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MEBAUAC: Methodology for elaborating a baseline of the accomplishment of university accreditation criteria

MEBAUAC: Metodología para elaborar una línea de base para el cumplimiento de los criterios de acreditación universitaria

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Resumen

El objetivo del estudio fue proponer y aplicar una metodología rápida para elaborar una línea de base del cumplimiento de los criterios de acreditación universitaria en las carreras universitarias con la percepción de los profesores y las autoridades académicas y aplicarla a una ciudad. MEBAUAC es original y ha permitido el establecimiento de una línea de base. No se encontraron metodologías similares anteriores. El instrumento de la evaluación es original y se aplicó a la evaluación del cumplimiento de los criterios de acreditación universitaria de carreras de ingeniería con una muestra de 73 profesores y autoridades académicas de carreras de ingeniería en Lima, capital del Perú. Utilizando la metodología propuesta, se obtuvieron los resultados de los siguientes criterios: (a) el conocimiento de las estrategias adecuadas de los procesos de enseñanza-aprendizaje por parte de los profesores, (b) la implementación de programas de bienestar (biblioteca, artes, atención de la salud, recreación actividades, etc.), (c) planificación a largo plazo, (d) elaboración de planes de estudio de acuerdo con los requisitos del mercado laboral, (e) aplicación de estrategias adecuadas para los procesos de enseñanza-aprendizaje, (f) tutoría, (g) extensión universitaria y proyección social, (h) espacios y equipamiento y (i) relaciones con grupos de interés. Las investigaciones futuras sobre la evaluación del proceso de acreditación deben tener en cuenta los enfoques para las escuelas universitarias, las autoridades gubernamentales y los investigadores interesados.

Palabras clave: MEBAUAC, ingeniería, metodología de línea de base, acreditación, criterios de acreditación universitaria, enseñanza, aprendizaje.

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Abstract
The purpose of the study was to propose and apply a quick methodology for elaborating a baseline of the accomplishment of university accreditation criteria in university careers, with the perception of the professors and academic authorities and to apply it to a city. MEBAUAC is original and has permitted the establishment of a baseline. There were not found previous similar methodologies. The instrument of the evaluation is original too, and was applied to the evaluation of the accomplishment of university accreditation criteria of engineering careers with a sample of 73 professors and academic authorities of engineering careers in the city of Lima, capital of Peru. Using the proposed methodology, there were results of the accomplishment of the following criteria: (a) the knowledge of the adequate strategies of teaching-learning processes by professors, (b) the implementation of welfare programs (library, arts, health attention, recreational activities, etc.), (c) long term planning, (d) elaboration of adequate study planning according to the requirements of the labor market, (e) application of adequate strategies for teaching-learning processes, (f) tutorship, (g) university extension and social projection, (h) spaces and equipment, and (i) relationships with interest groups. Future researches about the evaluation of the accreditation process must take into account the focuses for university schools, for government authorities, and for interested researchers.

Keywords: MEBAUAC, engineering, baseline methodology, accreditation accomplishment, university accreditation criteria, teaching, learning

Introduction

The accreditation of engineering careers has been growing quickly around the world, increasing the need of methodologies for evaluating its accomplishment. About the accreditation, Polanin (2020) indicated: “Generally, accreditation is a nongovernmental peer review process that complies with nationally recognized standards established for the practice of accreditation in the United States” (p. 6). Damaj, Zaher, and Yousafzai (2017) also indicated: “The rapid growth in number of higher education institutes, all over the world, necessitates exploring frameworks for assessment and evaluation (AE) that promote quality” (p. 73). Additionally, Wang and Cao (2019) indicated: “Economic globalization will accelerate the internationalization of engineering education, so global and regional accreditation has gradually become an indispensable measure to guarantee engineering talent training quality” (p. 155).

Therefore, the determination of the level of accomplishment of the university accreditation criteria on the diverse careers of the diverse universities of a city or country becomes a real challenge due to its complexity, time and cost. In this sense, the purpose of the study was the development of a quick methodology for determining the accomplishment of the university accreditation criteria based on the perceptions of the professors and academic authorities. The methodology MEBAUAC permitted to determine the level of the

accomplishment of the university accreditation criteria through its application to engineering careers in Lima, capital of Peru.

Background of the Problem

The evaluation of the accomplishment of accreditation standards in diverse countries, revealed diverse complex situations about the educational issues, such as: corruption, problems with infrastructure and equipment, low teaching quality, problems with curriculum, lack of research activities, lack of contact with the labor market, etc. In this sense, Wang and Cao (2019) explained: "In the United Kingdom and the United States, Engineering Programs Accreditation goes through a long history of development" (p. 155). Additionally, Wang and Cao (2019) indicated:

> Professional accreditation organizations such as the U.S. Accreditation Board for Engineering and Technology (ABET), the British Engineering Council (ECUK) and German Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics (ASIIN) have promoted the development and implementation of a series of global and regional accreditation criteria and evaluation standards in an effort to make engineering program quality gain recognition from international counterparts, ensure that the trained engineering talents obtain world-recognized certificates, and facilitate the international mobility of engineering professionals as well as their employment in the international market. (p. 155)

About the corruption in higher education in Russia, Sergeevich (2015) indicated: "the legislation and court practice in Russia in the first decade of the 21st century enabled educational institutions to do some kinds of activities in corrupted way." (p. 160). Sergeevich (2015) also discovered the following issues:

- people entering the educational institutions and their parents, when they gave bribes for a positive decision on their admission,
- students, when they paid bribes for good grades,
- applicants for degrees, when they paid for "turnkey dissertations", for their defense in a "friendly dissertation council" and for a positive decision from the Higher Attestation Commission,
- employees of educational institutions, when they paid bribes for the distribution of resources within the institutions,
- service organizations and vendors, when they paid kickbacks for contracts on rendering of services and on supply of goods,

- applicants for posts in management of HEIs, when they paid bribes for appointment to the post,
- administrations of educational institutions, when they put pressure (using bribery and blackmail) on the subordinates who made decisions on all above-mentioned issues,
- educational authorities, when they exerted pressure (using bribery and blackmail) on the administration of educational institutions to make decisions on all of the above mentioned and other issues. (p. 166)

On the other hand, Flórez, Moreno, and Laguado (2019) studied the accreditation of engineering programs in Colombia and concluded that the programs of provincial universities are generally not accredited by the lack of knowledge of the alignments and norms, which only seek to comply with the requirement regarding the percentage of programs accredited, depending on the creditable established by the current norms (p. 120). After an evaluation of the higher education in India, Chahal and Dar (2015) concluded the following challenges and issues: (a) the demand-supply gap, (b) inadequate facilities and infrastructure, (c) lower level of teaching quality, (d) research constraints, (e) uneven growth and access to opportunity, (f) more concentrated on theories and rather than practical knowledge, (g) lack of involvement in and control of educational matters by professors, (h) traditional methods of teaching, (i) abroad settlement after education, (k) quota system, and (l) quality-reflecting on. Chahal and Dar (2015) also indicated: “The syllabus or curriculum for higher education is outdated in most cases. Its syllabus contains matters that the world has moved on with” (p. 166).

