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**“MANAGEMENT SYSTEM BASED ON THE NORM ISO 9001: 2008
IN COMPLIANCE TO EVALUATION INDICATORS ACADEMIC
FUNCTION FOR THE FACULTY OF ENGINEERING IN APPLIED
SCIENCE (FICA) OF THE TECNICA DEL NORTE UNIVERSITY”**

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MANAGEMENT SYSTEM BASED ON THE NORM ISO 9001: 2008 IN COMPLIANCE TO EVALUATION INDICATORS ACADEMIC FUNCTION FOR THE FACULTY OF ENGINEERING IN APPLIED SCIENCE (FICA) OF THE TECNICA DEL NORTE UNIVERSITY.

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Abstract. In this article has developed the proposal for the design of a management system based on ISO 9001:2008 in accordance with standard evaluation indicators established by the Council of evaluation, accreditation and assurance of the quality of the education top of the Ecuador to the academic function in the Faculty of Engineering Sciences applied the University technique of North

The main purpose of the research is to provide faculty the necessary guidelines that allow the continuous improvement of the processes of the academic function and therefore regulated by the CEAACES accreditation and the international ISO certification.

It starts with the development of the theoretical and legal foundation underpinning the design of the system, then an analysis of the present situation of the academic function using a SWOT analysis and internal audits that establish compliance with the requirements of the ISO 9001 standard and the indicators established by the CEAACES. Subsequently identify academic procedures of the Faculty documenting the information in a manual of procedures and processes and a comparative analysis of the initial results with the final model of the management system, in addition to an improvement plan that will allow to ensure the continuous improvement of the quality of the processes of the academic function is finally performed.

Keywords

Quality management system, ISO 9001: 2008, Academic Function, Evaluation indicators, continuous improvement, CEAACES.

1. Introduction

In recent years globalization has required nations to change their educational systems, due to advances in new technologies and the modification of knowledge, which today would be affected by the changes in obtaining the information, since the perspective of globalization and take other routes would require a change in the vision of quality assessment in education. (Diaz, 2013)

Due to which in Ecuador from 2008 is ordered the mandate Constituent No 14, which states that one of the processes to run the evaluation of institutional performance of universities and polytechnics is the evaluation of classroom careers and semipresential offered by these institutions of higher education (IES).

Therefore currently the Tecnica del Norte University seeks accreditation of courses that make each of its powers, this being the case of the FICA, the accreditation process for the Board of Evaluation, Accreditation and Quality Assurance in Education superior (CEAACES) has established a career assessment matrix for different functions under the Law on higher Education (LOES) are: Academic, Bonding, Research and Management.

The activities of the academic performance of the Faculty of Engineering in Applied Sciences has a breach in the indicators established by the CEAACES due to the lack of defined processes and procedures, which creates problems because it does not have guidelines to guides the successful completion of the academic activities. For example, you do not have defined procedures for curriculum development, mentoring for students, as well as procedures for the preparation of syllabi generating problems in the development of academic activities.

Due to the above comes the need for designing a management system designed to define the processes of design or redesign curriculum, tutoring, academic planning activities among others. Allowing continuously improve the quality of education, as well as help improve compliance with the indicators established by the CEAACES for the accreditation of courses that make up the power and thus respond to the current indicators related to quality assurance of the higher education because if it does not comply with the provisions of the CES races could be closed.

2. Materials and Methods

The methods and materials used for the development of the research are as follows:

2.1 SWOT Analysis

SWOT analysis is performed to determine the strengths, weaknesses, opportunities and threats that are present in the faculty regarding academic function. To perform this analysis, the information gathered during the internal audit function where he attended the Dean, Deputy Dean, career coordinators, teachers and student representatives of the faculty was considered.

Once finalized the determination of strengths, weaknesses, opportunities and threats they are designed strategies. The combination of strengths and opportunities are offensive strategies (FO), the strengths and weaknesses leading to defensive strategies (FA); the combination of weaknesses and opportunities generated reorientation strategies (DO) and finally the weaknesses and threats lead to coping strategies (DA). (Wheelen & Hunger, 2013).

