Enhancing Educational Excellence: A Continuous Improvement Model for Accreditation Success

Prof. Miguel X. Rodriguez-Paz, Tecnologico de Monterrey (ITESM)

Prof. RodrÃguez-Paz got his B.Sc. In Civil Engineering from Tecnologico de Oaxaca in 1993. He studied a M.Sc. In Structural Engineering at Tecnologico de Monterrey and got his Ph.D. from the University of Wales at Swansea in 2003 where he did research on

Prof. Israel Zamora-Hernandez

Israel Zamora-Hernández has a B.Sc. in Electronic Engineering from the Autonomous University of Puebla, Mexico. He has a M.Sc. in Digital Systems from Tecnologico de Monterrey, currently collaborating with this university since 2004 holding different positions and responsibilities, among which stand out; the creation of the electronics laboratories in 2005, assuming the direction of the Electronic Engineering and Communications degree in 2006, the creation of the networks laboratory in 2007, the creation of the media center laboratories in 2008, assuming In the same year the position of director of academic programs, which included the career directorates, the admissions directorate and the marketing directorate of the Campus. His work especializes in attracting new students to STEM programs at University level. In 2017, he took the position of career director of Engineering in Innovation and Development and in 2019, the Industrial and Systems Engineering direction was added. Based on this trajectory, an educational channel was created in which academic topics, vocational guidance, and university promotion, among others, upload. He is currently part of a group of research professors in educational innovation, allowing him to publish in SCOPUS conferences.

Mr. Jorge A. Gonzalez-Mendivil, Tecnológico de Monterrey

Master in Sciences with an speciality in Quality Systems and Industrial and Systems Engineer by ITESM in Mexico, twenty years of experience in engineering education, several projects in innovation of engineering education such as the use of 3D virtual amb

Ing. Luis Horacio Hernandez Carrasco P.E., Tecnologico de Monterrey (ITESM)

Civil Engineer Master degree in Structural Engineering Master in Business Administration Full time professor at (Tec de Monterrey) ITESM Professional Registered Engineer in Structural Design

Enhancing Educational Excellence - A Continuous Improvement Model for Accreditation Success

Abstract

In a globalized world where professional mobility is increasingly frequent, higher education institutions face the challenge of ensuring their programs meet international accreditation standards. Accreditation processes not only emphasize academic excellence but also focus on developing the competencies and skills needed for graduates to succeed in highly competitive environments. The Washington Accord (WA) plays a key role in facilitating mutual recognition of engineering programs across member countries, ensuring alignment with global benchmarks.

This paper presents a continuous improvement model designed to streamline accreditation processes and enhance the quality of academic programs. The model facilitates the systematic collection, analysis, and visualization of key performance indicators (KPIs), enabling data-driven decision-making and fostering continuous improvement. Successfully implemented in three engineering programs—Industrial Engineering, Computational Technologies Engineering, and Mechatronics—at our institution, Tecnologico de Monterrey, the model contributed to achieving accreditation from both the Accreditation Board for Engineering and Technology (ABET) and the Consejo de Acreditación de la Enseñanza de la Ingeniería (CACEI) in 2024.

Results show a significant reduction in evaluator observations compared to previous cycles, with CACEI observations reduced from nine to one, and ABET weaknesses eliminated entirely. Evaluator feedback highlighted the model's effectiveness in organizing and presenting information. This study provides a replicable framework for institutions aiming to achieve international accreditation while fostering a culture of educational excellence.

Introduction

In a globalized world where the mobility of professionals is increasingly frequent, higher education institutions face the challenge of aligning their academic programs with international accreditation standards. Accreditation is not only a mark of academic excellence but also a recognition of the competencies and skills that prepare graduates for competitive environments. However, achieving and maintaining accreditation requires institutions to overcome significant challenges related to evolving standards, resource allocation, and stakeholder alignment.

Accreditation processes, such as those defined by the Washington Accord (WA), play a pivotal role in establishing global benchmarks for engineering education. These frameworks ensure mutual recognition of programs across member countries, fostering graduate mobility and international collaboration [1]. Nonetheless, institutions must continuously monitor and adapt their programs to meet these rigorous criteria. This involves addressing the variability of accreditation systems, as highlighted by Memom [2], where differences between national and international standards often complicate compliance. For example, in regions like Asia, the lack

of uniform accreditation systems creates significant hurdles for institutions seeking international recognition.

Resource constraints further exacerbate these challenges, particularly in emerging economies. Institutions often face limitations in laboratory equipment, qualified faculty, and financial support, all of which are critical for meeting accreditation standards [3], [4]. Additionally, the rapid evolution of industry demands necessitates constant updates to curricula and teaching methodologies, as noted by Zamyatina [5], who underscore the importance of aligning educational programs with market expectations.

Beyond structural and resource challenges, the accreditation process also demands robust documentation and evidence collection. Institutions must implement continuous improvement mechanisms, such as the Plan-Do-Check-Act (PDCA) cycle, to monitor outcomes and demonstrate alignment with accreditation criteria [6]. This process includes engaging diverse stakeholders—students, alumni, employers, and faculty—in evaluating program effectiveness and proposing actionable improvements. Feedback from these groups not only strengthens institutional practices but also ensures the relevance of educational objectives to professional and societal needs [7].

