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The role of ISO 21001 in quality enhancement: an analysis of Ecuadorian higher technical and technological institutes

O papel da norma ISO 21001 no aprimoramento da qualidade: uma análise dos institutos técnicos e tecnológicos superiores do Equador

El rol de la norma ISO 21001 en la mejora de la calidad: un análisis de los institutos superiores técnicos y tecnológicos ecuatorianos

Jaime Hernán Acurio Masabanda
https://orcid.org/0000-0002-1564-6950
Professor at Universidad Técnica de Cotopaxi, Ecuador
jaime.acurio@utc.edu.ec (correspondence)

Milton Fernando Hidalgo Achig
https://orcid.org/0000-0001-5184-3110
Professor at Instituto Superior Tecnológico Vicente León, Ecuador

Germanico Sinchiguano Molina
https://orcid.org/0009-0006-8400-6072
Graduate Researcher. Universidad de las Fuerzas Armadas ESPE, Ecuador

Marco Vinicio Sandoval Cárdenas
https://orcid.org/0000-0002-0392-2276
Professor at Instituto Superior Tecnológico Vicente León, Ecuador

Juan David Iza Garnica
https://orcid.org/0000-0002-2926-358X
Professor at Instituto Superior Tecnológico Vicente León, Ecuador

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This article is one of the few empirical studies in Ecuador regarding ISO 21001 implementation with accreditation outcomes in TTHEIs, combining national frameworks with international quality standards.

ABSTRACT

In Ecuador, higher technical and technological institutes (HTTIs) face significant challenges in achieving quality accreditation and public legitimacy. This study evaluates the ISO 21001 standard as a potential internal quality management tool to improve performance, accreditation outcomes, and institutional perception. Adopting a non-experimental, correlational, and descriptive methodology, surveys were conducted with 300 educators and administrators across 100 HTTIs, alongside 300 high school students and recent graduates. Results reveal that only 21% of HTTIs are currently accredited, while 67% remain under conditional accreditation. Teachers cite weak institutional management and insufficient state support as primary barriers to quality, while students highlight limited program offerings and low employability of graduates. A strong positive correlation was found between the application of ISO 21001 principles and improved accreditation results. The analysis identifies alignment between the national evaluation model by Higher Education Quality Assurance Council (*Consejo de Aseguramiento de la Calidad de la Educación Superior - CACES*) and ISO 21001's quality criteria, reinforcing the standard's relevance. The study concludes that ISO 21001 offers an actionable and internationally validated framework to guide Ecuadorian HTTIs toward operational excellence, stakeholder satisfaction, and improved institutional credibility. Recommendations include fostering internal quality assurance cultures and promoting policy support to facilitate implementation.

Keywords: Educational management; quality of education; higher education; accreditation.

RESUMO

No Equador, os institutos técnicos e tecnológicos superiores (HTTIs) enfrentam desafios significativos para obter o credenciamento de qualidade e a legitimidade pública. Este estudo avalia a norma ISO 21001 como uma possível ferramenta interna de gestão da qualidade para melhorar o desempenho, os resultados do credenciamento e a percepção institucional. Adotando uma metodologia não experimental, correlacional e descritiva, foram realizadas pesquisas com 300 educadores e administradores em 100 HTTIs, além de 300 alunos do ensino médio e recém-formados. Os resultados revelam que apenas 21% dos HTTIs são atualmente credenciados, enquanto 67% permanecem sob credenciamento condicional. Os professores citam a fraca gestão institucional e o apoio estatal insuficiente como as principais barreiras à qualidade, enquanto os alunos destacam as ofertas limitadas de programas e a baixa empregabilidade dos formandos. Foi encontrada uma forte correlação positiva entre a aplicação dos princípios da ISO 21001 e a melhoria dos resultados de credenciamento. A análise identifica o alinhamento entre o modelo de avaliação nacional do Conselho de Garantia da Qualidade do Ensino Superior (Consejo de Aseguramiento de la Calidad de la Educación Superior - CACES) e os critérios de qualidade da ISO 21001, reforçando a relevância da norma. O estudo conclui que a ISO 21001 oferece uma estrutura acionável e validada internacionalmente para orientar os HTTIs equatorianos rumo à excelência operacional, à satisfação das partes interessadas e ao aumento da credibilidade institucional. As recomendações incluem a promoção de culturas internas de garantia de qualidade e a promoção de apoio político para facilitar a implementação.

Palavras-chave: Gestão da educação; qualidade da educação; ensino superior; acreditação.

RESUMEN

En Ecuador, los institutos superiores técnicos y tecnológicos (IETT) se enfrentan a importantes retos para lograr la acreditación de calidad y mejorar la legitimidad pública. Este estudio evalúa la norma ISO 21001 como potencial herramienta de gestión interna de la calidad para mejorar el desempeño, los resultados de la acreditación y la percepción institucional. Adoptando una metodología no experimental, correlacional y descriptiva, se realizaron encuestas a 300 educadores y administradores de 100 HTTI, junto con 300 estudiantes de secundaria y recién graduados. Los resultados revelan que sólo el 21% de los HTTI están actualmente acreditados, mientras que el 67% permanecen bajo acreditación condicional. Los profesores citan la débil gestión institucional y el insuficiente apoyo estatal como principales obstáculos a la calidad, mientras que los estudiantes destacan la limitada oferta de programas y la escasa empleabilidad de los graduados. Se encontró una fuerte correlación positiva entre la aplicación de los principios de la norma ISO 21001 y la mejora de los resultados de acreditación. El análisis identifica una alineación entre el modelo nacional de evaluación del Consejo de Aseguramiento de la Calidad de la Educación Superior (CACES) y los criterios de calidad de ISO 21001, lo que refuerza la relevancia de la norma. El estudio concluye que la ISO 21001 ofrece un marco práctico e internacionalmente validado para guiar a los HTTI ecuatorianos hacia la excelencia operativa, la satisfacción de las partes interesadas y la mejora de la credibilidad institucional. Las recomendaciones incluyen el fomento de culturas internas de garantía de la calidad y la promoción del apoyo político para facilitar la aplicación.

Palabras clave: Gestión educativa; calidad de la educación; enseñanza superior; acreditación.

INTRODUCTION

We live in a globalized world in which it is evident the growing trend towards quality originated in recent years, in the business sector regardless of the type of product or service offered, the search for quality and continuous improvement is imperative to survive in the highly competitive market, and the educational field is no exception, in the educational centers where future professionals are trained, it is even greater the need for quality to be immersed in the teaching-learning processes, since they play a key role in promoting the development and welfare of society.