On the other hand also, Ibrahim, Ab Rahman, and Yasin (2014) evaluated the students’ perception of quality of service offered in Malaysian skill training institutes and how it influences overall satisfaction, and found that “campus environment was the most significant predictor of student satisfaction, followed by management of institute and support services” (p. 9). Ibrahim et al. (2014) also found that “physical facilities and training delivery were not significant predictors of students’ overall satisfaction” (p. 9).

About the scientific research in programs for graduates in Peru, Lip and Gonzalez (2010) reported that the gap between the number of students who successfully complete all the courses in their curriculum, and the realization of thesis for graduation is explained in part because the curricula of programs does not facilitate the acquisition of frames to think scientifically. The analysts of Red de Ciencia y Desarrollo (2010) of Peru (citing a publication of Comex Peru) indicated that less than 5% of the resources granted to state universities for investing in science and technology is actually used for that purpose. According to the interview by journalist Zoraida

Portillo, of the Red de Ciencia y Desarrollo, to Rafael Zacnich, economist of COMEX Peru who led the study, this situation only demonstrates the inability of universities in resource management and project development, referring mainly to those universities that receive the benefits of the canon and royalties of mining projects.

About the engineering curriculum in South Africa, Mutereko (2018) indicated: "there is clear evidence of governmentality notions in which the locus of power has been decentralized and internalized in the governed by giving them autonomy and responsibilities in certain aspects of the engineering curriculum" (p. 235), after the study with 11 in-depth interviews with academics from the Faculty of Engineering at a university of technology. In this context, Johnson, Johnson, and Shaney (2008) explained the importance of the inclusion of the service learning in the curriculum, and showed the results of the International Service Learning of The University of Alabama for engaging students in leadership and teaming roles, remarking a practice of their students in Peru, for meeting the challenges of engineering in a global society and for demonstrating that accreditation learning outcomes are not easily taught in traditional classrooms. About the role of curriculum in higher education, Ayub and Smith (2015) explained that:

> Curriculum is crucial for the well-being and effectiveness of higher education (Barnett & Coate, 2005) both in the short and long-term. Lamentably, it is a widely recognized notion in academia that the approach to developing curriculum is disintegrated in that minimal and isolated considerations are given to the various critical elements such as institutional leadership, social trends, industry factor and the role of the government. (p. 66)

Coe (2006) detailed the diverse observations which were found in the civil, architectural, and construction engineering programs encountered by ABET's accreditation evaluators during fall 2004, which were related to the general criteria: (a) students, (b) program educational objectives, (c) program outcomes and assessment, (d) professional component, (e) faculty, (f) facilities, and (g) institutional support and financial resources; and the program criteria: (a) curriculum and (b) faculty. In respect, among the diverse observations which were found, Coe (2006) remarked the following observations: (a) students did not take prerequisite courses, (b) objectives were defined as what the students are expected to know or be able to do at the time of graduation rather than as the accomplishments expected during the first several years following graduation, (c) multidisciplinary teams involving members with different experiences and knowledge were not used, (d) engineering standards and realistic constraints were not considered in the major design experience, (e) faculty reported that heavy teaching loads and advising responsibilities prevented adequate research and professional development, (f) laboratory space was inadequate, (g) funds for laboratory space and acquisition, as well as for maintenance and

operation of laboratory equipment were inadequate, and (h) there is no evidence that professional practice issues were included in the curriculum as actually taught.

For this study, the accomplishment of the accreditation criteria of the engineering careers was evaluated due to the following reasons: (a) their importance for the development of the countries—especially in Peru (Arias, 2015); (b) the proportion of the population who finished engineering careers: 22.4% of the total population who finished an university career, considering the Industrial and Production Engineering, the Systems and Telecommunications Engineering, and the Construction and Sanitary Engineering and Architecture (National Institute of Statistics and Informatics, INEI, 2014, p. 21), (c) the more diverse requirements of this type of careers related to the infrastructure, equipment, laboratories, etc. (Coe, 2006); and (d) due to the literature review reveals diverse and more complex difficulties for obtaining the accomplishment of the accreditation criteria in comparison with other types of careers, overall in respect to the criteria related to research, technological development, and innovation (Herkert, 2000; Coe, 2006; Johnson et al., 2008). Considering the mentioned reasons, the accomplishment of the accreditation criteria of the engineering careers in Lima Metropolitan City was evaluated as a sample.

Careers in science and technology (S&T) occupy a leading position in economic competitiveness in an increasingly globalized world and a sufficient number of trained professionals in these fields are indispensable for the prosperity of any current economy (Arias, 2015). In respect to the generated patents of diverse careers, the specialists of National Institute for the Defense of the Competence and the Intellectual Property in Peru (Indecopi, 2018) indicated: “76% of university centers in Peru indicated that they do not have professionals in engineering or specialized sciences in intellectual property” (p. 18). Additionally, the specialists of Indecopi (2018) explained:

> These professionals are the called to collaborate in the research, intellectual property or technology transfer offices with the supply of specialized information, the identification of protectable and / or patentable material, the analysis of the state of the art, the estimation of the potential of protection and / or patentability of creations, as well as with the development of technical documentation of protection requests, among other aspects. (p. 18).

Burga, Zegarra, and Lerner (2005) indicated that in Universidad Nacional Mayor de San Marcos in Peru, many new leaders of students use the old political language of the 20th century (unrestricted gratuity, free meals and dorms, verbal radicalism against authority, and absence of proposals to seek a quality, modern and responsible university), which reduced the effectiveness

of university governance. Burga et al. (2005) also explained that the majority of private universities didn't have research programs, have a scarcity of scientific production, and have low rates of graduation (probably due to that many times, the economic aspects are considered more important than the academic quality). Additionally, Burga et al. (2005) indicated that USA invested more than US$ 900 per capita on research and development in 1999, with a GDP (gross domestic product) per capita near to US$ 30,000, while Peru invested US$ 1.65 per capita on research and development, with a GDP per capita of US$ 2,600; finally, the authors indicated that this situation places Peru among the least invest of research and development in Latin America and the Caribbean, which is about 17 to 19 times less, compared with Chile and Costa Rica, placing Peru to the level of Nicaragua and El Salvador.

The same authors indicated that the proliferation of universities, professional institutes, technical training centers, offices, careers, qualifications and special programs, "every day is more necessary to have clear the conceptual foundations of knowledge production and to have a regulatory system that ensures the quality and safeguarding public faith in graduate programs" (p. 24). The poor quality of regular basic education would be drawn into the undergraduate; but it would also be dragged to programs for graduates. In this regard, Burga et al. (2005) explained that in 2005 approximately 495 master programs and 74 doctoral programs were offered in Peru; however, these figures could give the wrong idea of the reality of what that situation represents about the research due to only 5 to 10% completed a research work. Burga et al. (2005) stressed that in general, graduate programs are not based on research and have too schooled programs, coinciding with Sota (2002) who said that the graduate is not contributing significantly to the research and the knowledge production.