A significant barrier for many institutions is the complexity of managing accreditation across multiple frameworks, as noted by Vasudevan & SudalaiMuthu [8]. For example, dual accreditation systems require programs to meet criteria from different accrediting bodies, often with varying expectations and timelines. This can result in administrative overload and potential misalignment of institutional priorities [9].

In this context, this study presents a continuous improvement model designed to address these challenges systematically. The model provides a structured framework for data collection, analysis, and implementation of improvements across academic programs. By integrating tools such as Power BI dashboards and Excel-based analytics, the model ensures transparency and accessibility of key performance indicators (KPIs), fostering a culture of evidence-based decision-making. Its application to three engineering programs—Industrial Engineering, Computational Technologies Engineering, and Mechatronics—has resulted in significant improvements in accreditation outcomes, reducing evaluator observations and strengthening compliance with both ABET and CACEI standards.

This paper aims to contribute to the field of educational innovation by offering a replicable framework that other institutions can adapt to their unique contexts. It addresses the complexities of accreditation while demonstrating how structured processes and stakeholder collaboration can lead to continuous improvement and educational excellence.

Theoretical Framework

Accreditation is a cornerstone of quality assurance in higher education, serving as a formal recognition that an academic program meets specific quality standards. This process, conducted by external accrediting bodies, validates the relevance and rigor of programs, ensuring that graduates are well-prepared to meet the demands of their profession. As highlighted by ABET, accreditation is not merely a certification; it is a catalyst for continuous improvement,

promoting the alignment of academic offerings with industry needs and global benchmarks [10].

Definition and Impact of Accreditation

Accreditation is defined as a comprehensive evaluation process that certifies whether educational programs adhere to established quality standards. Beyond serving as a quality assurance mechanism, accreditation fosters continuous improvement, requiring institutions to regularly assess and enhance their programs. This cyclical process benefits students, institutions, and employers by ensuring the development of competencies that meet the expectations of a competitive, globalized workforce [11], [12].

In the context of engineering education, accreditation plays a pivotal role in ensuring that graduates possess the skills, knowledge, and ethical foundations required for professional practice. Programs accredited by bodies such as ABET are subject to rigorous scrutiny, with criteria encompassing faculty credentials, curriculum design, infrastructure, and institutional support. These elements collectively contribute to a robust educational experience, preparing students to address complex challenges in their fields [13], [14].

Core Criteria for Accreditation

The criteria for accreditation are designed to uphold educational quality and relevance. Key aspects include:

Faculty Credentials: Accredited programs must demonstrate that their academic staff possess appropriate qualifications and experience. Faculty members are expected to engage in continuous professional development to remain current in their disciplines, thereby enhancing the quality of instruction and mentorship provided to students [15].

Curriculum Design: A well-structured curriculum is essential for aligning educational outcomes with industry standards. Accreditation ensures that programs incorporate both theoretical and practical components, fostering competencies such as critical thinking, problem-solving, and ethical decision-making. Additionally, curricula must address contemporary issues, including sustainability, public health, and safety [12].

Infrastructure and Resources: Adequate facilities, including laboratories, libraries, and technological resources, are critical for supporting student learning and research activities. Accreditation bodies evaluate whether institutions provide sufficient resources to enable hands-on learning and the development of technical skills [14].

Continuous Improvement: Accreditation requires institutions to establish mechanisms for monitoring and improving program performance. This involves collecting and analyzing data on student outcomes, curricular effectiveness, and industry trends, ensuring that programs remain responsive to the evolving needs of the professional landscape [13].

The Washington Accord and International Accreditation

The Washington Accord (WA), established in 1989, serves as an international framework for the recognition of engineering programs accredited by its signatory bodies. This agreement facilitates the mobility of engineering professionals by ensuring the substantial equivalency of

accredited programs. For example, programs accredited by Mexico's CACEI are evaluated against international standards, enabling recognition through ABET and other WA signatories. This interconnected framework not only enhances the global competitiveness of graduates but also fosters collaboration and knowledge exchange among institutions worldwide [16].

Through its emphasis on mutual recognition and quality assurance, the WA has become a benchmark for excellence in engineering education. By adhering to WA standards, institutions demonstrate their commitment to producing globally competent graduates who are equipped to contribute meaningfully to their professions and societies.

Continuous Improvement Model

The continuous improvement model presented in this study (Figure 1) has been designed to provide a systematic framework for enhancing the quality and effectiveness of academic programs. This model integrates critical phases and processes that align with the principles of continuous improvement, as required by international accreditation standards. Its goal is to ensure that educational programs are aligned with the needs of stakeholders, foster accountability, and maintain a high level of academic excellence.

