level, within the framework of the Friendly Consultation Platform of the Ministry of Economy and Finance (MEF). While significant advances were observed in technological infrastructure and curriculum adaptability, challenges related to teacher training and equity in access to resources also emerged. This investment period reflects the priority and commitment of the regional government of Lima Provinces to the modernization of the education system, although it also highlights the need for continuous evaluation to optimize future investments.

Keywords: Public investment, Educational quality, Financial resources, Educational services.

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INTRODUCTION

Public investment in technological development and educational infrastructure is essential to guarantee the equity, quality and modernization of the education system. Beyond improving facilities and access to advanced technologies, this investment is a pillar for the development of human capital, essential for sustainable economic growth. However, in many developing countries, resources allocated to these areas are insufficient due to competition with other priority sectors such as health and safety. For example, in Nigeria, investment in education remains limited despite its economic importance (Adetula et al., 2017).

The allocation of funds is often unequal, exacerbating disparities between urban and rural areas, affecting the educational opportunities of students in rural areas (Wang et al., 2019). In addition, poor management and inefficiency in the implementation of projects significantly reduce the impact of investments. Factors such as corruption and lack of transparency contribute to the failure of government projects (Damoah et al., 2018).

In Latin America, one of the most unequal regions in the world, rural and indigenous communities receive a fraction of the investment destined for urban areas, perpetuating inequalities in access to quality education. In Brazil, inequalities in local income have generated a wide financing gap, while in countries such as Chile and Ecuador, progressive spending on education is maintained (Bertoni et al., 2020). However, economic instability and frequent changes in education policies have affected the ability of governments to sustain sustained investment in education infrastructure, a problem exacerbated by falling tax revenues due to lower commodity prices (Kwon et al., 2017).

In Peru, efficiency in the execution of public investment projects in education has been a constant challenge. In Sanagorán, La Libertad, more than 75% of public investment projects were viable, but their impact was limited by the lack of capacity in their management (Muñoa et al., 2019). Likewise, investment in science, technology and innovation in Peru has been insufficient, which has limited the country's technological and scientific development. A recent study noted that the allocation of financial resources was inefficient, with minimal impact on GDP (Quispe Alvarado et al., 2023).

One of the main challenges in the Peruvian education sector is insufficient investment, which remains inadequate to meet the growing and diverse needs of the student population (Inquilla-Mamani & Rodríguez-Limachi, 2019). Although the budget for education has increased, the implementation of these funds is alarmingly low; Between 2016 and 2020, only 40% of the programmed budget was executed. This lack of resources and implementation limits the ability of the education system to provide quality services, adequate infrastructure, up-to-date teaching materials, and fair training and remuneration for teachers. Low budget execution is especially worrying due to the clear correlation between investment and economic growth (Tuesta, 2021). This execution deficit



represents a significant loss of opportunities for the country, particularly in those regional governments that, despite managing considerable budgets, do not make investments commensurate with the size of their population.

Public investment in educational technology and infrastructure is crucial at the global level, as it drives both the educational and economic development of countries. Various experiences have shown that collaborations between governments and companies in educational technologies (EdTech) are effective in improving access to and quality of education, while promoting economic growth and strengthening international political alliances (Udanoh & Zouria, 2023). In addition, investment in educational infrastructure tends to be concentrated in regions with favorable conditions, influenced by factors such as diplomatic visits and the availability of natural resources (Hu et al., 2023). In India, the construction of new schools and libraries has been shown to improve school enrolment and academic skills, although the impact varies depending on the type of investment (Cunningham et al., 2018).

In Peru, research on public investment in educational infrastructure has revealed that, although these investments have improved school attendance, their impact on educational quality has been limited (Paxson & Schady, 2002). Programs that increased access to computers and the Internet in Peruvian high schools did not show significant effects on student repetition, dropout, or enrollment (Cristia et al., 2017). In addition, the effectiveness of public investment in education has been questioned, since factors such as the quality of school infrastructure and the coverage of basic services have a greater influence on educational attainment (Silva Gil & Tejada Vidal, 2021).

Recent studies indicate that the allocation of financial resources in Peru has been inefficient, with minimal impact on GDP, highlighting the need to improve spending efficiency at the local level (Quispe Alvarado et al., 2023). Investment in infrastructure in Peru has shown a strong relationship with economic development, integrating social, economic, and humanistic components (Romero Escalante, 2023). Scientific production in Peruvian universities has not been significantly influenced by research policies, suggesting the need to strengthen collaboration and training in research (Millones-Gómez et al., 2021). Likewise, the expansion of infrastructure is presented as a potentially effective strategy for economic growth, depending on financing schemes (Montaud et al., 2020).