Burga et al. (2005) indicated that the quality of the university education has been damaged since 1970, situation which is very related to the decrease of the budget and the salaries of the university professors to the lowest levels of Latin America, and Sota (2002) indicated that the low level of salaries of professors cause that they must dedicate to other jobs limiting their permanent improvement of qualifications. Sota (2002) also indicated that the universities have converted in institutions which produce professionals and grades undervalued and that their offers are not in concordance with the current needs or the future and strategic needs of the country.

The low quality of university education has their roots in the regular basic education. In this regard, Sota (2002) explained that "It is obvious that the quality of students entering college is an element of prime importance for achieving the aims of the university. Fatally, this quality is not always desirable" (p. 51), mainly for the following reasons: "a) the inadequate level of

preparation of reached graduates of secondary education, b) entrance exams, equally inadequate to measuring the most significant competencies, which also often are too permissive and are a mere formality" (p. 51). Góngora (2002) indicated that the bureaucracy of state universities used between 30% and 40% of the total of the salaries, situation that limits the budget for the salaries of professors, and the improvement of infrastructure and the quality of education. In respect to the public careers of the professors, Sota (2002) explained that the criteria must be focused to academic parameters and not to years of service or labor stability, situations which demotivate the academic production and stimulates the conformism. Sota (2002) also remarked that some groups of radical students with economist perspectives are present yet.

Jing and Doorn (2020) indicated: "Moral responsibility are one of the core concepts in engineering ethics and consequently in most engineering ethics education" (p. 233). About the engineering ethics education in USA, Herkert (2000) explained that "nearly 80% of engineering graduates are not required to take ethics-related courses" (p. 303) and "The content of engineering ethics education consists of 'micro ethical' issues focusing on individual professional responsibility and 'macro ethical' issues dealing with the development of technology" (p. 303). Herkert (2000) also indicated: "Prominent curriculum models in the USA include a required course in engineering ethics, ethics-across-the-curriculum projects, and integration of engineering ethics and science, technology and society material." (p. 303). Similar situations, which were described in this section, were occurring in the Peru's university education, including the engineering education. Additionally, Mabres (1994) explained that the main five problems of Peruvian universities were: (a) low academic level, (b) economic uncertainty, (c) little research with adequate quality, (d) very little relationships for collaborating with other universities, and (e) the lack of relationships with the entrepreneurial sector.

Theoretical Framework

There are several international accrediting bodies, some of them have already been granted accreditations in Peru, and are the following: Accreditation Board of Engineering and Technology (ABET) of the United States of America (USA), National Accreditation Council (CNA) of Colombia, and International Organization for Standardization (ISO); however, the CONEAU has a set of standards that are more difficult to meet than those indicated by international accrediting bodies, due to the breadth of the criteria evaluated. Here are some universities and careers that are accredited in Peru, as well as a brief summary of the factors of the accreditations outlined above.

ABET

ABET (2010) is recognized in the United States by the Council for Higher Education Accreditation (CHEA) as the organization responsible for the accreditation of educational programs in science, computing, engineering and engineering technology. In addition, with the document "Criteria for Accrediting Engineering Technology Programs", ABET (2010b) noted that accreditation is aligned to the following eight general criteria: a) students, (b) the educational objectives of the program, (c) results students, (d) continuous improvement, (e) curriculum, (f) competencies of faculty, (g) infrastructure, and (h) institutional support. According to ABET (2011), the steps of accreditation are the following:

1. Before Accreditation: Evaluation Planning. Before the sending of a formal request for the evaluation of a curriculum of a career, the program must have an internal evaluation. These processes could be developed for several years. During the preparation phase, a program must realize the following actions:
   A. To implement the process for evaluating the objectives and results of the educational programs.
   B. To demonstrate a continuous improvement cycle.
   C. To collect examples of student works.
   D. To review the criteria, policies and procedure manuals of accreditation and self-assessment questionnaires updated annually.
2. During Accreditation. Programs that have met the requirements for accreditation and completed their evaluation planning could start the accreditation process by sending a request for evaluation.
3. After Accreditation. ABET provides guidance on how to promote accreditation of the program and information about appeals, complaints, and changes in programs during the crediting period.

CNA Colombia

CNA Colombia (2006) indicated that the factors for university accreditation are: (a) Factor 1: Characteristics associated with the Mission and Institutional Project, (b) Factor 2: Characteristics associated with students, (c) Factor 3: related features to professors, (d) Factor 4: Technical Characteristics associated with the academic, (e) Factor 5: Characteristics associated with the Institutional Welfare, (f) Factor 6: Characteristics associated with the organization, administration and management, (g) Factor 7: Features associated with graduates and their

impact on the society, and (h) Factor 8: Features associated with physical and financial resources. For the CNA Colombia (2006), the formal accreditation process includes the following steps:

1. The self-evaluation of the institution, for which should be used guidelines which are consistent with the criteria and quality features defined by the National Accreditation Council. The self-evaluation has the definition of the institution of its nature, its mission and its educational project, as its starting point. This is to preserve the characteristics of each institution, not homogenize.
2. The external evaluation carried out by academic peers appointed by the National Accreditation Council. This evaluation used the self-evaluation of the institution as a starting point, verifies its results, identifies the internal conditions of operation of the institution and the academic program, and concluded in a judgment on the quality of the academic program delivered by academic peers to CNA with a written report.
3. The final evaluation which is realized by the National Accreditation Council, after the analysis of the documents of the self-evaluation and the external evaluation, and known the reaction of the institution to the report of academic peers. In the case of a favorable judgment, this stage ends with the corresponding Accreditation Recommendation, made by the National Accreditation Council to the Minister of National Education. In the case of unfavorable judgment, it will proceed to make recommendations to the institution.

Completed the above steps, and based on the opinion issued by the National Accreditation Council, the Minister of National Education will realize the act of accreditation. (p. 8)

ISO

The International Organization for Standardization (ISO) is the developer and publisher of the world's largest international standards. ISO is not an institution for university accreditation; however, due to ISO certifies quality standardized processes, has certified diverse universities. Furthermore, the Model of a Quality Management System based on processes ISO 9001: 2000 System Quality Management Requirements (ISO, 2000), included the following:

1. Inputs: customer requirements.
2. Outputs: customer satisfaction through products.
3. Process, which includes: (a) the responsibility of management; (b) management of resources; (c) product realization; and (d) measurement, analysis and improvement, which should be framed in a process of continuous improvement of the system of quality management.

With regard to the management of an audit program to assess the quality management system, ISO (2002) developed the ISO 19011: 2002 Guidelines for auditing quality and/or environmental management systems, which indicated that the management of an audit program has the following steps:

1. Establishment of an audit program:
   - Objectives and scope.
   - Responsibilities.
   - Resources.
   - Procedures.
2. Implementation of the audit program:
   - Preparation of scheduling audits.
   - Evaluation of auditors.
   - Selection of audit teams.
   - Conduct of audit activities.
   - Preservation of records.

   The implementation of the audit program is linked to the competence and evaluation of the auditors and the audit activities.
3. Monitoring and review of the audit program:
   - Monitoring and review.
   - Identification of the need for corrective and preventive actions.
   - Identify opportunities for improvement.
4. To improve the audit program.