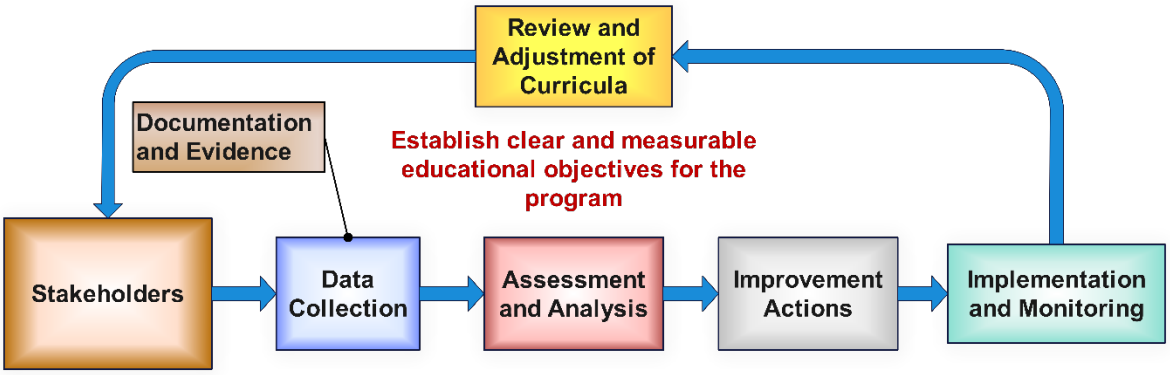

Figure 1. Continuous improvement model design.

The model is structured around six interconnected stages, supported by two overarching processes: documentation and evidence collection and review and adjustment of curricula. Each stage represents a critical component of the improvement cycle, fostering a dynamic and iterative process aimed at achieving and sustaining quality in education.

Stakeholders: The process begins with the identification and engagement of stakeholders, including students, faculty, alumni, employers, and accreditation bodies. Stakeholders provide valuable insights and expectations that guide the definition of program objectives and priorities. Their involvement ensures that the program remains relevant to both societal and professional demands.

Data Collection: This stage involves the systematic gathering of quantitative and qualitative data. Sources include academic performance metrics, graduate feedback, employer surveys, and industry trends. The data serves as the foundation for assessing program performance and identifying areas for improvement.

Assessment and Analysis: The collected data is subjected to rigorous evaluation and analysis to identify trends, gaps, and opportunities for enhancement. This stage involves benchmarking against accreditation criteria, industry standards, and institutional goals, ensuring a comprehensive understanding of program strengths and weaknesses.

Improvement Actions: Based on the analysis, specific improvement actions are designed and prioritized. These actions may include curricular updates, faculty development initiatives, infrastructure enhancements, or policy changes. The aim is to address identified gaps and align the program with stakeholder expectations and accreditation requirements.

Implementation and Monitoring: Improvement actions are implemented with a focus on measurable outcomes. This stage emphasizes continuous monitoring to evaluate the effectiveness of changes, ensuring that the desired improvements are achieved. Regular feedback loops allow for real-time adjustments and refinements.

Review and Adjustment of Curricula: The iterative nature of the model culminates in a periodic review of the curriculum. This process ensures that the program objectives remain clear and measurable, adapting to emerging trends and evolving stakeholder needs. Curriculum adjustments are informed by the findings from previous stages, fostering a culture of continuous innovation and excellence.

Throughout the model, documentation and evidence collection play a vital role in maintaining transparency and accountability. This ensures that every phase is well-documented, facilitating compliance with accreditation standards and providing a clear audit trail for evaluators.

By integrating these stages, the proposed model establishes a robust framework for continuous improvement in educational programs. It has been successfully applied to engineering programs at University, resulting in significant advancements in program quality and accreditation outcomes. This model offers a replicable structure that can be adapted by other institutions seeking to enhance their academic offerings and align with international accreditation standards.

Alignment Between the Institutional National Model and the Continuous Improvement Framework

The periodic structure of the continuous improvement model proposed in this study is built upon the foundational framework established at a national level within the institution. This institutional model, aligned with the principles of the National Continuous Improvement Process for Academic Programs, emphasizes a structured timeline for evaluating and enhancing educational quality. The relationship between these two models provides a cohesive structure that integrates immediate, short-term, medium-term, and long-term actions to ensure sustained program improvement.

The national model (Figure 2) is designed to address the continuous improvement process at multiple temporal levels:

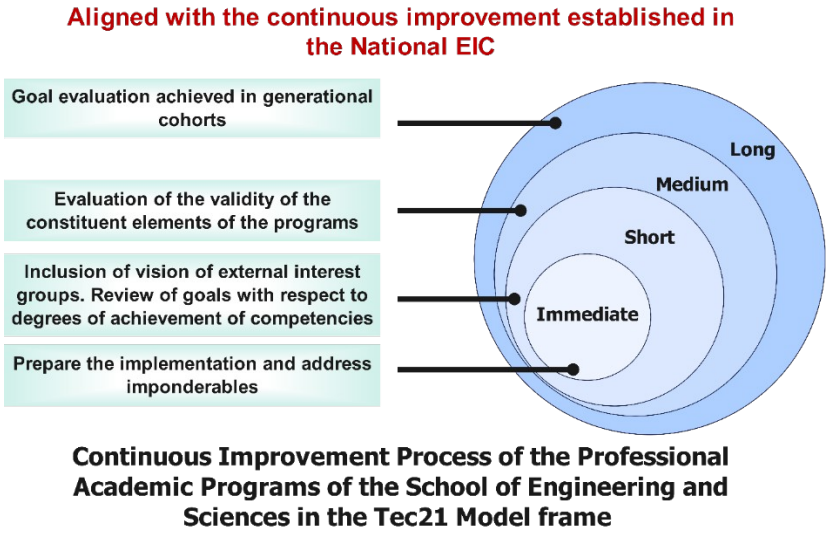

Figure 2. The National Continuous Improvement Process for Academic Programs provides the foundational structure for aligning short-, medium-, and long-term program improvement actions.