They can cause problems		They can build competitive advantage	
	Weaknesses	F	Strengths
D1	Lack of documented procedures and activities of the academic function. (update curriculum, mentoring and evaluation)	F1	Teachers assigned workload to implement improvement plans, curriculum structure, quality management and tutorials.
D2	The races are not accredited by the CEAACES.	F2	Adequate and relevant legislation in the performance of academic performance.
D3	Little relationship between theoretical and practical training because it is not included in the syllabus of the subject laboratory practice.	F3	Commitment of authorities, teachers and students in achieving educational quality.
Threats		Opportunities	
A1	Changes in Higher Education Standards.	O1	Societal need for training professionals that help increase industrial activity in the area.
A2	Inadequate academic education of graduates.	O2	Growing student demand.
A3	Limited time to comply with the indicators established by the CEAACES	O3	Easy access to information technology and communication in the market
A4	Uncertainty in the budget allocation for higher education from the State	O4	Government support for improving the quality of higher education.

Table 1. Academic SWOT Analysis Function

	Opportunities	Threats
Strengths	OFFENSIVE STRATEGIES (FO)	DEFENSIVE STRATEGIES (FA)
	1. Strengthen the teaching-learning process of the students of the Faculty for upgrading skills according to the demands of society. 2. Strengthen and continually improve academic programs by updating curricula, analytical programs and syllabi to improve the skills of students.	1. Increase the number of teachers with workload assigned for participation in the processes of accreditation of programs and thus fulfill in time with the indicators issued by the CEAACES. 2. Promote the participation of teachers and students in the process of accreditation to comply with current legislation in Higher Education.
Weaknesses	REORIENTATION STRATEGIES (DO)	SURVIVAL STRATEGIES (DA)
	1. Identify and define the processes and resources for planning and development of the activities of the Academic function 2. Acting on the learning process by using technological tools to enhance the skills of students. 3. Standardize methodologies development, implementation and qualification assessments and work	1. Advance the study of graduate teachers in order to comply with current regulations in higher education and achieve maintain educational prestige and recognition to new universities.

Table 2. Matrix function SWOT- Academic Strategies

2.2 Internal Audit ISO 9001: 2008

An internal audit program to meet compliance requirements of the norm ISO 9001.

This audit is conducted in two parts: the first part is audited to points four, five, six and eight (quality management system, management responsibility, resource management and measurement, analysis and improvement) and part audited focusing seven (service delivery) of the standard where it refers to the development of the activities of the Academic Function of the Faculty.

For the audit ISO 9001: 2008 was used as the main instrument a checklist in which a series of questions intended to obtain information for compliance with the requirements of the ISO 9001 standard was developed: 2008 and thus diagnose Faculty baseline.

For the calculation of percentages it is based on the total of items or developed and depending on the questions obtained as compliant or not these percentages are obtained questions.

The following table summarizes the checklist used in the internal audit function for the Academic seven point (service delivery) of ISO 9001:2008.

ELEMENT OF ISO 9001: 2008	MEETS	FAILS
7. DELIVERY SERVICE		
7.1. Planning the service		X
7.2.1. Determination of requirements related to the service	X	
7.2.2. Review of requirements related to the service		X
7.2.3. Communication with the user	X	
7.3.1 Development Planning Academic Function	X	
7.3.2 Input for the development of the Academic Function	X	
7.3.3 Results of development of the Academic Function		X
7.3.4 Review of development of the Academic Function	X	
7.3.5 Verification of the development of the Academic Function	X	
7.3.6 Validation of the development of the Academic Function		X
7.3.7 Control of changes in the development of the Academic Function		X
7.5.1. Control of the service	X	
7.5.2. Validation of the service		X
7.5.3. Identification and traceability		X
7.5.4. User Property		X
7.5.5 Preservation Service		X
TOTAL	7	9

Table 3. Summary Academic ISO Audit Function - Provision of Service (Item 7)