Other international accreditors

Other international accreditors of university programs, are the following: Canadian Engineering Accreditation Board (CEAB), MERCOSUR, and Federal Council of Engineering Deans of Argentina (CONFEDI). In respect, Tejada (2003) stated:

1. The CEAB is responsible for accrediting undergraduate engineering programs in Canada that meet the standards required in this country, and also, the CEAB is responsible for determining the equivalence of the accreditation systems with other countries and to monitor the activities of the Accreditation Committees of countries with mutual recognition agreements.

2. MERCOSUR has created an experimental accreditation mechanism of careers, "through the action of national accreditation agencies, establishing common criteria and evaluation parameters and procedures agreed upon between members and partner countries" (p. 5). MERCOSUR's accreditation assesses the institutions in the following areas: (a) institutional context; (b) academic project; (c) teachers, students, and graduates; and (d) buildings and infrastructure.
3. The CONFEDI's proposal for engineering careers (except agricultural and forestry), considers the following dimensions or areas: (a) identification and definition of the careers and its objectives; (b) professional profile of the graduate; (c) characteristics of the career (curriculum content, regulations, teaching and learning); (d) students (freshmen, regular students, and graduates); (e) career resources (human resources and physical resources); (f) career management; (g) research and technological development; (h) dissemination of knowledge, extension, and binding; (i) institutional welfare; and (j) process efficiency in the training of professionals.

CONEAU's Accreditation

On May 19th, 2006, with the Law N° 28740, the National System for Evaluation, Accreditation and Certification of Educational Quality (SINEACE, *Sistema Nacional de Evaluación, Acreditación y Certificación de la Calidad Educativa*) was created, and on July 9th, 2007, the Regulation of SINEACE was approved with the supreme decree D.S. N° 018-2007. Also, the CONEAU, on September 16th, 2009, published the Guidelines for the Accreditation of University Professional Careers, in which the stages and dimensions of university accreditation were presented. The stages of university accreditation given by the CONEAU (2009) were the following:

A. Genesis of the process. It includes: (a) presentation and approval of the Internal Committee, and (b) presentation and approval of the official accreditation project.
B. Generation of information. It includes: (a) collection and systematization of sources of verification and reporting of internal audit of the management system of quality, (b) preliminary assessment of the internal committee, (c) acquisition, processing and recording of data virtually, and (d) workshops analysis and discussion.
C. Preparation of the final report. It includes the elaboration of the final report that contains the results and the improvement plan.

Furthermore, the evaluation processes to improve the quality of education provided for in Article N° 11 “Evaluation, accreditation and certification of educational quality” of the Law N° 28740 (Law which established the SINEACE) are the following:

A. Self-assessment of educational, institutional and administrative management, which is handled by the actors of the educational institution. Its implementation is essential and indispensable to improve the quality of the offered educational service and to begin, if apply, to the external processes defined below.
B. External evaluation for the purpose of accreditation, which is required by educational institutions voluntarily. For this purpose, it designates the specialized entity that carried out the evaluation, according to the procedure outlined in the regulations, the same as at the end of the evaluation, elaborates a report which will be delivered to the institution and to the corresponding operating area.
C. Accreditation, which is public and temporal recognition of the educational institution, area, program or career that voluntarily participated in an evaluation process of its educational, institutional and administrative management.

The operator body credits without further formality and as a result of the satisfactory assessment report duly verified, submitted by the accreditation entity. (p. 6)

The dimensions of the university accreditation, the factors and criteria set by CONEAU (2009) are shown below:

Table 1

The CONEAU’s Accreditation Criteria

Dimensions	Factors	Criteria
Management of the career program	*Planning, organization, direction, and control*	*Strategic planning*
		Organization, direction, and control
Professional Education	Teaching-learning	Educational Project – curricula
		Teaching-learning activities Development of teaching-learning activities Evaluation of the learning activities Students and graduates
	Research	Generation and evaluation of research projects
	Universitary Extension and Social Projection	Generation and evaluation of projects of universitary extension and social projection
Support Service for the Professional Education	*Professors*	*Teaching labor and tutorship*
		Research labor
		Labor of universitary extension and social projection

Infrastructure and Equipment	*Spaces and equipment for teaching-learning, research, universitary extension, social projection, administration, and welfare*
Welfare	*Implementation of welfare programs*
Financial Resources	*Financing of the career's implementation*
Interest Groups	*Relationships with interest groups*

Method

Statement of the Problem

There was not found a methodology for elaborating a baseline of the accomplishment of university accreditation criteria of engineering careers, based on the joint perception of professors and academic authorities, and this absence limited the decision making and the adoption of effective alignments and actions for stimulating and directing the implementation of the standards of the university accreditation criteria in the countries.

Purpose of the Research

The purpose of this research was to propose a quick methodology for elaborating a baseline of the accomplishment of university accreditation criteria in engineering careers, with the perception of the professors and academic authorities and to apply it to a city.

MEBAUAC: Methodology for Elaborating a Baseline of the Accomplishment of University Accreditation Criteria

The steps of MEBAUAC were the following:

1. To select the target population and sample for the evaluation.

   The selected city was Lima, capital of Peru. For the evaluation, the population was formed by professors and academic authorities of engineering careers of Metropolitan Lima's universities, estimated around 10,666 considering the results of the university census of 2010 (Asamblea Nacional de Rectores, 2012) due to the exact number was not detailed, and due to the professors commonly teach in various universities inside and outside Metropolitan Lima. With the formula for a normal population considering a support level of 95%, the calculated number of professors and academic authorities was 73 and included professors without administrative labors, professors with administrative labors and academic authorities (deans, directors of careers and academic coordinators) of diverse universities such as: Universidad de San Martín de Porres, Universidad Privada Norbert Wiener, Universidad Nacional Mayor de San

Marcos, Universidad Alas Peruanas, Universidad Nacional de Ingeniería, Universidad de Lima, Universidad del Pacífico, Universidad Ricardo Palma, Universidad César Vallejo, and Universidad Nacional Agraria La Molina, 10 of 32 universities with engineering careers.

It is important to remark that professors without administrative labors in a university can have administrative labors in other universities, and an academic authority can be professor with or without administrative assignments inside and outside the universities in which responded the questionnaires. Also, it is important to remark that in the sample existed eight academic authorities.

2. To prepare the data collection instrument based on the accreditation criteria of the official set of university standards of the city or country. The set of standards of the accreditation criteria in Peru was proposed by CONEAU. The steps for the validity and the reliability of the instrument and were the following:
   A. The instrument was validated by content validity. The main theoretical framework was the accreditation criteria of CONEAU in Peru.
   B. A pilot test was developed, through the application of the instrument to 21 respondents (12 professors without administrative assignments, 8 professors with administrative assignments, and 1 dean) of an Engineering Faculty. After the application of the instrument, the required corrections were realized. The corrected questions are in the Table 2.
   C. The Cronbach Alpha was calculated for the measurement instrument and a value of 0.878 was obtained. With this value, the reliability of the measurement instrument was evidenced.
   D. The final instrument (to see the appendix one) was applied to the whole sample (73 professors and academic authorities), personally or with the support of the academic coordinators.
3. To execute the data collection. The data collection of this research was realized in the second and the third trimester of the year 2012.
4. To determine the perception of the accomplishment of the university accreditation criteria of professors of engineering careers without administrative assignments.
5. To determine the perception of the accomplishment of the university accreditation criteria of professors of engineering careers with administrative assignments.
6. To determine the perception of the accomplishment of the university accreditation criteria of academic authorities of engineering careers.