1. Immediate Actions: These focus on preparing implementation strategies and addressing unforeseen challenges. This stage is critical for ensuring that program adjustments can be initiated swiftly and effectively.
2. Short-Term Actions: These involve incorporating the perspectives of external interest groups, such as employers and accreditation bodies. This stage also includes revisiting program goals and ensuring alignment with competency achievement levels.
3. Medium-Term Actions: The evaluation of the validity of the program's core elements, including curriculum design, instructional quality, and infrastructure, takes place in this phase. This ensures that the program remains relevant and responsive to evolving academic and industry standards.
4. Long-Term Actions: The focus shifts to evaluating generational cohorts to assess the overarching impact of the program's objectives and their achievement over time.

The proposed model for continuous improvement (Figure 3) adapts and operationalizes these principles within the academic calendar, providing a more granular and actionable structure. This periodicity, divided into the February-June Semester and the August-December Semester, mirrors the immediate and short-term actions outlined in the national model. Each semester incorporates systematic data collection, rigorous assessment, and the implementation of targeted improvements, aligning with the immediate and short-term levels of the national framework.

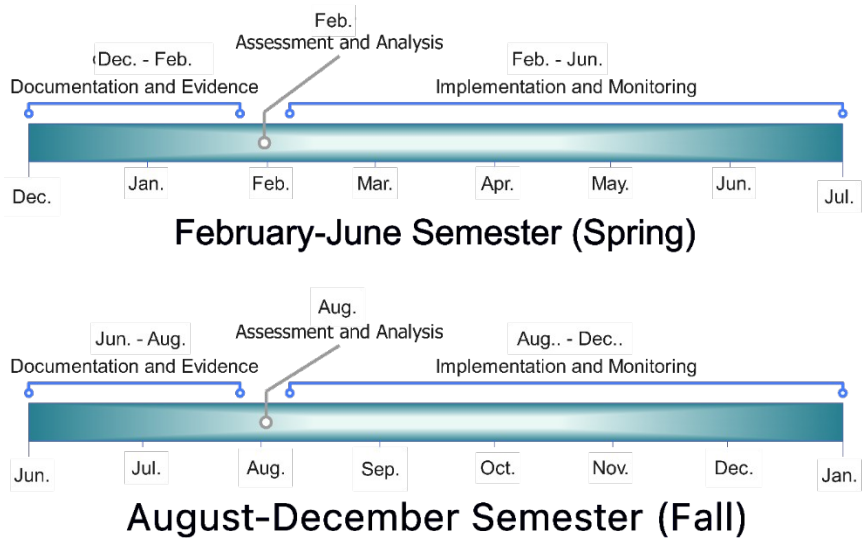

Figure 3. illustrates the adaptation of this national model into a periodic structure aligned with the academic calendar, ensuring that improvements are implemented in a timely and systematic manner.

- The integration of these two models creates a seamless flow of actions that not only address immediate needs but also contribute to long-term program excellence. For example:
- The documentation and evidence collection phase, aligned with immediate actions, ensures that critical program data is consistently available for evaluation.
- The assessment and analysis phase incorporates stakeholder feedback and external evaluations, addressing short-term and medium-term goals.
- The implementation and monitoring phase reflects the iterative process required to maintain alignment with program objectives and accreditation standards, contributing to long-term improvement.

The relationship between the institutional national model (Figure 1) and the periodic model (Figure 2) exemplifies how a high-level framework can be effectively translated into actionable strategies within an academic context. This alignment ensures that both institutional goals and accreditation standards are met while fostering a culture of continuous improvement and innovation in education.

Use of Collected Data for KPI Generation

A fundamental aspect of the continuous improvement process described in this study is the collection and analysis of relevant data to generate Key Performance Indicators (KPIs). These indicators serve as a cornerstone for monitoring program performance and aligning it with accreditation standards and institutional objectives. The systematic approach to data processing ensures that insights are actionable and presented in a format conducive to informed decision-making.

The data collected from various sources, such as assessments, surveys, and institutional databases, is consolidated and analyzed using advanced tools. Power BI dashboards play a

pivotal role in this process, enabling the visualization of competencies and outcomes across multiple dimensions. These dashboards allow stakeholders, including faculty and administrators, to interact with real-time data, facilitating a deeper understanding of performance trends and areas requiring improvement. Figure 4 llustrates an example of a Competency Dashboard, showcasing how data is synthesized and presented for analysis.