It is essential for governments to provide all inhabitants with a complete and quality education that guarantees equivalence of results and equal opportunities (Martínez, et al., 2024). At the end of the 1990s, when middle class social sectors began to migrate towards private education institutions, due to the quality crisis in public education (Alonso, Acosta & Calmet, 2024). Different national, international and supranational organizations and institutions have shown their concern for inequity in access and quality, reflecting it among their main lines of action (Otero, Vélaz & Expósito, 2021).

Education can be understood as a phenomenon that establishes and perpetuates practices, schemes and power relations, through relationships that occur in specific fields that interact with each other. Consequently, it is necessary to pay special attention to the ways in which educational systems are configured and re-signified and, especially, if the type of practices developed by the different actors are quality-oriented (Barragán, Pirela & Riaño, 2024).

In this regard, the Constitution of the Republic of Ecuador (2015) in Art. 352 establishes: "The higher education system shall be composed of universities and polytechnic schools; higher technical, technological and pedagogical institutes; and music and arts conservatories, duly accredited and evaluated." (p.158) Furthermore, art. 351 establishes that the higher education system shall be governed by the principles of responsible autonomy, co-government, equal opportunities, quality, pertinence, integrality, self-determination to produce science and knowledge, within the framework of the dialogue of knowledge, universal thought and global scientific and technological production. (p.158).

The institutes of higher education are included in the higher education system, which despite being the majority, represent only 11% of enrollments compared to 89% of universities and polytechnic schools. The situation of the higher education institutes is unfavorable, the evaluation processes developed by the Council for Quality Assurance in Higher Education since 2007 to date have reflected serious management problems, the high index of institutes that currently continue with limitations that prevent them from obtaining accreditation and are strongly conditioned, This reflects that the evaluation and accreditation processes alone have not been sufficient, there has been slight progress, but there is a clear need for an efficient continuous improvement mechanism to increase the quality and efficiency of their programs, the adequate use of resources, articulating the educational offer with the real needs of the labor market.

It is important that educational programs involve innovation, research, teaching and linkage with society as a whole where quality is the central axis, in this sense it is necessary that they work from two factors, the external one since they must comply with the current regulations governing the higher education system and other provisions issued by regulatory agencies where it includes meeting mandatory accreditation requirements and internally manage quality autonomously, In this regard, an interesting tool is the ISO 20001 standard oriented to the management systems of educational institutions. This standard will allow Ecuadorian institutes to increase management efficiency and raise quality levels to international standards.

Teaching, like the other substantive components, is a key element in the quality of the training process; therefore, it must possess the knowledge, experience and resources necessary to offer students the necessary level of quality in teaching (Pozo, Poza & Aguayo, 2024). One of the objectives of quality management in higher education is to ensure good functioning at the administrative, procedural and functional levels to, among other issues, guarantee the training of students, remembering that the organizational efficiency and administrative quality of an educational institution translate directly into academic excellence (Martínez, Rodríguez & García, 2024).

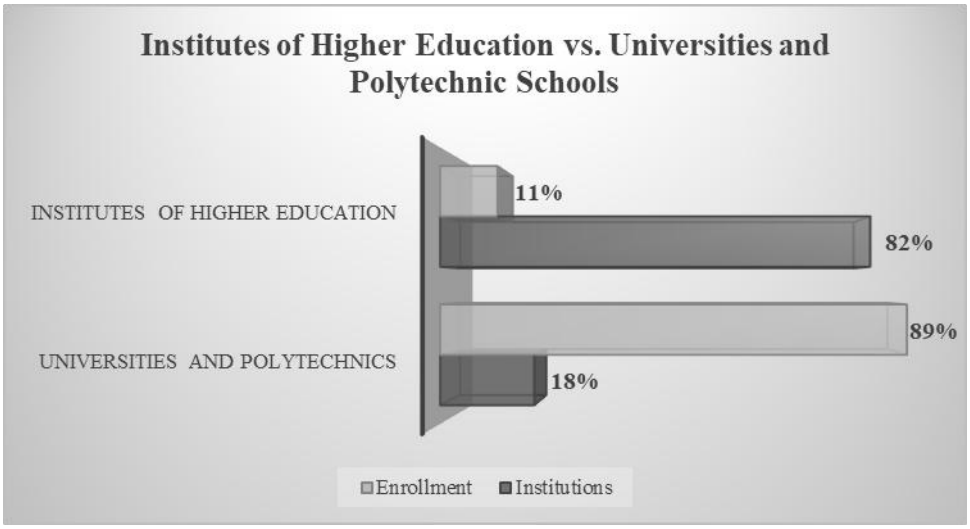
It is evident that there are still difficulties in the quality evaluation processes derived from the normative nature of education and the problems of valuing diversity within an impact agenda (García et al., 20224). Given the above, the present research consists of analyzing the feasibility of the ISO 21001 standard created in 2018 as a mechanism for improving internal quality management and its close relationship with compliance with accreditation criteria and parameters.

Background of the study

The higher education system in Ecuador is made up of 348 institutions of which 61 are Universities and Polytechnic Schools and 287 correspond to Higher Technical, Technological and Pedagogical Institutes, Conservatories of Music and Arts. The academic offer of third level consists of 3,313 careers available, the predominant modality of the system is face-to-face, although at present the online, blended, hybrid distance and dual modalities have become more popular. The number of

institutions dedicated to technical and technological education represents 82% of the higher education system and universities and polytechnic schools 18%; however, in terms of enrollment, universities have a larger number of students (CES, 2021). Figure 1 illustrates this structural background of the described educational system.

Figure 1. Institutes of Higher Education vs Universities and Polytechnic Schools in Ecuador



Note: Own elaboration, based on CES (2021)

The present research has as a group of interest the segment of Higher Technical and Technological Institutes, institutions that go unnoticed and although they are part of the higher education system in Ecuador, they are unconsciously and involuntarily related exclusively to universities and polytechnic schools, technical and technological training is seen at a disadvantage compared to universities, In the programs, seminars and other actions that the government together with other organizations involved in higher education have undertaken in the last years, the focus is almost exclusively on universities and polytechnic schools, there is little reflection on the reality, problems and challenges facing technical and technological education in Ecuador. Analyses of the quality of higher education in most countries and especially in Ecuador focus on universities as a field of analysis and as the central spaces in the management of knowledge within a society. Technological institutes are a fundamental link in the management of knowledge and innovation.