7. To determine the joint perception of the accomplishment of the university accreditation criteria of professors and academic authorities of engineering careers.
8. To propose the joint perception of the accomplishment of the university accreditation criteria as the baseline for future evaluations.

Hypotheses

Over the basis of the literature review and the CONEAU's accreditation criteria, the general hypothesis is the following:

GH: The joint perception of professors and academic authorities is that the engineering careers of Metropolitan Lima's universities accomplish the CONEAU's accreditation criteria.

The specific hypotheses are the following:

- H1: The perception of professors without administrative assignments is that the engineering careers of Metropolitan Lima's universities accomplish the CONEAU's accreditation criteria.
- H2: The perception of professors with administrative assignments is that the engineering careers of Metropolitan Lima's universities accomplish the CONEAU's accreditation criteria.
- H3: The perception of academic authorities is that the engineering careers of Metropolitan Lima's universities accomplish the CONEAU's accreditation criteria.

Table 2

Questions for evaluating the CONEAU's Accreditation Criteria

N°	Criteria	Question
1	Strategic planning	The engineering careers of universities in Metropolitan Lima have been developed long term strategic plans.
2	Organization, direction, and control	The engineering careers of universities in Metropolitan Lima have been developed adequate processes of organization, direction, and control, inside a management system of quality.
3	Educational Project - curricula	The educational Project or the study plan of the engineering careers of universities in Metropolitan Lima are aligned to the current requirements of the labor market.
4	Teaching-learning activities	The professors know adequate strategies of teaching-learning.
5	Development of teaching-learning activities	The professors apply adequate strategies of teaching-learning.
6	Evaluation of the learning activities	The engineering careers of universities in Metropolitan Lima evaluate the applied strategies of teaching-learning and develop improvement actions.
7	Students and graduates	The students and graduates feedback the teaching-learning processes.

8	Generation and evaluation of research projects	Research projects are generated and evaluated adequately in the engineering careers of universities in Metropolitan Lima.
9	Generation and evaluation of projects of universitary extension and social projection	Projects of universitary extension and social projection are generated and evaluated adequately in the engineering careers of universities in Metropolitan Lima.
10	Teaching labor and tutorship	The professors participate in adequate tutorships, based on integral processes of tutorship to the level of engineering careers of universities in Metropolitan Lima in which have worked.
11	Research labor	The professors participate in adequate scientific researches, based on integral processes of scientific research to the level of engineering careers of universities in Metropolitan Lima in which have worked.
12	Labor of universitary extension and social projection	The professors participate in universitary extension and social projection labors, based on integral processes of universitary extension and social projection to the level of engineering careers of universities in Metropolitan Lima in which have worked.
13	Spaces and equipment for teaching-learning, research, universitary extension, social projection, administration, and welfare	The engineering careers of universities in Metropolitan Lima have adequate spaces and equipment for teaching-learning, research, universitary extension, social projection, administration, and welfare.
14	Implementation of welfare programs	The engineering careers of universities in Metropolitan Lima have implemented welfare programs (library, recreational activities, health attention, arts, etc.)
15	Financing of the career's implementation	The engineering careers of universities in Metropolitan Lima have approved budgets for short, medium, and long term, for the implementation of their processes.
16	Relationships with interest groups	The engineering careers of universities in Metropolitan Lima have relationships with interest groups (students, graduates, employers of graduates, professional associations, academic authorities, and administrative authorities).

Results

The results of this research were the following:

A. The years of experience of the professors and academic authorities were the following:

Table 3

Years of experience of the professors and academic authorities

Years of Experience	Respondents	Percentage
[1,10]	29	39.73%
]10,20]	24	32.88%
>20	20	27.40%
Total	73	100.00%

B. The quantities of engineering careers in which the professors and academic authorities worked in the past five years were the following:

Table 4

Quantities of engineering careers in which professors and academic authorities worked

Quantity of engineering careers in the last 5 years	Respondents	Percentage
[1,2]	29	39.73%
[3,4]	36	49.32%
[5,7]	8	10.96%
Total	73	100.00%

C. H1 was not supported due to the perception of professors without administrative labors revealed that:
   a. 63.48% were in agreement or total agreement with question 14: "The engineering careers of universities in Lima Metropolitan City have implemented welfare programs (library, recreational activities, health attention, arts, etc.)".
   b. Disagreements or total disagreements between 30.77% and 40.38 % for the questions 1, 2, 7, 8, 9, 11, 12 y 16.
   c. Agreements or total agreements between 32.69% and 50.00% for the questions 1, 3, 4, 5, 6, 10, 12, 13 y 16.

D. H2 was not supported due to the perception of professors with administrative labors revealed that:
   a. 54.55% were in agreement or total agreement with question 4: "The professors know adequate strategies of teaching-learning".
   b. 51.52% were in agreement or total agreement with question 6: "The engineering careers of universities in Lima Metropolitan City evaluate the applied strategies of teaching-learning and develop improvement actions".
   c. 69.7% were in agreement or total agreement with question 14: "The engineering careers of universities in Lima Metropolitan City have implemented welfare programs (libraries, recreational activities, health attention systems, arts, etc.)".
   d. Disagreements or total disagreements between 33.33% and 51.52% for the questions 1, 2, 7, 8, 9 y 11.
   e. Agreements or total agreements between 30.3% and 45.45% for the questions 1, 3, 5, 7, 11, 12, 13 y 16.

E. H3 was not supported due to the perception of academic authorities revealed that:
   a. 75% were in agreement or total agreement with question 4: "The professors know adequate strategies of teaching-learning".

b. Disagreements or total disagreements between 37.5% and 62.5% for the questions 1, 2, 7, 8, 10, 11, 13 and 15. It is important to remark that the answers for the question 11 "The professors participate in adequate scientific researches, based on integral processes of scientific research to the level of engineering careers of universities in Lima Metropolitan City in which have worked" and the question 15 "The engineering careers of universities in Lima Metropolitan City have approved budgets for short, medium and long term, for the implementation of their processes" revealed 65% of disagreements or total disagreements.

c. Agreements or total agreements between 37.5% and 50% for questions 1, 3, 5, 6, 14 y 16.

F. GH was not supported, due to the joint perception of professors and academic authorities revealed that:

a. 52.05% were in agreement or total agreement with question 4: "The professors know adequate strategies of teaching-learning".

b. 64.38% were in agreement or total agreement with question 14: "The engineering careers of universities in Lima Metropolitan City have implemented welfare programs (library, recreational activities, health attention, arts, etc.)".

c. Disagreements or total disagreements between 32.88% and 41.67% for the questions 1, 2, 7, 8, 9 y 11.

d. Agreements or total agreements between 31.51% and 49.32% for the questions 1, 3, 5, 6, 10, 12, 13 y 16.