Key Sub-competency	202111	202113	202211	202213	202311	202313	202410	202411	202413
SIN0101	**31.15%**		**32.67%**		**42.54%**			**49.70%**	
Basic					0.55%			1.80%	
No evaluation					1.10%			1.20%	
Not observed			3.33%						
Observed	31.15%		29.33%						
Outstanding					29.83%			33.53%	
Solid					11.05%			13.17%	
SIN0503	**68.85%**	**100.00%**	**67.33%**	**100.00%**	**57.46%**	**100.00%**	**100.00%**	**50.30%**	**100.00%**
Basic				9.26%	6.08%	13.21%	50.00%	9.58%	2.00%
Incipient					1.66%	7.55%		2.99%	
No evaluation				1.85%	13.81%				
Not observed		4.08%							
Observed	68.85%	95.92%	67.33%						
Outstanding				66.67%	18.78%	58.49%		20.36%	56.00%
Solid				22.22%	17.13%	20.75%	50.00%	17.37%	42.00%

Figure 4. Competency Dashboard Using Power BI.

In addition to interactive dashboards, Excel-generated graphs and tables are used to complement the data visualization process. These tools provide a static, yet highly detailed representation of specific performance metrics, such as results from standardized tests or cohort performance comparisons. For example, Figure 5 presents a CENEVAL Results Graph, demonstrating how individual and aggregated scores are depicted to identify strengths and opportunities for improvement within the program.

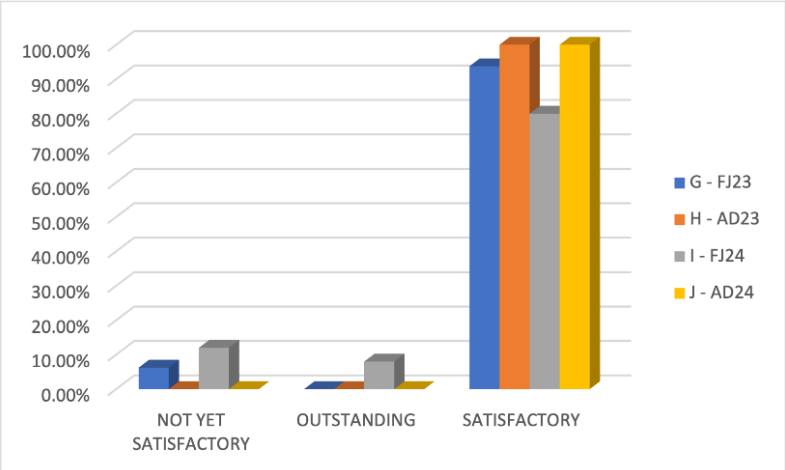

Figure 5. CENEVAL Results Graph.

This dual approach to data visualization ensures that information is accessible to a diverse range of stakeholders, from academic leaders to external evaluators. The use of Power BI enhances the ability to explore data dynamically, while Excel-generated graphs and tables offer detailed and precise visual summaries. Together, these tools provide a robust foundation for conducting rigorous analyses and fostering evidence-based decision-making.

By employing these methods, the institution not only aligns its processes with international accreditation standards but also builds a culture of transparency and accountability. The ability to visualize KPIs through interactive and static formats empowers decision-makers to implement targeted actions that drive continuous improvement in academic programs.

The Role of Documentation and Meeting Minutes in Continuous Improvement

An essential component of the continuous improvement model is the systematic documentation of all sessions and activities conducted throughout the process. This documentation ensures transparency, accountability, and the ability to track progress over time. The primary mechanism for maintaining this documentation is through meeting minutes, which serve as formal records of the discussions, decisions, and actions taken during each meeting.

The minutes are designed to capture key details such as the type of meeting, the stakeholders involved, and the topics discussed. This level of detail not only ensures clarity but also provides a historical record that can be reviewed during future cycles of improvement. For example, Figure 6 illustrates the cover page of a meeting minute used by the Industrial Engineering Department. The document clearly identifies the meeting type (e.g., kickoff, planning, evaluation, continuous improvement) and the stakeholders present, such as faculty members, students, or advisory board representatives.

Date: 19/01/2024
Time: 11:00 hrs
Unit of Study: Department Kickoff Meeting
Type: Kickoff [ ] Planning [X] Evaluation [ ] Presentation [ ] Continuous Improvement [X]
Stakeholders: Teachers [X] Training Partner [ ] Students [ ] Advisory Board [ ] Other_____

Attendees

Ericka Zulema Rodríguez Calvo
Eduardo Caballero Montes
Jorge Alberto González Mendívil
Gabriela Guadalupe Reyes Zarate
Mostafa Hajiaghaeikeshteli
Andrés Esteban Acero López
María del Pilar del Carmen Rodríguez Dobarganes
Fatemeh Gholiyanjouybari
Israel Zamora Hernández

Agenda Items

- Competency Review
- Educational Objectives
- CENEVAL Results
- Averages
- ECOAS Results (AD23)
- Unit of Study Delivery
- Miscellaneous Items

Figure 6. Cover Page of a Departmental Meeting Minute

By categorizing meetings and associating them with specific groups of interest, the model fosters a targeted and collaborative approach to program improvement. Each session is aligned with the objectives of the continuous improvement process, ensuring that feedback and analysis are systematically integrated into decision-making. Additionally, the structured format of the minutes ensures that critical elements such as agenda items, participant roles, and outcomes are consistently recorded.