The neglect of quality reflection in technological higher education is evidenced mainly by the fact that they are new institutions (Reinoso & Chicaiza, 2022, pp. 2-3). Higher institutes as well as universities and polytechnic schools are subject to accreditation processes where an external evaluation is carried out through an evaluation model that contains established parameters, "the substantive functions are evaluated in three dimensions: planning, execution and results, for each of which standards are determined, their fundamental elements and components, as well as the sources of information that the institutions must provide" (Orozco, Jaya, Ramos & Guerra, 2020) these procedures seek to guarantee quality higher education, understanding as quality what is determined by the Organic Law of Higher Education LOES (2018) art. 93:

> The continuous, self-reflective search for improvement, assurance and collective construction of the culture of higher education quality with the participation of all the strata of higher education institutions and the Higher Education System, based on the balance of teaching, research and innovation and linkage with society, oriented by relevance, inclusion, democratization of access and equity, diversity, responsible autonomy, integrality, democracy, knowledge production, dialogue of knowledge, and citizen values (p. 39)

After the last external accreditation evaluation, 65 of them are in a conditioned accreditation process and 82 in a strongly conditioned accreditation process, which are currently being evaluated by CACES, the Higher Education Quality Assurance Council (*Consejo de Aseguramiento de la Calidad de la Educación Superior*). Of the 66 technical and technological institutes not accredited by CACES, some have assurance or improvement plans. Additionally, 8 institutes were not evaluated, 5 are authorized to merge, 3 are in the process of accreditation and 2 are in the process of closing. (SENESCYT, 2021). In this context, Table 1 above illustrates the evaluation of technical and technological institutes in the most recent model structured by criteria and sub-criteria.

In addition to the criteria and sub-criteria, there are qualitative and quantitative indicators. It is important to remember, as mentioned by Santos et al. (2024), that the criteria are starting points of reference and the indicators are key characteristics of each dimension or criterion to delimit quality.

Table 1. Criteria and sub-criteria of the evaluation model for Higher Institutes**.**

Criterion	Subcriteria
Organization	✓ Planning and development ✓ Social management
Infrastructure	✓ Basic Infrastructure
Teachers	✓ Selection and pre-training ✓ Organization and development ✓ Remunerations
Teaching	✓ Academic training ✓ Computerization of the teaching process ✓ Citizenship training ✓ Practical training ✓ Library
R&D and innovation	✓ R&D and scientific and technical publications ✓ Innovation
Outreach to society	✓ Outreach planning and execution ✓ Presence in the community

Note: Obtained from the Evaluation Model for Technical and Technological Institutes.

Table 1. *Criteria and indicators of the evaluation model for higher education institutions.*

Criterion	Subcriteria	Total Indicators	Quantitative	Qualitative
Organization	2	7	0	7
Infrastructure	1	4	2	2
Teachers	3	10	7	3
Teaching	5	17	5	12
R&D and innovation	2	3	1	2
Outreach to society	2	2	0	2
Total	15	43	15	28

Note: Obtained from the Evaluation Model for Technical and Technological Institutes.

To achieve higher levels of quality in higher education processes, it is necessary to consciously, in a planned, organized and evaluated manner, introduce effective actions to meet the challenges and make possible the execution of initiatives. And it also argues that the Ecuadorian model focuses on the results of the institutional objectives but does not focus on the indicators of the processes to achieve them, given that the patterns evaluate results and not the how it is obtained (Veliz, 2018). The LOES in art. 95 determines that the accreditation criteria and standards:

> The Council for Quality Assurance in Higher Education will establish models that will include quantitative and qualitative criteria and standards, which higher education institutions, careers and programs must achieve in order to be accredited; understanding that the ultimate goal is quality and not accreditation (p. 40).

Ibidem in art. 96 referring to internal quality assurance establishes:

> Internal quality assurance is a set of actions carried out by the institutions of higher education, with the purpose of developing and applying effective policies to promote the constant development of the quality of careers, academic programs; in coordination with other actors of the Higher Education System (p. 40).

Therefore, it is affirmed that internal quality assurance is the main axis that helps to achieve accreditation, if the higher institutes manage to increase the efficiency of institutional management and raise the levels of quality by articulating the actors of the institution in a global and coordinated manner, If the higher education institutions are able to increase the efficiency of institutional management and raise the levels of quality by articulating the actors of the institution in a global and coordinated manner, they will achieve the objectives set out in the strategic plans for institutional development (PEDI) and in the annual operating plan (POA), interrelating the three central axes of teaching, research and outreach, based on a continuous self-evaluation that allows permanent improvement, which will be reflected in the achievement of optimal levels of accreditation.

In agreement with Reinoso and Chicaiza (2022) who state that the LOES:

It is very clear in pointing out that quality must be evaluated to determine the state of the institutions and their careers, through the collection and systematization of quantitative and qualitative data that give way to the diagnosis of the components, functions and processes. This evaluation will be permanent and continuous. All institutions must undergo a process of accreditation, which is a certification of quality after having complied with international quality guidelines, standards and criteria.

In this sense an instrument of international character created recently specifically in 2018 is the ISO 21001 standard, it is an optimal instrument that revolutionizes the management of educational institutions and allows to interrelate the resources of the entity and focus on satisfying the customer who in this case are the students and other users or stakeholders. This is the first international standard that has a direct approach to educational institutions, taking into consideration that education, unlike business, not only involves a product or service, but also involves relationships between all stakeholders and greater social responsibility.

The ISO 21001 standard represents a tailored response to the unique organizational needs of educational institutions, providing a comprehensive and contextually relevant framework for internal quality assurance. It offers a more granular focus on educational dynamics such as learner outcomes, stakeholder satisfaction, and ethical governance (Aurachman, Studiyanti & Febriani, 2020; Wibisono, 2018).

Comparative studies demonstrate that ISO 21001 goes beyond structural alignment with ISO 9001 by incorporating education-specific clauses, thus positioning itself as a suitable and strategic alternative for academic institutions aiming for sustainable quality (Vorobyova et al., 2022). This specificity facilitates improved process management and stakeholder inclusion in educational environments, a key feature emphasized by Bretaña, Almaguer, and Bonilla (2024) in their implementation of ISO 21001 in postgraduate programs.

The literature further substantiates ISO 21001's capacity to act as a quality management backbone in a rapidly evolving educational landscape. As universities adapt to Industry 4.0 imperatives, ISO 21001 emerges as a vehicle to align institutional processes with digital innovation, stakeholder engagement, and process-oriented governance (Ülker, 2023). Scholars like Dwaikat (2021) have proposed integrative models combining Total Quality Management (TQM) philosophies with input, process, and output constructs (where ISO 21001 finds compatibility as a framework that supports comprehensive quality assessment in higher education institutions). In parallel, new educational settings such as Smart Learning Environments (SLEs), benefit from ISO-aligned systems that promote technological fluency and dynamic feedback mechanisms (Rosmansyah et al., 2023). Hence, educational quality becomes increasingly dependent not only on regulatory compliance, but on adaptive standards that mediate complexity with clarity.

In addition to these institutional advantages, ISO 21001 has proven instrumental in bridging gaps exposed by crises such as the COVID-19 pandemic. As reported by Benmoussa et al. (2021), the integration of hybrid and digital learning platforms under ISO-guided protocols enabled more responsive, structured, and transparent teaching environments. Institutions that applied ISO-based frameworks for internal quality assurance, such as those detailed in Silaeva and Semenov (2018), demonstrated increased resilience and adaptability.