Public investment is defined as the disbursements made by the government to develop infrastructure and public services in order to stimulate economic growth and improve social welfare. This type of investment is essential for the creation of physical and human capital, and for the provision of essential public goods and services. According to Delitheou et al. (2019), it contributes significantly to economic growth and the quality of life of citizens, but they must be reconciled with new development models and international governance rules to effectively support private investment. Warner (2014) states that public investment encompasses government expenditures that



aim to create infrastructure, provide essential services, and promote economic development, constituting a fundamental pillar for long-term economic growth and stability.

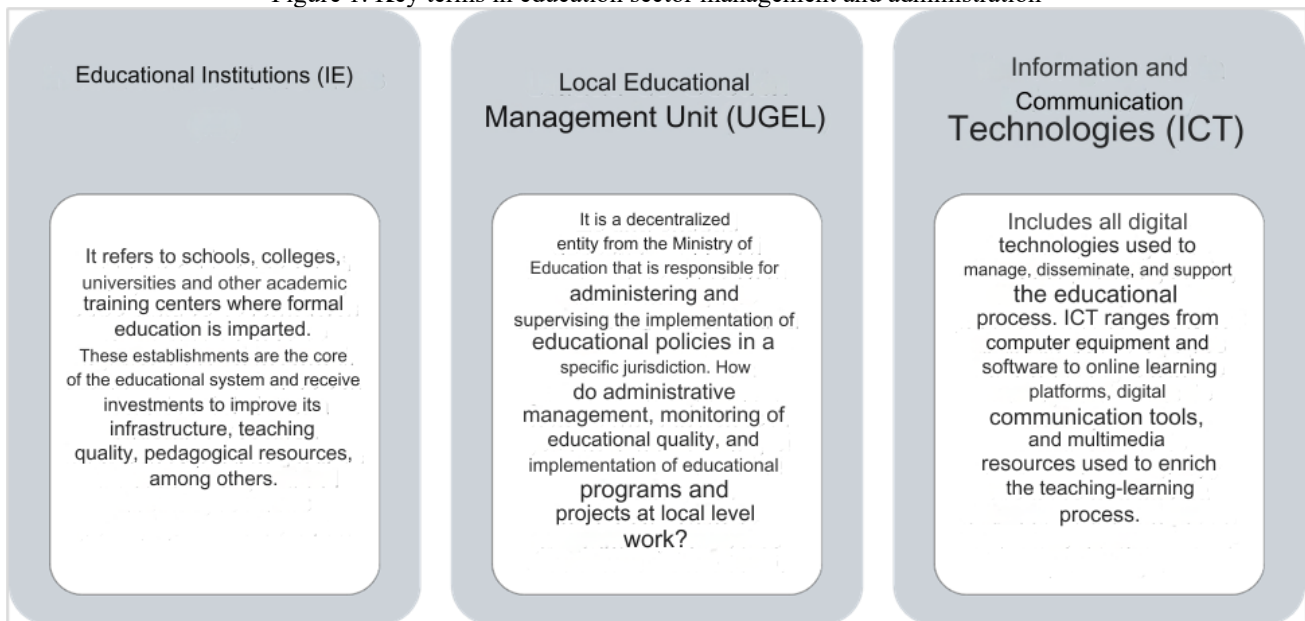
"Investment in the technological development of the education sector" refers to resources allocated by the government or educational institutions for the implementation, improvement, and expansion of technologies that support and enhance teaching and learning. This investment includes the acquisition of technological equipment, development of digital infrastructures, teacher training in technological skills, and the integration of information and communication technologies (ICT) into the educational curriculum (Manjarres Marquez & Salazar Ramos, 2021). New technologies in education improve the quality of teaching and self-learning by providing various virtual tools to strengthen knowledge, share ideas, and encourage critical thinking (Pérez et al., 2023).

Public investment in education sector infrastructure refers to funds earmarked by the government for the construction, maintenance, and improvement of educational facilities, such as schools, universities, laboratories, libraries, and other spaces needed to support teaching and learning. This investment seeks to ensure that educational facilities are safe, accessible, and adequate to provide quality education. Glewwe and Muralidharan (2016) describe public investment in educational infrastructure as "the financial resources allocated by the public sector for the construction and improvement of physical infrastructure in educational institutions, with the aim of creating an environment that favors learning and educational equity.

The "Modified Institutional Budget (MIP)" refers to the adjusted budget of a government entity during a fiscal year, after incorporating approved modifications such as extensions, reductions, or redistributions of funds initially allocated. The PIM reflects the final amount available to execute during the year, after considering all changes that affect resource allocation. According to the Ministry of Economy and Finance of Peru (MEF), the PIM is "the result of the Institutional Opening Budget (PIA) adjusted by all the budget modifications authorized during the fiscal year, representing the current budget to which the entity must adhere for its execution."