The importance of maintaining this documentation lies in its ability to provide evidence of compliance with accreditation standards, particularly those emphasizing stakeholder involvement and continuous improvement. Furthermore, the minutes serve as a valuable resource for tracking the implementation of improvement actions and for evaluating their impact during subsequent cycles.

In conclusion, the meticulous documentation of meetings through structured minutes, as exemplified in Figure 6, is a cornerstone of the continuous improvement model. It ensures that every phase of the process is documented, reviewed, and aligned with institutional and accreditation objectives, thereby reinforcing the commitment to educational excellence and innovation.

Methodology

The methodology employed in this study is centered on the systematic collection, analysis, and application of data to drive continuous improvement in educational programs. This process integrates various data sources, rigorous evaluation techniques, and stakeholder feedback to align academic objectives with market demands and accreditation standards. The methodology is divided into three main phases: data collection, competency and educational objective evaluation, and review and adjustment of academic units or curricular updates.

1. Data Collection

The foundation of this continuous improvement model lies in the comprehensive collection of data from diverse sources.

- Sources of Information: Data is gathered from student and alumni surveys, standardized examination results (e.g., CENEVAL), and feedback from employers and advisory boards. Each source provides critical insights into the program's performance, including student competencies, academic outcomes, and alignment with professional requirements. For instance, alumni feedback offers a generational perspective on the achievement of educational objectives, while employer surveys validate the relevance of the competencies developed in the program.
- Quantitative and Qualitative Analysis: Once the data is collected, it is subjected to both quantitative and qualitative analysis. Quantitative metrics, such as grades, competency achievement percentages, and exam scores, are complemented by qualitative insights from open-ended survey responses and focus groups. This dual approach ensures a holistic understanding of program effectiveness, identifying not only numerical trends but also contextual factors influencing outcomes.

2. Evaluation of Competencies and Educational Objectives

The second phase involves aligning the competencies and skills developed within the program with the established educational objectives and market demands.

- Definition of Competencies: Competencies are defined based on accreditation standards, employer expectations, and institutional goals. These include technical, problem-solving, and interpersonal skills critical for graduates' success in their professional fields. Each competency is linked to specific Key Performance Indicators (KPIs) to track achievement over time.

- Workshops and Training: To prepare students for standardized examinations and professional practice, workshops and training sessions are implemented. These initiatives focus on familiarizing students with exam structures, common question types, and time management strategies, ensuring they are well-prepared to demonstrate their competencies.

3. *Review and Adjustment of Academic Units or Curricular Updates*

The final phase involves translating the insights gained from data analysis and stakeholder feedback into actionable changes in the curriculum.

- Periodic Updates: Curricular updates are conducted on a five-year cycle, ensuring that academic programs remain aligned with evolving industry needs and educational standards. These updates are informed by data trends, competency achievement levels, and accreditation requirements.
- Stakeholder Consultation: Feedback from various stakeholder groups, including students, alumni, employers, and faculty, is systematically incorporated into the review process. These consultations ensure that the curriculum remains relevant and responsive to market demands. Adjustments are categorized into immediate, short-term, medium-term, and long-term actions. Immediate changes are implemented in the current semester, short- and medium-term actions influence the following academic year, and long-term adjustments guide significant revisions to the educational model.

Integration with Continuous Improvement

The methodology ensures a seamless integration of data-driven decision-making into the continuous improvement cycle. Real-time analysis and feedback loops empower decision-makers to implement targeted changes promptly, fostering a culture of excellence and accountability. The structured involvement of stakeholders at every stage strengthens the alignment between program objectives, market needs, and student outcomes.

Results

The implementation of the continuous improvement model at the University, specifically in the Industrial Engineering program, has demonstrated its adaptability and effectiveness across diverse academic contexts. This model was tailored to fit the institution’s academic structure, integrating program-specific elements, support entities, and the semester-based framework. The adaptability of the model highlights its potential for application in other universities and programs, ensuring alignment with unique institutional needs while maintaining compliance with accreditation standards.

Accreditation Outcomes

The application of this model led to significant achievements in accreditation outcomes for the Industrial Engineering program, as well as for the Computational Technologies and Mechatronics programs:

- CACEI Accreditation: Observations were reduced from nine in the previous cycle to only one in the most recent evaluation.
- ABET Accreditation: All prior weaknesses identified in the previous cycle were fully addressed, resulting in zero observations.

These results demonstrate the capacity of the model to improve program quality, streamline processes, and meet rigorous accreditation criteria.

Evaluator Feedback

The feedback from evaluators further underscores the model's strengths. For example, evaluators of the Industrial Engineering program noted that information was not only well-structured and readily available but also promptly provided when additional details were requested. This efficiency reflects the robustness of the model in organizing and managing accreditation processes.