G. The accomplishment percentages of the CONEAU's Accreditation Criteria were the following:

Table 5

Baseline of the accomplishment of the CONEAU's accreditation criteria

N°	Criteria	Question	Percentage of Accomplishment
1	Strategic planning	The engineering careers of universities in Metropolitan Lima have been developed long term strategic plans.	37.50%
2	Organization, direction, and control	The engineering careers of universities in Metropolitan Lima have been developed adequate processes of organization, direction, and control, inside a management system of quality.	28.77%
3	Educational Project curricula	The educational Project or the study plan of the engineering careers of universities in Metropolitan Lima are aligned to the current requirements of the labor market.	34.25%
4	Teaching-learning activities	The professors know adequate strategies of teaching-learning.	52.05%
5	Development of teaching-learning activities	The professors apply adequate strategies of teaching-learning.	47.95%

6	Evaluation of the learning activities	The engineering careers of universities in Metropolitan Lima evaluate the applied strategies of teaching-learning and develop improvement actions.	49.32%
7	Students and graduates	The students and graduates feedback the teaching-learning processes.	28.77%
8	Generation and evaluation of research projects	Research projects are generated and evaluated adequately in the engineering careers of universities in Metropolitan Lima.	20.55%
9	Generation and evaluation of projects of universitary extension and social projection	Projects of universitary extension and social projection are generated and evaluated adequately in the engineering careers of universities in Metropolitan Lima.	23.29%
10	Teaching labor and tutorship	The professors participate in adequate tutorships, based on integral processes of tutorship to the level of engineering careers of universities in Metropolitan Lima in which have worked.	31.51%
11	Research labor	The professors participate in adequate scientific researches, based on integral processes of scientific research to the level of engineering careers of universities in Metropolitan Lima in which have worked.	27.40%
12	Labor of universitary extension and social projection	The professors participate in universitary extension and social projection labors, based on integral processes of universitary extension and social projection to the level of engineering careers of universities in Metropolitan Lima in which have worked.	32.88%
13	Spaces and equipment for teaching-learning, research, universitary extension, social projection, administration, and welfare	The engineering careers of universities in Metropolitan Lima have adequate spaces and equipment for teaching-learning, research, universitary extension, social projection, administration, and welfare.	39.73%
14	Implementation of welfare programs	The engineering careers of universities in Metropolitan Lima have implemented welfare programs (library, recreational activities, health attention, arts, etc.).	64.38%
15	Financing of the career's implementation	The engineering careers of universities in Metropolitan Lima have approved budgets for short, medium, and long term, for the implementation of their processes.	24.66%
16	Relationships with interest groups	The engineering careers of universities in Metropolitan Lima have relationships with interest groups (students, graduates, employers of graduates, professional associations, academic authorities, and administrative authorities).	47.95%

Discussion

The results found in this research coincided with previous studies conducted by Coe (2006), Zhang et al. (2011), Mabres (1994), Sota (2002), Burga, Zegarra, and Lerner (2005), Góngora (2002), and Science and Development Network (2010); in which, the various problems in the long-term planning of universities, the problems associated with little or no scientific research, budgets, investments, infrastructure and equipment, among other aspects, were highlighted. It should be noted that discrepancies were found with other related studies, regarding the fulfillment of the criteria associated with the knowledge of appropriate teaching-learning strategies by teachers and the implementation of wellness programs, to which respondents expressed an agreement controlling. The coincidences and discrepancies with the aforementioned studies are detailed below for each criterion evaluated by the teachers and academic authorities who were surveyed.

The lack of development of long-term strategic plans coincided with the studies carried out by Coe (2006), Burga, Zegarra, and Lerner (2005), Science and Development Network (2010), and Sota (2002). Coe (2006) explained that Engineering careers that had been evaluated under the ABET accreditation system did not have long-term plans for equipment replacement, while Burga, Zegarra, and Lerner (2005) indicated that political problems and the general idiosyncrasies of the Peruvian public university did not allow it to have a long-term vision.

In this regard, in a publication of the Science and Development Network (2010), the little or no management capacity of Peruvian universities was highlighted, which were not able to propose long-term projects, thus preventing the use of resources that had been assigned to them, mainly referring to the universities that had an oil or mining fee. Sota (2002) also explained that "There are no instances of coordination both at the Regional and National levels, between the representative institutions of Civil Society, the State, and Universities." (p. 106), that the culture of planning, statistics and evaluation were weak or non-existent, thus blocking the adoption of long-term strategies and affecting the optimization of resources, and that "political instability in the university setting, and the weakness of the administrative career results in a high rate of rotation of the planning teams that severely affects the possibilities of policy continuity, as well as the consolidation of competencies in that sector." (p. 107).

The non-fulfillment of organizational, direction, and control processes, framed in a quality management system coincided with the studies of Coe (2006) and Sota (2002). Coe (2006) indicated the various problems associated with academic aspects, curricula and teaching staff, which evidenced the absence of processes aligned to a quality management system. In this regard, Sota (2002) described the poor quality of university higher education and that the organization of public universities had political nuances that prevented it from developing its processes with quality, thus invoking the recovery of academic quality.

The absence of an alignment of the curriculum of the engineering careers of the universities of Lima Metropolitan City towards the current requirements of the labor market, coincided with the studies of Coe (2006), Zhang et al. (2011), Mabres (1994), and Sota (2002). Coe (2006) explained that the careers related to Civil Engineering that were evaluated with the ABET accreditation system during 2004 did not cover a series of contents of the fundamental areas of Civil Engineering, while Zhang et al. (2011) indicated that one of the biggest concerns about the quality of education in China was the training of the future engineer in relation to his concern for the environment and his vision for solving global problems. In addition, according to the expressions of the students during the First National Congress of University Students held at the Congress of the Republic on December 4th and 5th, 2009, it was indicated that only

graduates of some universities were preferred by the labor market, thus limiting the chances of getting a job. In this regard, Mabres (1994) highlighted the little or no interaction with the business world and Sota (2002) explained the lag in university education that was not in line with the needs of the labor market. This result also is contrary to the results of the study of Mutereko (2018) who indicated that governmental notions appeared giving autonomy and responsibilities in certain aspects of the engineering curriculum (p. 235).

The majority agreement about the knowledge of appropriate teaching-learning strategies by teachers did not coincide with what was stated by the students in the First National Congress of University Students or with what was stated by Burga, Zegarra, and Lerner (2006). According to the opinions of the students, expressed in the First National Congress of University Students, teachers did not teach classes and escaped from the university to go to other jobs, in addition to the fact that many teachers did not have the ability to link the aspects that they taught with reality, due to that they did not know the world of non-university work. In this regard, Burga, Zegarra, and Lerner (2005) indicated that the low budget and low salary of university professors caused the impossibility of continuing to study in order to continue improving their teaching, in addition to do not conducting scientific research, which reduced the generation of knowledge (basic requirement for improving the quality of teaching). However, it should be noted that what was stated by university students and Burga, Zegarra and Lerner coincided with the results found regarding the lack of application of appropriate teaching-learning strategies.