In the context of public policies and resource allocation, Educational Institutions (EI), the Local Educational Management Unit (UGEL) and Information and Communication Technologies (ICT) are key terms in the management and administration of the education sector (see Figure 1). The effective integration of them is crucial to improve educational management and promote quality education in diverse and decentralized environments (Quimper et al., 2024).

Figure 1: Key terms in education sector management and administration



Source: The authors

This study is based on the theory of human capital, proposed by Gary Becker, which argues that investment in education and human skills is essential for economic growth. Investment in educational infrastructure not only improves productivity, but also drives technological advances and expands employment opportunities, contributing to sustainable and inclusive economic growth (Pal, 2023; Vanhuyse, 2007). In this context, improvements in educational infrastructure are key to increasing the quality of education and, consequently, the country's economic development. Based on this premise, the objective of this study was to determine the budget allocation in the education sector of the regional government of Lima provinces and to analyze the percentage of this investment in the technological development and infrastructure of this sector during the period 2014-2023.

METHODOLOGY

This study was developed under a quantitative approach with a descriptive design, aimed at analyzing the budget allocation of the education sector of the regional government of Lima Provinces and its investment in technological development and infrastructure during the period 2014-2023.

The study population was made up of the public investment budgets allocated to the education sector by the regional government of Lima Provinces during the period 2014-2023. The sample included all records of investment in educational infrastructure, information and communication technologies (ICT), and other relevant subsectors, as detailed in the reports of the Ministry of Economy and Finance (MEF).

The Friendly Consultation Platform of the Ministry of Economy and Finance (MEF) was used as the main tool for data collection. This platform allows access to detailed information on the



allocation and execution of the public budget, which was essential to analyze investment in the education sector.

The procedure followed for data collection included the following steps:

- 1) **Access to the MEF's Friendly Consultation Platform:** The platform was accessed to obtain public investment data for the years 2014 to 2023.
- 2) **Selection of Investment Categories:** Specific categories related to the education sector were selected, including Educational Institutions, Local Educational Management Unit (UGEL), and Information and Communication Technologies (ICT).
- 3) **Data Extraction and Organization:** Data were extracted and organized into tables and graphs for easy analysis. Particular attention was paid to annual changes in budget allocations and investment trends in each category.
- 4) **Data Analysis:** A descriptive analysis of the data was carried out to identify investment patterns and evaluate the impact of public policies on the development of educational infrastructure and technology in the region.

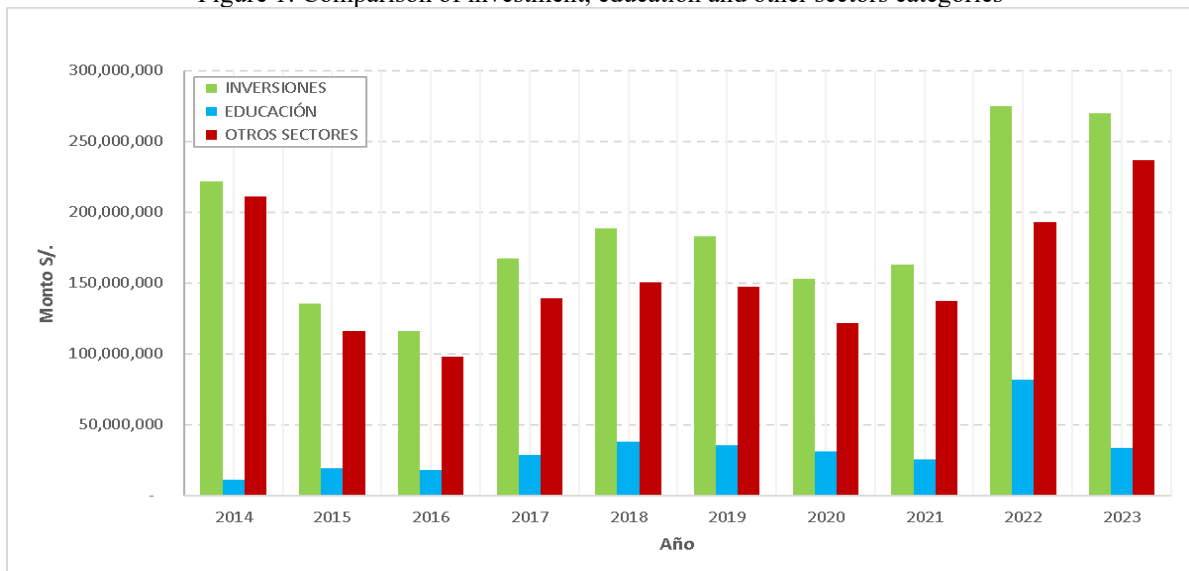
Data analysis was carried out using descriptive statistical techniques, such as percentage and average calculations, to identify trends in budget distribution in the education sector over time. Graphs and tables were used to visually represent the results and facilitate the interpretation of the data.