Model Adaptation

The adaptation of the continuous improvement model to the Industrial Engineering program is illustrated in Figure 7, which highlights how the framework aligns with the institution's semester structure and incorporates various academic and administrative entities. This adaptability underscores the model’s portability to other universities and academic programs, enabling institutions to optimize their continuous improvement efforts.

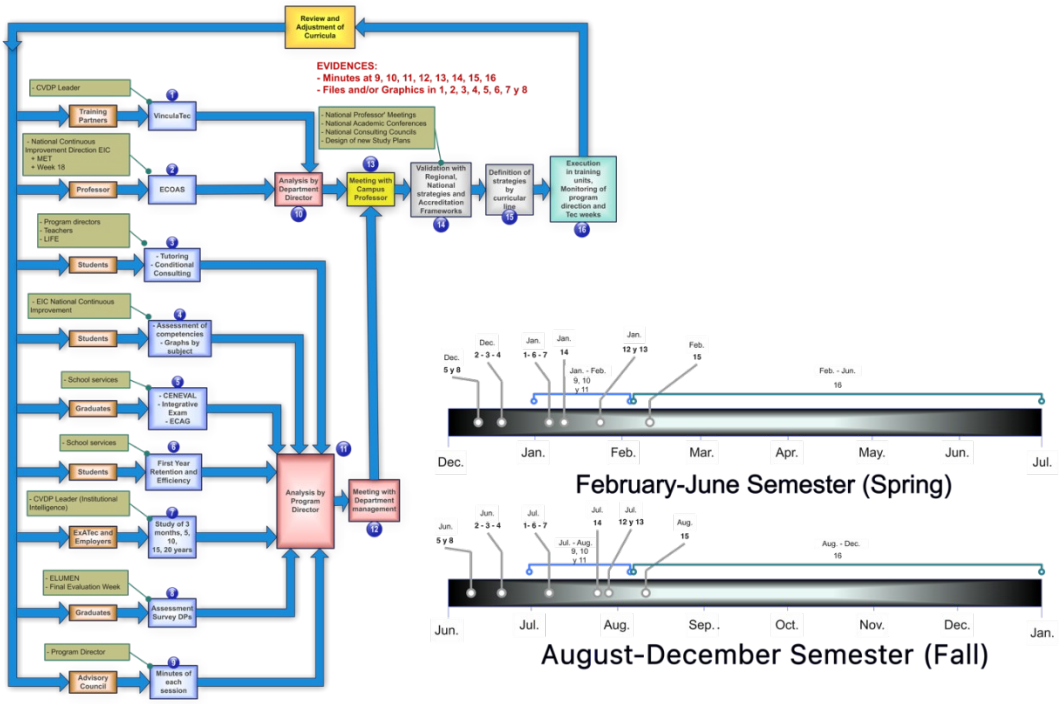

Figure 7. Adaptation of the Continuous Improvement Model to the Industrial Engineering Program.

The results obtained underscore the model's portability and potential for broader application. Its flexible structure allows institutions to tailor the model to their unique academic frameworks, organizational structures, and stakeholder needs. This adaptability ensures that the model can effectively support continuous improvement and accreditation efforts across diverse educational contexts.

Derived Research Lines

The implementation of the continuous improvement model and the results obtained in the accreditation processes have opened multiple opportunities for generating new research lines in higher education and educational innovation. These lines aim not only to strengthen the quality of academic programs but also to contribute to the development of replicable and sustainable practices for other institutions. Among the main derived research lines, the following stand out:

Design and Evaluation of Continuous Improvement Models: Delve into the adaptation and scalability of the implemented model, exploring its application in other academic programs and educational contexts. This line would include evaluating its impact on institutions of different sizes and profiles.

Integration of Technologies for Academic Quality Management: Investigate the use of tools such as Power BI, Excel, and digital platforms to optimize the collection, analysis, and visualization of real-time data, promoting more agile and effective decision-making.

Impact of Accreditation on the Professional Performance of Graduates: Analyze how improvements in academic program quality, derived from compliance with accreditation criteria, impact employability, professional competencies, and international mobility of graduates.

These research lines provide a framework for further exploring and strengthening the relationship between continuous improvement processes and international quality standards in education, with the aim of generating a positive impact on student professional development and institutional competitiveness.

Conclusions

The results of this study confirm the effectiveness of the continuous improvement model in optimizing the quality of academic programs and meeting accreditation standards established by national and international bodies such as CACEI and ABET. The significant reduction in evaluator observations, along with the accreditations achieved in the Industrial Engineering, Computational Technologies, and Mechatronics programs, highlights the model's capacity to identify areas for improvement, implement strategic changes, and generate tangible outcomes.

The proposed model is characterized by its systematic approach, its integration of technological tools for data management, and its ability to involve stakeholders in all stages of the process. These features not only facilitated compliance with accreditation criteria but also fostered a culture of continuous improvement and institutional adaptability. Additionally, the model's flexible structure demonstrates its potential for replication in other institutions, enabling them to align their academic programs with international standards while addressing their unique contexts and needs.