ITEMS	% INITIAL	% EXPECTED
7.1. Planning service delivery	2,04%	10,20%
7.2. User related processes	16,33 %	20,41%
7.3. Design and development	18,37 %	38,78%
7.5. Production and service provision	14,28 %	30,61 %
TOTAL	51,02%	100%

Table 4. Audit Academic Results initial ISO function

2.3 Internal Audit Academic function CEAACES

The internal audit of the Academic function is based on the Generic Model Assessment Career Learning Environment and face Semi Presence of Universities and Polytechnics of Ecuador established by the CEAACES. This audit will reveal the fulfillment of the indicators related to academic performance. To conduct the audit was made using a checklist or checklist CEAACES indicators and evidence requested for the fulfillment of each indicator.

For the percentage of completion at the end of a count of audit evidence that is to comply and not comply and is calculated based on the totality of evidence requested it is performed.

The following table summarizes the internal audit of the FICA respect to indicators established for Academic CEAACES function is shown.

AUDIT CEAACES FICA			
INDICATORS OF THE MATRIX CEAACES	MEETS	FAIL	OBSERVATION
Graduate Profile (A2.1)			
1. Professional Profile	X		
2. Graduate Profile	X		
3. Curriculum	X		
4. Document analysis of occupational career field	X		
Curriculum Structure (B2.1)			
1. Rationale of the race:	X		
2. Profiles: h. egress i. Income.	X		
Curriculum (B2.1)			
1. Curriculum Planning	X		
2. Curriculum	X		
3. Methodological guidelines		X	You do not have methodological guidelines by race..
4. Guidelines and strategies for student assessment	X		
5. Training Lines		X	Is currently working on the lines of training per race
Program subjects (B3.1)			
1. Analytical Program	X		
2. Syllabus	X		
Practices regarding subjects (B3.2)			
1. Laboratory practice guides / workshops / simulation centers.		X	Need to develop guidelines for laboratory practice.
Tutorials (E1.1)			
1. Planning and allocation of mentoring activities teachers with teaching activities in the race.		X	They lack for student tutoring accompaniment.
2. Records tutorials.		X	Has not standardized formats

Table 5. Summary Academic Audit Function CEAACES FICA

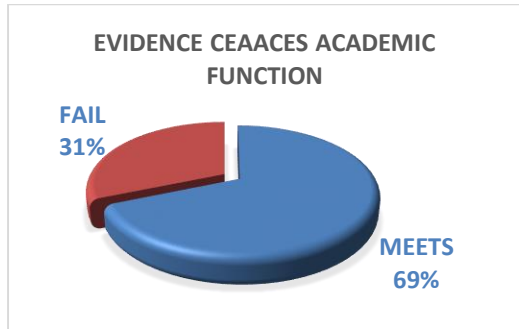


Figure.1. Results of Academic evidence CEAACES function

2.4 Methodology according to the ISO 9001: 2008

The norm ISO 9001: 2008 it suggests a process-based approach which seeks organizations articulate their processes, procedures, tasks and resources systemically, bringing an improvement in the quality of processes and thus achieved ensures quality and continuous improvement of the product or service. (Fontalvo Schmalbach Herrera & Vergara, 2010, p. 13)

According to paragraph, 4.2.1 of ISO 9001: 2008 indicates that the documentation of the quality management system should include:

- Documented statements of a quality policy and quality objectives,
- A quality manual,
- Documented procedures and records required by this International Standard, and
- Documents, including records determined by the organization that are necessary to ensure the effective planning, operation and control of its processes

The QMS documentation can describe how an organization's activities are organized in order to ensure quality in product realization and / or the service and therefore the total satisfaction of its customers.



Figure. 2. Pyramid documentary ISO 9001: 2008

In the figure above documentation suggested in ISO 9001:2008 is as follows ordered according to the importance of each document.