Furthermore, integrating ISO 21001 with broader risk management frameworks (e.g., ISO 31000), as illustrated by Muhammad et al. (2024), empowers educational institutions to not only meet accreditation thresholds but to do so while addressing uncertainty and complexity in a systematic fashion. The growing convergence of standards, including artificial intelligence regulation under ISO/IEC 42001 (Gueorguiev, 2025), indicates an expanding horizon for ISO 21001 as a dynamic and integrative quality management system.

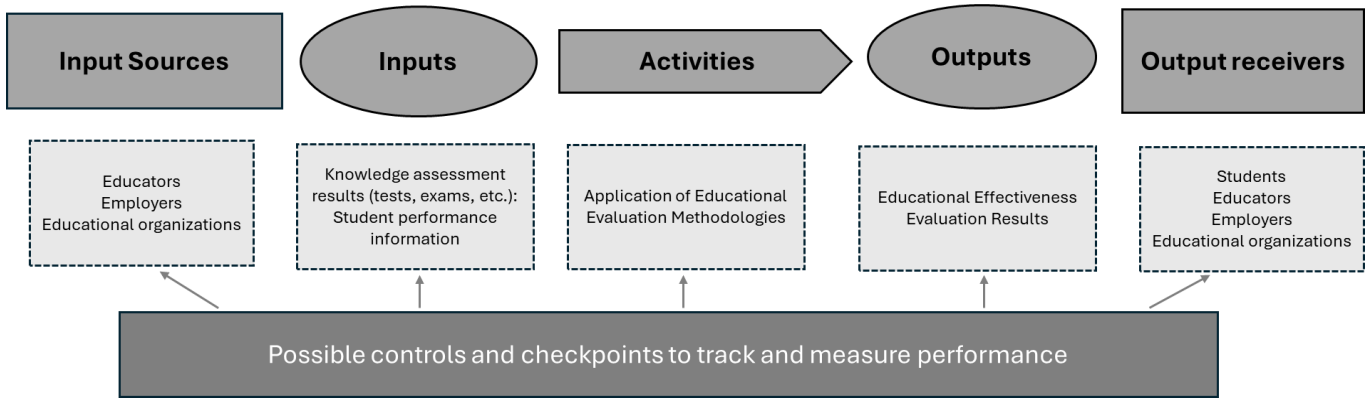
In Ecuador there is no standard that obliges higher education institutions to obtain a quality certification, "the certification of management systems is a purely voluntary act. For this purpose, the HEI applies to a certification body" (Guerra & Others, 2022, p.75). The educational service provided in Ecuador is carried out under the general guidelines of the Ministry of Education, but without applying norms or standards that come from the set of ISO norms or from any accrediting institution (Cerruto, 2022, p.3).

The implementation and certification of quality management systems under ISO 9001 is a great challenge, since it implies the adoption of a new philosophy and a profound transformation in the work culture, so that a radical intervention in the social culture is required to achieve new ways of doing things that meet the needs of users and achieve that valuable product of the new economy: knowledge. (Hernández, Arcos & Cevilla, 2013, p.27).

It should be emphasized that the ISO 21001 standard is based on ISO 9001, complemented with relevant and necessary aspects in the educational context, it can be applied to any educational institution regardless of the level and modality of education it offers. The ISO 21001 standard is based on 11 principles: Focus on students and other beneficiaries, Visionary leadership, Commitment of people, focus on processes, Improvement, Evidence-based decision making, Relationship management, Social responsibility, Accessibility and equity, Ethical conduct in education, Security and data protection (ISO, 2018, p. 9).

It is important to emphasize that ISO 21001 has two main approaches the first is based on processes and the second on risks, for this reason as seen in the figure there are possible control points throughout the process from input sources to output receivers, understanding that risks may be present at any stage and it is necessary to measure performance, follow up, identify and control deviations. Figure 2 bellow illustrates shows the main elements of evaluation that should be considered.

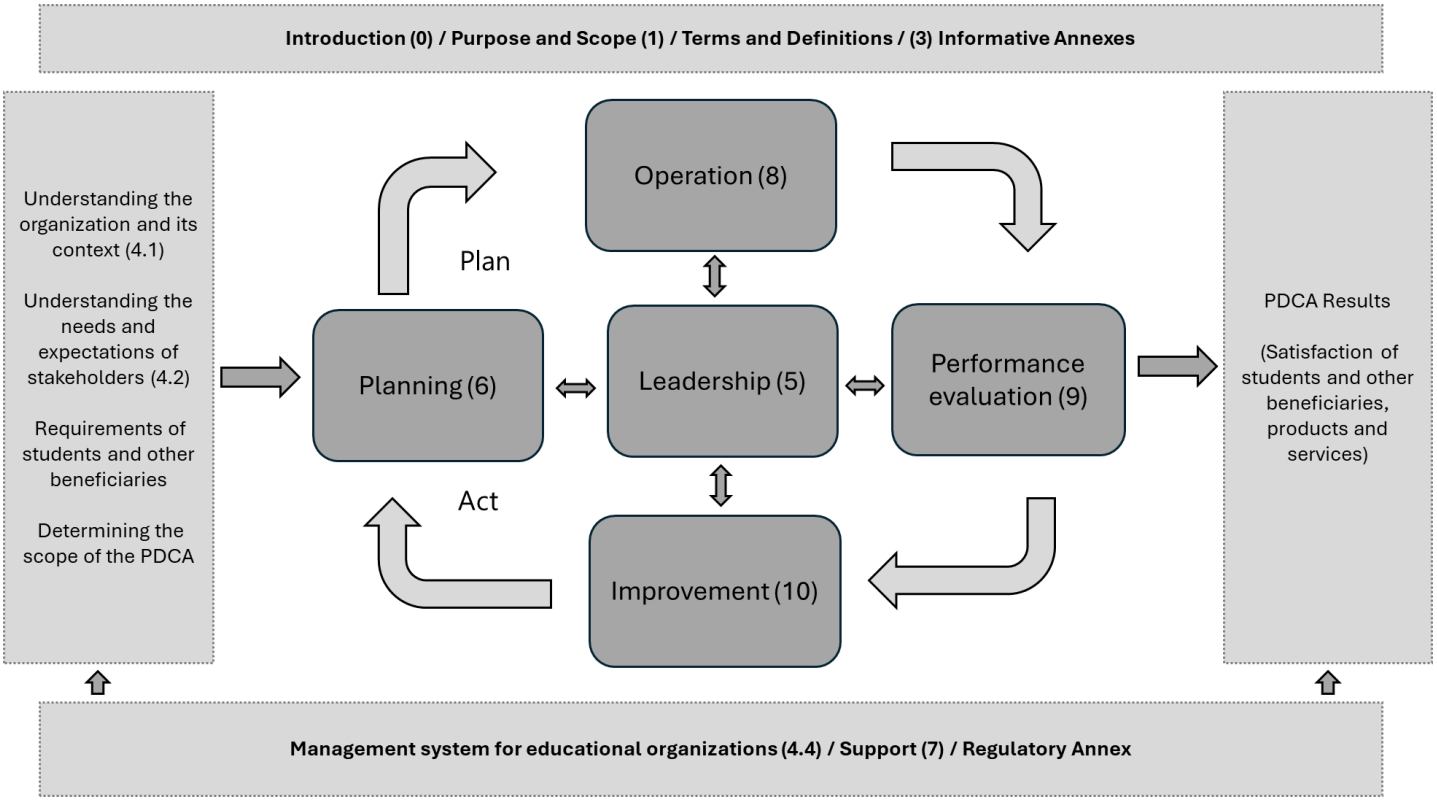
Figure 2. Elements of evaluation of the educational effectiveness process