Furthermore, this model provides a foundation for fostering international collaborations and influencing global educational policies. By aligning with frameworks such as the Washington Accord and emphasizing data-driven decision-making, the model encourages knowledge exchange and shared best practices among institutions worldwide. Its application can serve as a benchmark for developing international accreditation systems and strengthening the global mobility of engineering graduates.

In conclusion, this work contributes to the field of higher education by demonstrating that continuous improvement processes, when grounded in data, technology, and collaboration, can transform how institutions address accreditation challenges and ensure educational excellence. It also opens new pathways for fostering global partnerships and shaping policies that promote innovation, quality, and equity in education across borders..

References

[1] M. Iqbal Khan, S. M. Mourad, and W. M. Zahid, "Developing and qualifying Civil Engineering Programs for ABET accreditation," *Journal of King Saud University - Engineering Sciences*, vol. 28, no. 1, pp. 1–11, Jan. 2016, doi: 10.1016/j.jksues.2014.09.001.

[2] J. A. Memon, R. E. Demirdöğen, and B. S. Chowdhry, "Achievements, outcomes and proposal for global accreditation of engineering education in developing countries," *Procedia Soc Behav Sci*, vol. 1, no. 1, pp. 2557–2561, 2009, doi: 10.1016/j.sbspro.2009.01.451.

[3] H. Chowdhury, F. Alam, S. K. Biswas, M. T. Islam, and A. K. M. S. Islam, "Quality assurance and accreditation of engineering education in Bangladesh," in *Procedia Engineering*, Elsevier Ltd, 2013, pp. 864–869. doi: 10.1016/j.proeng.2013.03.208.

[4] S. Paramasivam, K. Mutusamy, and K. Tan, “Study of the Effectiveness of the Implementation of Washington Accord in Malaysia’s Engineering Undergraduate Programme Using SEM,” *Procedia Soc Behav Sci*, vol. 90, pp. 803–812, Oct. 2013, doi: 10.1016/j.sbspro.2013.07.155.

[5] O. M. Zamyatina, M. G. Minin, D. S. Denchuk, and V. O. Sadchenko, “Analysis of Engineering Invention Competencies in Standards and Programmes of Engineering Universities,” *Procedia Soc Behav Sci*, vol. 171, pp. 1088–1096, Jan. 2015, doi: 10.1016/j.sbspro.2015.01.270.

[6] Zarate-Garcia J. Asuncion, Serrano-Reye Ariadna, Rodriguez-Paz Miguel X., and Zamora-Hernandez Israel, “A Continuous Improvement Model to Enhance Academic Quality in Engineering Programs,” *ASEE Virtual Conference*, 2020, doi: 10.18260/1-2--33988.

[7] A. Mendoza-Mendoza, D. Mendoza-Casseres, and E. De La Hoz-Domíngez, “Comparison of industrial engineering programs in Colombia based on standardized test results,” *Eval Program Plann*, vol. 103, Apr. 2024, doi: 10.1016/j.evalprogplan.2024.102415.

[8] N. Vasudevan and T. SudalaiMuthu, “Development of a common framework for outcome based accreditation and rankings,” in *Procedia Computer Science*, Elsevier B.V., 2020, pp. 270–276. doi: 10.1016/j.procs.2020.05.043.

[9] A. Kootsookos, F. Alam, H. Chowdhury, and M. Jollands, “Offshore Engineering Education: Assuring Quality Through Dual Accreditation,” in *Energy Procedia*, Elsevier Ltd, 2017, pp. 537–542. doi: 10.1016/j.egypro.2017.03.181.

[10] “What Is Accreditation? - ABET,” ABET. Accessed: Jan. 12, 2025. [Online]. Available: https://www.abet.org/accreditation/what-is-accreditation/

[11] “¿Qué es la acreditación?,” CACEI. Accessed: Jan. 12, 2025. [Online]. Available: https://cacei.org.mx/nv/nv02/nv0201.html

[12] “COLABORACIÓN INTERNACIONAL,” CACEI. Accessed: Jan. 12, 2025. [Online]. Available: https://cacei.org.mx/nv/nv04/nv0402.html

[13] “Why ABET Accreditation Matters - ABET,” ABET. Accessed: Jan. 12, 2025. [Online]. Available: https://www.abet.org/accreditation/what-is-accreditation/why-abet-accreditation-matters/

[14] “Manual del Marco de Referencia 2025,” 2024. Accessed: Jan. 13, 2025. [Online]. Available: https://cacei.org.mx/nv/nvdocs/marco_ing_2025.pdf

[15] “Engineering Accreditation Commission,” 2023. Accessed: Jan. 13, 2025. [Online]. Available: https://www.abet.org/2025-2026_eac_criteria/

[16] “Celebrating international engineering education standards and recognition,” International Engineering Alliance. Accessed: Jan. 13, 2025. [Online]. Available: https://www.internationalengineeringalliance.org/assets/Uploads/Documents/History/25YearsWashingtonAccord-A5booklet-FINAL.pdf