Good practices in data collection and management were guaranteed, ensuring the integrity and reliability of the information obtained from official sources. In addition, the confidentiality of any sensitive data related to public finances was respected.

RESULTS

ANALYSIS OF THE PIM OF INVESTMENTS OF THE REGIONAL GOVERNMENT OF LIMA PROVINCES

Figure 1: Comparison of investment, education and other sectors categories

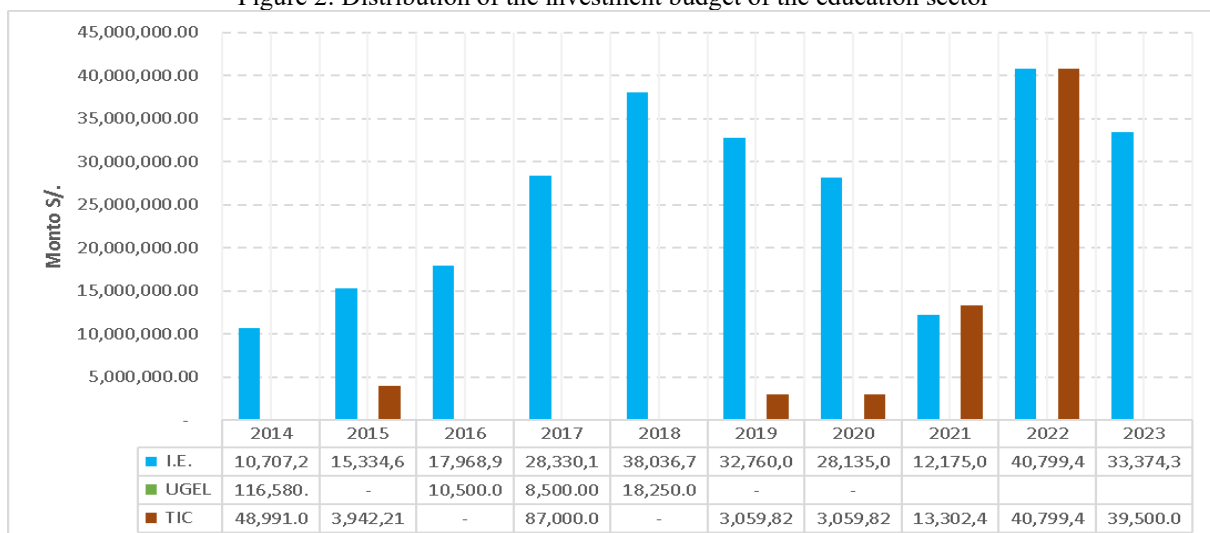


Source: MEF

Figure 1 shows the investments of the regional government of Lima provinces in three categories: Investments, Education and Other Sectors, during the period 2014-2023. The Investments category has consistently been the highest, with a notable increase through 2019, followed by a drop in 2020 and a subsequent recovery through 2023. Investment in Education also fluctuated, reaching its peak in 2019, then declining in 2020 and recovering in the following years. The amounts allocated to Other Sectors were generally lower, although they also showed an increase towards the end of the period. Taken together, these data reflect the regional government's focus on strengthening infrastructure and education, adjusting investments according to regional priorities and needs, and responding to changing economic and social dynamics.

INVESTMENT IN THE EDUCATION SECTOR COMPARED TO OTHER SECTORS

Figure 2: Distribution of the investment budget of the education sector



Source: MEF



Figure 2 shows the distribution of the investment budget in the education sector during the decade from 2014 to 2023, focused on three areas: Educational Institutions (EI), Local Educational Management Unit (UGEL) and Information and Communication Technologies (ICT). Investments in Educational Institutions show a growing trend, reflecting a continuous commitment to the improvement of educational infrastructure. Investments in UGEL, although minor and sporadic, seem to respond to specific needs or specific projects. From 2021 onwards, there has been a significant increase in ICT investments, suggesting a strategic focus on the digitalisation of education, possibly accelerated by the COVID-19 pandemic.