Note: Authors' development based on ISO (2018)

A significant aspect is that the standard applies the total quality methodology through the PDCA cycle Plan, Do, Check and Act and argues that each process in educational institutions should be developed under this precept (Figure 3).

Figure 3. PDCA Cycle in SGOE ISO 21001



Note: Authors' development based on ISO (2018)

METHODS

In this study it was necessary to develop a methodological route that consisted of a non-experimental, correlational and descriptive field design (Patten, 2016). Under this precept the execution was carried out in two phases the first through the application of surveys as a first point was applied to a group of 300 teachers and authorities belonging to 100 Ecuadorian technical and technological institutes, in this step it was possible to verify the real situation of these institutions in terms of accreditation and the main problems they face from the perspective of teachers and authorities.

Another study group was composed of 300 high school students and graduates. From the responses of this group, data was obtained on the inclination or tendency of potential users towards technical and technological education as an option for third level higher education and the main problems they perceive in these educational establishments.

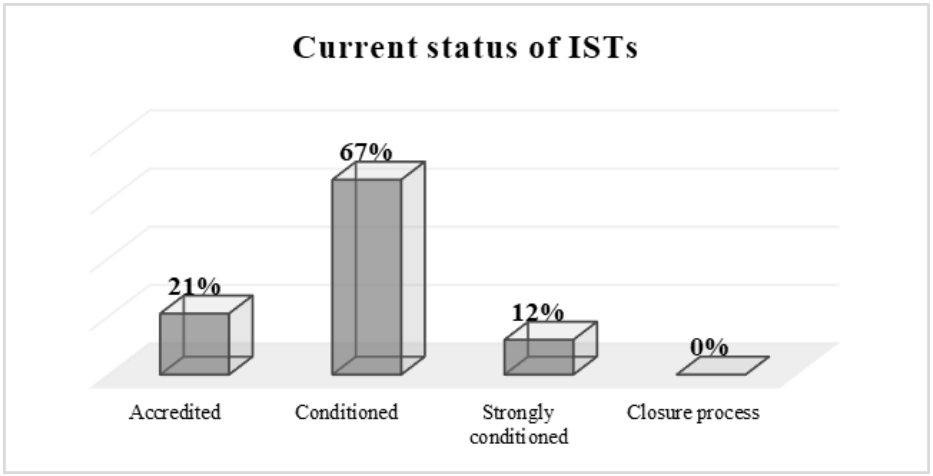
In addition, it was necessary to analyze the data by means of correlation tools using two variables: accreditation (variable Y) and the ISO 21001 standard (variable X). In this sense, the accreditation conditions and the aspects in which the standard contributes to the improvement and increase of quality were considered, using the scatter graph, Pearson's correlation coefficient and the R2 coefficient (Field, 2013).

All ethical procedures and measures to safeguard the integrity and confidentiality of the participants (Kaiser, 2012) were followed.

RESULTS AND DISCUSSION

After applying a survey to 300 teachers and authorities belonging to 100 Ecuadorian technical and technological institutes, the main results determined that the current accreditation status generally corresponds to 21% of the 100 institutions are accredited, 67% are conditioned and 12% are strongly conditioned (Figure 4). This reflects the management deficiencies that the institutions are going through as they do not meet the quality standards established by the Council for Quality Assurance in Higher Education (CACES).

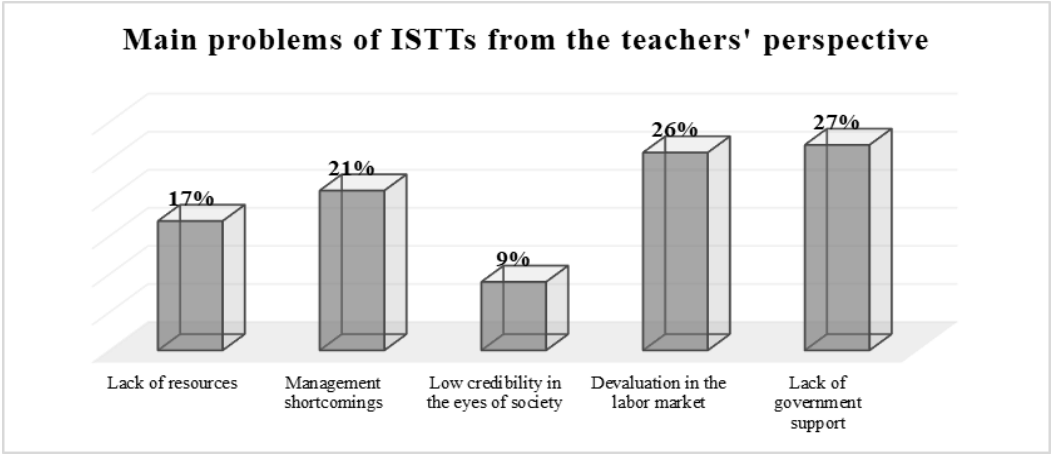
Figure 2. Current Accreditation Status of Technical and Technological Institutions



Note: Authors' development based on the research data

The main problems faced by the Technical and Technological Institutes, according to the teachers' perspective, are the lack of support from the state; the teachers consider that this higher education sector needs greater support from the government through public policies and programs that promote their development, as well as a greater allocation of resources, since those allocated are limited and they barely manage to survive without opportunities to invest in improvements, in addition to the devaluation of professional technical and technological degrees in the labor market, which generates low credibility in the eyes of society; An internal aspect that teachers consider relevant are the management failures, this is a significant factor since internal management is the pillar on which the institution's operation is based, if there are management failures there is no adequate control of resources, nor is the fulfillment of plans and objectives evaluated, which in this case are the PEDI and POA, this translates into low academic performance and loss of credibility of these institutions. Figure 5 illustrate these findings.