The results of the present investigation regarding the lack of evaluation of the teaching-learning strategies applied together with the lack of development of improvement actions, as well as the lack of feedback on the teaching-learning processes by part of the students and graduates coincided with Coe (2006), who found that Engineering careers that had been evaluated with the ABET accreditation system, in some cases had developed improvement actions with a non-representative number of students, and that some students had to take physics classes from other engineering schools in other universities, due to that they doubted the quality of the teaching that they had received in their schools, in addition to do not have an adequate monitoring system to measure progress of the student or the professional development of the graduates.

On the other hand, the results regarding the absence of adequate generation and evaluation of projects of university extension and social projection in the careers of engineering of the universities of Lima Metropolitan City and the lack of participation of teachers in these projects coincided with Burga, Zegarra and Lerner (2005), who highlighted the urgent need to rescue the university's projection towards the community.

The lack of tutorials framed in comprehensive tutoring processes in the engineering careers of the universities of Lima Metropolitan City coincided with Coe (2006) and Burga, Zegarra, and Lerner (2005). Coe (2006) explained that the engineering careers evaluated with the ABET accreditation system did not have an adequate monitoring system to measure student progress, while Burga, Zegarra, and Lerner (2005) indicated that the politicization of student leaders reduced the efficiency and effectiveness of the university government and that it was urgent to recover the quality of university education.

The lack of scientific research of the teachers, framed in integral processes of scientific research in the engineering careers of the universities of Lima Metropolitan City coincided with the exposed by Coe (2006), Mabres (1994), Sota (2002), and the Science and Development Network (2010). Coe (2006) pointed out that in the Engineering careers evaluated with the ABET accreditation system, the high teaching assignments, and the various committees that were formed reduced the research. In this regard, Mabres (1994) indicated that among the five main problems of the Peruvian university, there was the little quality research.

Sota (2002) also explained that in the universities there was no planned research policy, the students did not intervene in the research projects, the competencies of the teachers to carry out research projects had a very low level, almost they did not have research project advisory offices, there was an inadequate treatment of international agreements, and that successful research at the local level did not come to the knowledge of the academic community because of its weak articulation. In addition, the Science and Development Network (2010), citing a publication of COMEX Peru indicated that less than 5% of the resources granted to state universities to be invested in science and technology are effectively used for that purpose.

The results of this research regarding the lack of processes of university extension and social projection coincided with what was stated by Burga, Zegarra, and Lerner (2005), who indicated the low relationship of Peruvian universities with their environment and the poor social projection. In addition, the lack of adequate environments and equipment for teaching-learning, research, university extension, social projection, administration and welfare, in the engineering careers of universities of Lima Metropolitan City coincided with what was stated by Coe (2006), Sota (2002), and the opinions of university students in the First National Congress of University Students. Coe (2006) indicated that the engineering careers evaluated with the ABET accreditation system did not have adequate infrastructure and equipment for the various courses in the main areas of the curriculum, while among the opinions of the students of the First Congress National University Students indicated that many universities did not have adequate infrastructure or equipment. In this regard, Sota (2002) indicated that many universities had

proliferated with the D.L. 882, which did not have the minimum infrastructure or equipment to successfully perform their duties.

The majority agreement of the respondents, on the implementation of wellness programs (libraries, recreational activities, arts, medical care systems, etc.) in the engineering careers of the universities of Lima Metropolitan City, did not coincide with other studies. It should be noted that there were no studies in which the benefits of the Peruvian university in general were highlighted.

The results on the lack of budgets approved in the short, medium and long term for the implementation of the processes coincided with the statements by Coe (2006), Mabres (1994), Sota (2002), Burga, Zegarra and Lerner (2005), and Gongora (2002). Coe (2006) indicated that the budget for engineering careers evaluated in recent years was reduced, there were few funds for teacher professional development, teacher salaries were very low, there were no funds for the promotion of the teaching staff, insufficient funds for the acquisition and maintenance of infrastructure and laboratory space, there was no long-term plan for equipment replacement, library books and especially professional magazines were incomplete and outdated, donation funding was used, among other aspects In this regard, Mabres (1994) explained that among the main five problems of the Peruvian university, there was economic uncertainty. Sota (2002) also explained that the lack of long-term strategies affected the optimization of resources in Peruvian universities. In addition, Burga, Zegarra and Lerner (2005) indicated that in 1999 Peru was among the countries that least invested in research in Latin America and the Caribbean, placing us at the level of Nicaragua and El Salvador, and that financing was needed to ensure the development of the Peruvian public universities as it happens with other countries in Latin America. In this regard, Gongora (2002) explained that public universities cannot use the full amount of their resources generated to improve the conditions of study because these resources are destined for bureaucratic senior management between 30% and 40% of their total income, generating the absence or lag of laboratories, libraries and specialized newspaper libraries, in addition to the infrastructure and training for their teachers.

Finally, the lack of links with interest groups (students, graduates, employers of graduates, professional associations, academic authorities and administrative authorities), coincided with what was stated by Coe (2006), Mabres (1994), and Sota (2002). Coe (2006) explained that in the engineering careers evaluated with the ABET accreditation system, the high teaching loads and the various committees that were formed, prevented them from devoting themselves to research and linking with professional associations, in addition they did not have a system for monitoring student progress and professional development of the graduate. In this

regard, Mabres (1994) explained that among the main problems of the Peruvian university there were: a) very few relations of academic collaboration between universities, and b) almost total absence of relationship with the business sector. In addition, Sota (2002) indicated the absence of instances of coordination at the regional or national level between organizations of civil society, the Peruvian government and universities.

The limitations of the investigation were the following: (a) there were not evaluations of the academic processes or administrative processes of the Engineering careers of universities in Lima Metropolitan City, due to the difficulty in accessing information on the processes of these entities; (b) the purpose was not the search for knowledge about the fulfillment of each of the standards of accreditation, but only the knowledge about the fulfillment of its criteria was sought, due to difficulties in accessing information of the universities; (c) the perception of compliance with accreditation standards was not investigated by any entity other than teachers and academic authorities, such as: students, parents, society, etc., given that teachers and academic authorities are the actors who know or should know in greater depth the various processes of university accreditation; and (d) due to limitations of economic resources, the research had a sample of teachers and academic authorities of universities in Lima Metropolitan City, chosen for convenience, although the sample had teachers from a representative number of universities in Lima Metropolitan City.

The application of MEBAUAC permitted to determine the level of accomplishment of university accreditation criteria in engineering careers quickly in comparison with the physical evaluation of the authorities of the universities or the governments, who could take many months and require diverse resources (personnel, infrastructure, equipment, etc.). The professors and the authorities can offer a closer and quick perception about the situation of the accomplishment that could permit the decision making to the authorities of the governments for improving the quality of the university education.

The joint perception of professors and academic authorities was that the accreditation criteria were not accomplished as a whole by the engineering careers of Lima Metropolitan City's universities. The majority of them indicated advances on the accomplishment of the criterion 4 "Teaching-Learning Strategies" with the question "The professors know adequate strategies of teaching-learning", and advances on the accomplishment of the criterion 14 "Implementation of welfare programs" with the question "The engineering careers of universities in Lima Metropolitan City have implemented welfare programs (library, recreational activities, health attention, arts, etc.)", situation which suggests that university authorities didn't prioritize the

strategic planning and the research processes in the engineering careers of Lima Metropolitan City's universities.