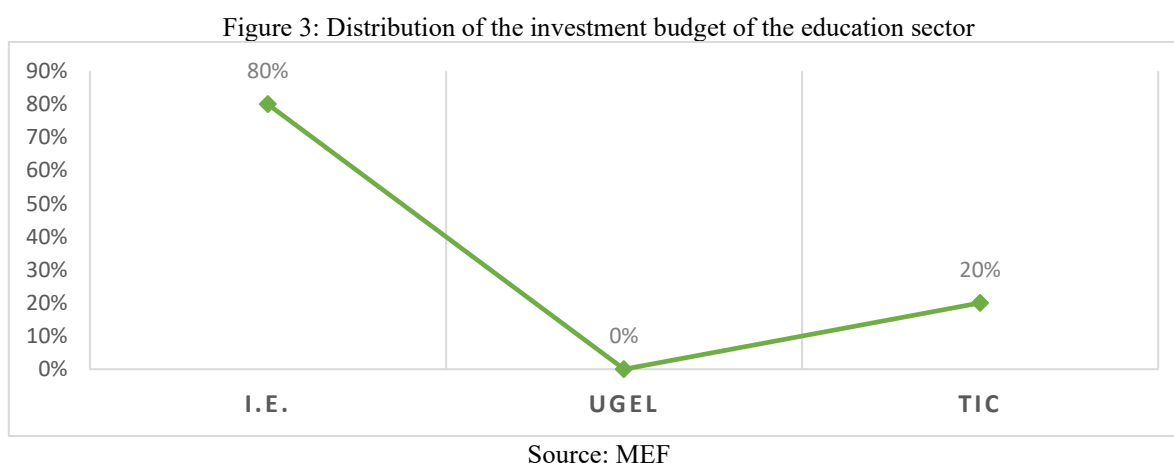


Figure 3 shows the distribution of the investment budget in the education sector. 80% of the budget is allocated to Educational Institutions (EI), highlighting a strong focus on improving physical infrastructure and school resources, including the construction, renovation and provision of materials and equipment. 20% of the budget is allocated to Information and Communication Technologies (ICT), reflecting a commitment to technological modernization to improve the quality and accessibility of digital learning. No budget is assigned to the Local Educational Management Unit (UGEL), which suggests that these investments were not a priority in this period or were covered with other funds.

DISCUSSIONS AND CONCLUSIONS

The analysis of the modified institutional budget (PIM) of the regional government of Lima Provinces reveals significant trends in the allocation of resources to the education sector during the period 2014-2023. Investment in educational infrastructure, particularly in Educational Institutions (EIs), showed a steady increase, reflecting the commitment to improving physical infrastructure and the provision of educational materials. However, investment in Information and Communication Technologies (ICT) only began to be prioritized from 2021, suggesting a strategic response to the growing need for digitalization driven by the COVID-19 pandemic.



The focus on improving physical infrastructure, with 80% of the budget allocated to EI, contrasts with the limited allocation for ICT, which only accounted for 20% of the total budget. This distribution reflects a traditional vision of educational investment, where physical infrastructure has been a priority. However, the pandemic highlighted the need to strengthen technological infrastructure to guarantee educational continuity in emergency situations, which has led to a change in budget prioritization in recent years, as mentioned by Glewwe and Muralidharan (2016).

A highlight of the results is the absence of investment in the Local Educational Management Units (UGEL) during the period analyzed, which could indicate that these entities were not considered a priority or that their needs were covered by other sources of financing. This lack of investment could have implications for management and supervision capacity at the local level, potentially affecting the effective implementation of educational policies in school institutions, as suggested by Silva Gil and Tejada Vidal (2021).

The study confirms that public investment in the technological development and infrastructure of the education sector in Lima Provinces has been key to the modernization of the regional education system, according to Quispe Alvarado et al. (2023). The strong prioritization of investments in physical infrastructure has allowed significant improvements in the conditions of Educational Institutions, although this has been to the detriment of investment in digital technologies. The COVID-19 pandemic catalyzed a shift in budget allocation towards ICTs, highlighting the importance of a more balanced and adaptive approach to budget planning.

However, the lack of investment in LGUs suggests the need to reevaluate resource allocation strategies, considering the crucial role of these units in the management and continuous improvement of the education system at the local level. Millones-Gómez et al. (2021) suggest that the prioritization of ICT in recent years is a positive step, but its long-term sustainability and effectiveness depend on a coherent integration with existing educational infrastructure and the development of digital competencies among teachers and students.

Among the limitations of this study is the focus on a specific region, Lima Provinces, which may limit the generalization of the findings to other regions of the country with different socioeconomic contexts and educational challenges. In addition, reliance on secondary data from the MEF's Friendly Consultation Platform may have limited the depth of analysis in terms of the quality and accuracy of the information available.



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