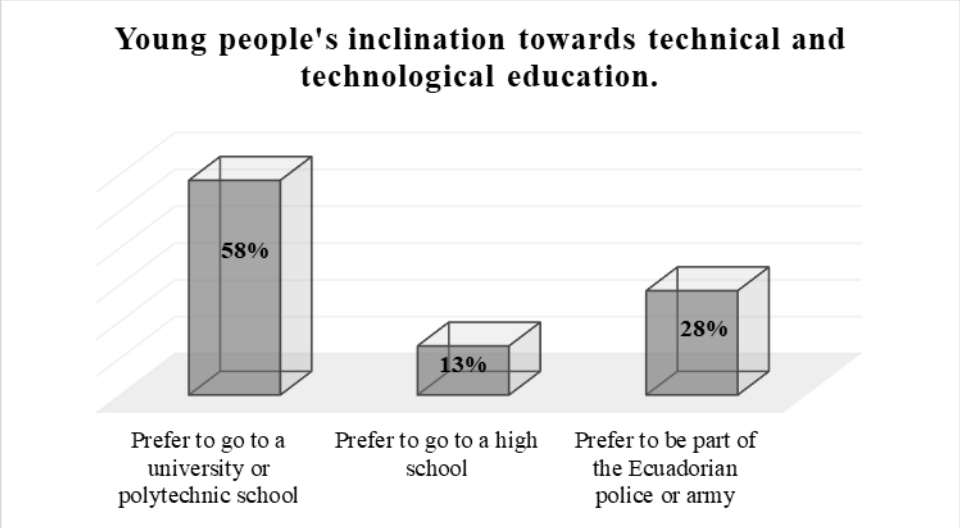
Figure 3. Main problems of the IS from the teachers' perspective.



Note: Authors' development based on the research data

The application of a survey to 300 students in their third year of high school and high school graduates identified that 58% prefer to go to universities and polytechnic schools, 28% are oriented towards belonging to the Ecuadorian police or army, and only 13% consider higher technical and technological institutes as an option to continue their third level studies. These findings are presented in Figure 6 below.

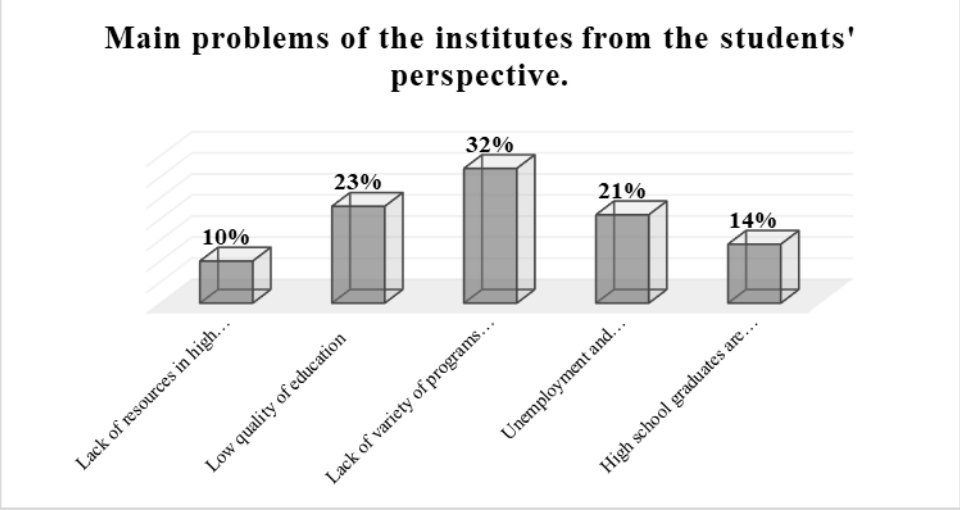
Figure 6. Young people's inclination toward technical and technological education



Note: Authors' development based on the research data

According to 32% of the students, the low inclination towards higher technical and technological institutes is due to the lack of variety of programs or careers offered by public higher education institutes, and they state that private institutions offer a greater number of options but do not have the resources to opt for paid technology, 23% state that the level of quality is low in technical and technological education, 21% refer to the unemployment and underemployment of graduates with technical and technological degrees, 14% state that these professionals are treated in the labor market as cheap labor, and 10% mention the lack of resources of the institutes. These findings are presented in Figure 7 below.

Figure 7. Main problems of the IS according to the perspective of the students



Note: Authors' development based on the research data

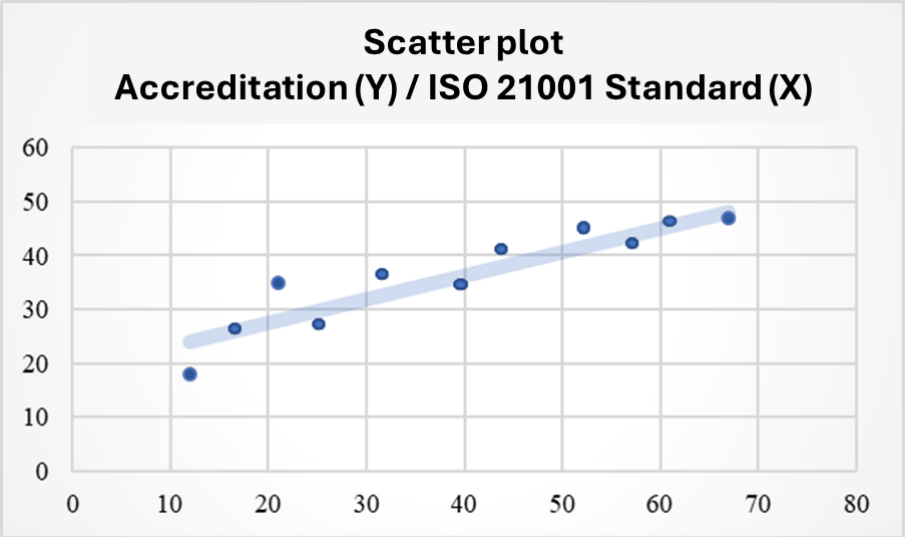
A relevant aspect that highlights the importance of the research is the correlation that exists between the accreditation variable (variable x) and the ISO 21001 standard (variable y), this correlation could be verified through data analysis using the scatter plot, Pearson's correlation coefficient and R2 coefficient, as detailed below.

The scatter graph (Figure 8) showed a positive trend line starting from the lower left to the upper right, since there is a positive correlation it is interpreted that the higher the variable x the higher the variable y, in this case the more effective the quality system under ISO 21001, the higher the score obtained by the institutes in the mandatory external evaluation and accreditation process.