The perception of the majority of academic authorities of engineering careers was that criterion 11 "Research Labor" with the question 11 "The professors participate in adequate scientific researches, based on integral processes of scientific research to the level of engineering careers of universities in Lima Metropolitan City in which have worked" and criterion 15 "Financing of the career's implementation" with the question "The engineering careers of universities in Lima Metropolitan City have approved budgets for short, medium and long term, for the implementation of their processes" are not accomplished by the management of universities for engineering careers of universities of Lima Metropolitan City, situation that suggests a lack of prioritization of the accomplishment of the accreditation criteria for engineering careers by the university authorities of Lima Metropolitan City's universities.

The baseline of the accomplishment of the CONEAU's accreditation criteria revealed that 14 of 16 criteria were not accomplished by the engineering careers of Lima Metropolitan City's universities, situation that suggest the need of reforms of the regulatory framework for stimulating the continuous improvement and the investment of the top management of the authorities of engineering faculties and the university authorities of diverse countries. Some recommendations for future researches for the university faculties or schools, for the governmental university authorities, and for researchers with interest about this theme are the following:

1. For the authorities of university faculties or schools: (a) to study about the learning results with the teaching-learning strategies, for directing concrete strategies for improving the standards associated to those criteria, and (b) to investigate about the results of the alliances among diverse universities in the world, for sharing resources for getting the accomplishment of the accreditation criteria through: budgets, joint researches, infrastructure and equipment, teaching-learning methodologies, social projection, etc.
2. For the governmental university authorities of diverse countries:
    A. To repeat this research every year for updating the accomplishment level of the accreditation criteria and to align strategies for an adequate implementation.
    B. To join the accomplishment level of the accreditation criteria in the quality cycle, considering the following phases:
        a. First phase:
            i. To develop long term strategic plans.

ii. To approve budgets for short, medium, and long term, for the implementation of the accreditation processes.

b. Second phase:
   i. To develop processes of organization, direction and control, inside a quality management system.
   ii. To elaborate curricula or educational projects according to the requirements of labor market.

c. Third phase:
   i. To implement the knowledge of adequate strategies of teaching-learning by professors.
   ii. To apply the adequate strategies of teaching-learning by professors.
   iii. To evaluate the adequate strategies of teaching-learning and to develop improvement actions.
   iv. To feedback the teaching-learning processes by the side of students and graduates.
   v. To improve the spaces and the equipment for the teaching-learning, scientific research, university extensions, and social projection.
   vi. To implement welfare programs (library, recreational activities, arts, health attention, etc.).

d. Fourth phase:
   i. To generate research projects and to evaluate them correctly.
   ii. To generate university extension and social projection projects and to evaluate them correctly.
   iii. To develop scientific researches inside integral scientific research processes, directed by the professors.
   iv. To develop university extension and social projection projects, by the side of professors.
   v. To link with interest groups (students, graduates, employers of graduates, associations of professionals, academic authorities and administrative authorities).

With the implementation of each phase, processes for evaluating and for taking corrective actions must be executed.

3. For the researches with interest about this theme:

A. To increase the population of the study, searching information about other cities inside Lima Region and other regions in Peru.
B. To adapt the methodological design of this research for developing similar researches in other countries.
C. To add other variables for studying the accomplishment of accreditation criteria, such as: the age of the professors, the age of the students, the social and economic characteristics of the students, etc.
D. To adapt and to apply this research for evaluating the accomplishment of accreditation criteria for education, health and law careers, to which the accomplishment of the whole criteria is mandatory but in the practice only a few careers have accomplished them.

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Appendix 1: Instrument for Data Collection

Questionnaire about the perception of the accomplishment of the CONEAU's Accreditation Criteria in engineering careers in Metropolitan Lima's universities

PERCEPTION OF THE ACCOMPLISHMENT OF THE CONEAU'S ACCREDITATION CRITERIA OF THE ENGINEERING CAREERS OF UNIVERSITIES IN METROPOLITAN LIMA

Instructions:

1. Please read clearly the questions before to respond.

2. It doesn't exist correct or incorrect answers. We wish to know your perception about the occurrences in the engineering careers of universities in Metropolitan Lima, in which you were professor without administrative assignments, professor with administrative assignment or academic authority, in respect to the accomplishment of the CONEAU's accreditation criteria.

3. The answers of the questions are in a scale from minimum to maximum in respect to the agreement with the showed propositions, considering: TD: Total disagreement, D: Disagreement, N: Not in disagreement and not in agreement, A: Agreement, TA: Total agreement.

All the answers will be used in a set, and respondents will not be identified. Your answers will be a valuable support for improving the comprehension about the needs of engineering careers. You must mark with a "X" in the boxes according to each question.

		Agreement Level				
		Min	...			Max
N°	QUESTION	TD	D	N	A	TA
1	The engineering careers of universities in Metropolitan Lima have been developed long term strategic plans.					
2	The engineering careers of universities in Metropolitan Lima have been developed adequated processes of organization, direction, and control, inside a management system of quality.					
3	The educational project or the study plan of the engineering careers of universities in Metropolitan Lima, are aligned to the current requirements of the labor market.					
4	The professors know adequated strategies of teaching-learning.					
5	The professors apply adequated strategies of teaching-learning.					
6	The engineering careers of universities in Metropolitan Lima evaluate the applied strategies of teaching-learning and develop improvement actions.					
7	The students and the graduates feedback the teaching-learning processes.					
8	Research projects are generated and evaluated adequately in the engineering careers of universities in Metropolitan Lima.					
9	Projects of universitary extension and social projection are generated and evaluated adequately in the engineering careers of universities in Metropolitan Lima.					
10	The professors participate in adequated tutorships, based on integral processes of tutorship to the level of engineering careers of universities in Metropolitan Lima in which have worked.					
11	The professors participate in adequated scientific researches, based on integral processes of scientific research to the level of engineering careers of universities in Metropolitan Lima in which have worked.					
12	The professors participate in universitary extension and social projection labors, based on integral processes of universitary extension and social projection to the level of engineering careers of universities in Metropolitan Lima in which have worked.					
13	The engineering careers of universities in Metropolitan Lima have adequated spaces and equipment for teaching-learning, research, universitary extension, social projection, administration and welfare.					
14	The engineering careers of universities in Metropolitan Lima have implemented welfare programs (library, recreational activities, health attention, arts, etc.).					
15	The engineering careers of universities in Metropolitan Lima have approved budgets for short, medium and long term, for the implementation of their processes.					
16	The engineering careers of universities in Metropolitan Lima have relationships with interest groups (students, graduates, employers of graduates, professional associations, academic authorities and administrative authorities).					

Experience in engineering careers of universities in Metropolitan Lima (in years):	years
Number of engineering careers in Metropolitan Lima in which worked in the last 5 years:	
Experience as (mark with X inside the boxes of all the options which apply):	Professor without administrative labors
	Professor with administrative labors
	Academic authority

FULL NAME AND SIGNATURE	DNI