Pearson's correlation coefficient is 0.89 and the R2 coefficient is 0.79 (Table 3), these values can be interpreted as

follows: the closer it is to one, the stronger the correlation, and if it is close to or equal to zero, it reflects the absence of correlation; in this case, obtaining 0.89 and 0.79 shows that there is a high correlation between the implementation of ISO 21001 standards and the achievement of accreditation of Ecuadorian technical and technological institutes, In other words, if these institutions implemented a quality system through ISO 21001, they would achieve greater efficiency, adequate use of resources, increase quality, plan and execute processes, identify risks and correct deviations, and be able to achieve the plans implemented in the PEDI and POA and thus increase the rating they would obtain at the time of the external evaluation applied by the competent body.

Figure 4. Scatter plot



Note: Authors' development based on the research data

Table 3. Correlation coefficients

Pearson correlation coefficient	0.891
Coefficient R2	0.795

Note: Authors' development based on the research data

Furthermore, as a final point of the research, a Table 4 is presented where the components of the evaluation and accreditation model of the higher technical and technological institutes and the relevant aspects provided by the ISO 21001 standard are related.

Discussion

The empirical results of this study, particularly the strong correlation between ISO 21001 implementation and institutional accreditation scores, illustrate the assertions found across multiple international studies regarding ISO 21001's effectiveness. The work of Bretaña, Almaguer, and Bonilla (2024), who implemented ISO 21001 in postgraduate programs in Havana, offers a clear parallel: improvements in stakeholder satisfaction and educational quality were evident even in resource-constrained environments. Similarly, Dwaikat (2021) observed that when ISO standards are applied to manage inputs and processes, institutions see measurable improvements in student and faculty quality, ultimately elevating academic program outcomes. This supports the inference that ISO 21001 is not only structurally sound but empirically reliable for institutions seeking to overcome chronic underperformance, as is the case in Ecuador's technical sector.

Implementation challenges remain, particularly around digital maturity and risk management. Emanuel and Santoso (2023) revealed that even institutions with robust ICT infrastructure often underperform due to lack of alignment with ISO process maturity indicators. This mirrors the Ecuadorian context, where limited digital integration hampers internal audits and operational transparency. Rosmansyah et al. (2023) propose that ISO-aligned SLEs offer scalable solutions to these deficiencies, particularly if tied to learner-centered metrics embedded in ISO 21001. Complementarily, Muhammad et al. (2024) highlight how ISO 21001 combined with ISO 31000 risk frameworks enables institutions to proactively respond to institutional fragility, an urgent requirement in Ecuador where accreditation failures are often tied to unmanaged operational risks.

Importantly, ISO 21001 does more than structure operational processes, it reshapes institutional culture. Idan (2023) shows how quality assurance frameworks based on ISO 21001 increased satisfaction and participation among faculty, even amid the pedagogical uncertainties of COVID-19. In this vein, Ülker (2023) introduces University 4.0 as a framework in which

ISO 21001 principles gain strategic importance, requiring institutions to move beyond compliance toward proactive innovation. Benmoussa et al. (2021) also demonstrate that ISO 21001 provides a valuable structure for retroactive feedback mechanisms in hybrid education, further reinforcing the relevance of the standard in reconfiguring educational systems under pressure.

The cultural and systemic implications of ISO 21001 are also documented in comparative studies. Wibisono (2018) and Aurachman et al. (2020) both point out that ISO 21001, while more complex than ISO 9001, is far more relevant to educational settings because of its specific vocabulary (e.g., "learner," "curriculum") and ethical components. This specificity makes it not only applicable but essential for Ecuadorian institutes struggling with stakeholder disengagement and labor market devaluation. Benz-Camino et al. (2022) highlight the importance of aligning national and ISO standards early in the quality assurance process to avoid duplication, a point echoed in the Indonesian SNI model developed by Rosiawan et al. (2025), where voluntary ISO standards complement mandatory accreditation criteria.

The implementation of ISO 21001 can drive Ecuadorian institutions toward global benchmarking and future-readiness. Gueorguiev (2025) warns that failure to adapt ISO frameworks to emerging digital standards, including AI governance, may leave educational institutions obsolete. Rais et al. (2021) similarly argue for integrated QMS adoption with strong feedback loops to ensure alignment with global trends. This implies that ISO 21001 not only supports institutional compliance and quality assurance but also prepares Ecuadorian technical institutes for leadership in a knowledge-based economy.

Quality may be something subjective, what for some is perceived as quality factors may not be so for others, but in Ecuadorian Technical and Technological Higher Education Institutes this is a crucial issue, since the situation is worsening for these institutions, to the extent that by 2021 only 11% of enrollments in higher education belong to this group, 89% of students prefer to go to universities and/or polytechnic schools. Technical and/or technologist degrees are devalued in the labor market, it is much more difficult to get a job if you have a degree of this nature despite being considered third level, companies and society discriminates against these degrees and devalues them, at the time of getting a job they are usually considered as cheap labor, With the system of access that was used in Ecuador, the students who had access to these institutions were to a large extent those who were unable to obtain the necessary scores to pursue the careers they wanted and accepted the places in the institutions that the system offered them.

In Ecuador, there is the perspective that the education received in higher education institutions is of low quality and does not meet expectations. This affects the image of these institutions, which is reflected in the low level of enrollment and in the scores obtained in the last accreditation evaluations, where a significant part did not meet the quality standards set forth in the CACES model, For this reason, it is important to employ a system that increases quality, increases prestige and captures the attention of the Ecuadorian society in order to improve the reputation and recover the credibility of these institutions.

One interesting tool is the ISO 21001 standard created especially for educational institutions. The research reflects the relationship between this international regulatory framework and the requirements established by CACES, which is the evaluating and regulating body; by implementing a quality system under ISO, in addition to complying with national standards, the institutions could aim for internationally renowned certifications, since ISO is a globally recognized quality regulatory framework,

This research proposes a specific system for higher technical and technological institutes that will improve operational and administrative efficiency, increasing quality in the substantive areas and in every aspect that these educational institutions handle, Therefore, the government plays a fundamental role, since through policies it can undertake programs that increase the quality of higher technical and technological education in Ecuador, thus indirectly contributing to the productive matrix, to the creation of companies and highly qualified labor. But it is important that the government supports and encourages these educational centers and considers the increase of quality as a factor that promotes this segment of education.

Limitations and future research

This study presents some limitations that should be acknowledged. First, the research design was non-experimental and cross-sectional, nuancing the ability to infer broad causality between the implementation of ISO 21001 and improvements in accreditation outcomes. The strong correlation observed suggests an association but does not confirm a directional or causal relationship. Second, the sample was limited to 100 Ecuadorian technical and technological institutes, which, while sizable, may not capture the full diversity and heterogeneity of institutional realities across other regions, particularly rural or underfunded areas. Moreover, since the difficulty to incorporate longitudinal data to evaluate the effect of ISO 21001 over time, this research is limited to assess the implementation depth or maturity level across institutions. Lastly, although the ISO 21001 standard is wide-ranging, this study focused primarily on its relationship with national accreditation

frameworks, without exploring into related specific aspects such as digital infrastructure readiness, organizational culture, or faculty competencies, which may act as mediating variables. Future research should explore longitudinal impacts, digital integration, and cross-country comparisons of ISO 21001 implementation, while examining mediating factors such as organizational culture, stakeholder outcomes, and cost-effectiveness in resource-constrained educational contexts

Table 4. ISO 21001 and the evaluation model of the IS

RELATIONSHIP OF CRITERIA AND INDICATORS OF THE CACES ASSESSMENT MODEL WITH THE PRINCIPLES AND ACTIONS OF THE ISO 21001 STANDARD			
ASSESSMENT MODEL FOR HIGHER TECHNICAL AND TECHNOLOGICAL INSTITUTES			ASPECTS OF THE ISO 21001 STANDARD (EDUCATIONAL ORGANIZATIONS)
CRITERIA	SUBCRITERIA	INDICATORS	ASPECT OF THE STANDARD THAT RELATES TO
Organization	Planning and development	Strategic and operational planning	**Planning**
			Actions to address risks and opportunities
			Objectives of the educational organization and planning to achieve them
			Planning for change
			Leadership
			Leadership and commitment
			Focus on students and other beneficiaries
			Additional requirements for special educational needs
			Policy
			Policy development
			Policy communication
			Roles, responsibilities and authorities in the organization
		Inter-agency relationships for development	**Communication**
			Purposes of communication
			Communication agreements
			Organizational knowledge
		Internal quality assurance	**Internal audit**
			Management review
			Management review inputs
			Management review outputs
			Improvement
			Non-conformity and corrective actions
			Continual improvement
			Improvement opportunities
		Computerized management system	Systematic management of processes and their interactions
		Equal opportunities	Increased social responsibility by providing inclusive and equitable quality education for all.
		Ethics and transparency	Awareness raising
			Adopt written codes of conduct or ethics
			Institute a policy of organizational ethical conduct
			Include ethics as an input to management review
			Institute a system of discipline when breaking the rules of ethical conduct
		Psychological well-being	Educational organizations may also consider how they will ensure health and safety (including physical and psychological integrity)
			Improving staff motivation and morale
Infrastructure	Basic infrastructure	Teachers' workplaces	Resources
		Occupational health and safety	Infrastructure
		Physical accessibility and recreation	Environment for the operation of educational processes
		Bandwidth	Learning resources
Teachers	Selection and previous training	Teacher selection	Determine, implement and publish recruitment or selection criteria, which shall be available to relevant stakeholders.
			Maintain documented information on the process used for recruitment or selection and maintain documented information on the results of recruitment.
		Postgraduate training	Recognition of prior learning and experience
		Practical professional experience of faculty TC of professional content	Ensure that these individuals are competent based on appropriate education, training or experience.
		Practical professional experience of MT and TP teachers of professional content	Recognition of experience
		Tenure TC and MT teachers	Planning requirements
		Weekly workload of TC teachers	Workload planning and responsibilities
	Organization and development	Teacher evaluation	Monitoring and measurement resources
			Measurement traceability
			Establish and implement methods to evaluate staff performance
		Ongoing education and training	**Competency**
			Support and ensure continuous development of competency
			Retain appropriate documented information as evidence of competency
	Remuneration	Average monthly remuneration TC	Resources
		Average hourly remuneration TP	
Teaching	Academic training	Subject curricula	**Requirements for educational products and services**
			Determination of requirements for educational products and services
			Communicating requirements for educational products and services
			Changes in requirements for educational products and services

	Information on the teaching process	Education-teaching affinity	**Design and development of educational products and services**
			Design and development planning
			Design and development inputs
		Monitoring, control and evaluation of the educational process	**Operational planning and control**
			Specific operational planning and control of educational products and services
			Design and development controls
		Subjects with adequate bibliographic coverage	Controls over the design and development of educational products and services
			Controls over curriculum design and development
			Controls over summative evaluation of design and development
		Faculty publications	**Production and provision of educational service**
			Controls over the production and delivery of educational services
		Classrooms	Infrastructure
		Complementary training	Training people
		Pedagogical accompaniment of students	Requirements due to program content and/or pedagogical approach
		Relationship with graduates	Job placement rate at specific intervals after graduations
			Workload, student progress and graduation rates
		Virtual learning environment	**Protection and transparency of student data**
			Release of educational products and services
			Control of non-compliant educational outputs
		Computerization in learning	**Documented information**
			Creation and updating of documented information
			Control of documented information
	Citizen training	Environmental education and sustainable development	Voluntary inclusion of social and environmental concerns in activities and their relationship with stakeholders.
	Practical training	Values training and soft skills development	
		Practical training in the academic environment	Ensure that these people are competent based on appropriate education, training or experience.
		Practical training in the actual work environment	
	Library	Operation of the library	
		Library holdings and relationship of the library to subjects and majors	Manage and maintain the necessary educational infrastructure (including classrooms, laboratories, study spaces, libraries, etc.).
Innovation R&D	R&D scientific and technical publications	Research and development	Ensuring the integrity of the research process and results
			Follow ethical guidelines for research and implement appropriate structures to do so.
		Scientific and technical publications and events	Publication and staff research
	Innovation	Innovation and absorptive capacity	Research-focused approach
Outreach to society	Planning and execution of outreach	Planning and execution of the linkage with society	Feedback on the organization's influence on the community
			Considering the needs of the community
	Presence in the community	Presence of the institution in the community	Contribute to sustainable development, including the health and well-being of society.

Note: Authors' development based on Evaluation and Accreditation Model for Higher Technical and Technological Institutes of Ecuador and the ISO 21001 Standard

CONCLUSIONS

Quality is a characteristic that is perceived as absent and distant in technical and technological education in Ecuador, the main problems they face are the lack of support from the state, considering that public policies regarding the improvement of higher education are oriented more towards universities and polytechnic schools, the lack of resources, the devaluation of third level technical and technological degrees in the labor market, lack of efficiency in the management and use of resources, make the paradigm of technical and technological education unfavorable for these institutions, which is reflected in the representative percentage of institutes that have not been accredited in previous evaluations and are conditioned or strongly conditioned. To promote the development of this education sector, an interesting tool is the ISO 21001 standard, which is aimed at the management of educational institutions. There are relevant aspects in the standard that are directly related to the components and indicators of the evaluation and accreditation model determined by the council for quality assurance in higher education.

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