The Quality Manual is the document in which the set of activities that FICA should be performed so that the quality management system detailed work effectively. This document describes the process map of the faculty, quality policy, quality objectives and inventory procedures required by the standard procedures, instructions and records detailing such procedures. (Alcalde, 2010)

Procedures are documents that described how, what, who, when, where, why are the activities carried out, it is also important that you make schematically by diagrams that show how to perform the work and its relationship with other procedures. For the layout of the procedures it was made using a process mapping software.

The organization must have at least the procedures required by ISO 9001: 2008 in which it states that it is mandatory to have documented procedures for the following activities: document control, control of records, internal auditing, product control or nonconforming, implementation of corrective action and preventive action application. In addition to those required by the authority to the service. (Sanchez Enriquez, & Sanchez, 2012)

Work instructions is a type of technical documentation that detailed specifically and ordered instructions to perform a particular activity or task (entry to the integrated system of the UTN, use the virtual classroom, entry qualifications, etc.)

Records are a set of documents that reflect the daily performance of the power to demonstrate compliance with the requirements and the effective operation of the QMS, which also provide insight into the implementation and monitoring of the procedures performed in college. These records should be easy to interpret, to consult at any time and must be available when the quality audit so requests.

2.5 Comparative analysis

The comparative analysis is performed based on the check list used in the initial audit, then by a final audit based on the proposal generated or actions taken for the development of the activities involved the SGC be verified compliance or otherwise of each of the items of ISO 9001: 2008.

2.6 Improvement Plan

The improvement plan is the instrument to identify and prioritize feasible actions to improve the nonconformities. In this plan the strategic decisions on changes to be added to the different processes and tasks to be developed to be translated into improved educational service offered is integrated.

For the implementation of the improvement plan the support and commitment of all those responsible for the processes of one form or another are related to the Faculty it

is required. This plan, in addition to serving as a guide for the structuring of areas for improvement, should allow control and monitoring of the various actions to be undertaken.

In the master plan prepared for the FICA preventive, corrective and improvement actions applied to the non-conformities detected in the comparative analysis of the academic performance and thus comply with the requirements of ISO 9001: 2008 are presented.

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3. Results

3.1 Proposed quality management system for the academic functioning of FICA..

The proposed management system based on ISO 9001: 2008 for Academic FICA function is presented as initial result quality. The quality manual contains all the documentation concerning the quality management system and find documentation relating to the four functions set by the LOES (Management, Academic, Research and Liaison). This quality manual contains the following information:

- ✓ Scope of quality management system, including details of and justification for any exclusions,
- ✓ Process Map,
- ✓ Description of the points of the Standard,
- ✓ Quality Policy
- ✓ Quality Objectives
- ✓ Documented procedures required by ISO 9001: 2008, among others.

The process map of FICA, which is divided into 3 phases consist of the main processes comprising the quality

management system was also constructed. Then we can see what these processes and how interaction.

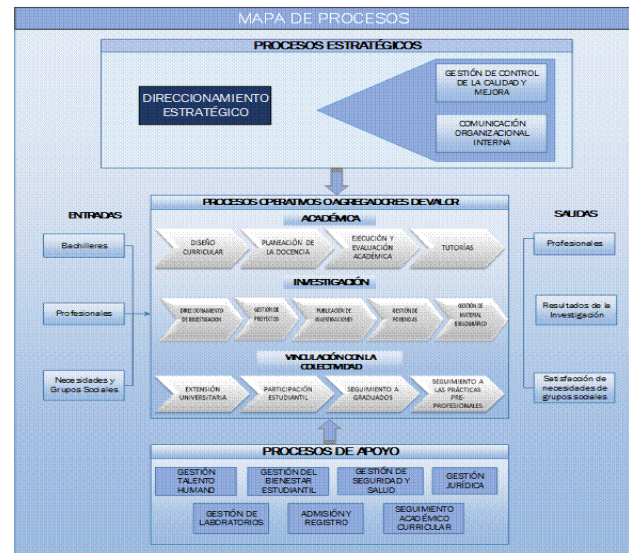


Figure. 3. Process Map FICA

In the diagram SIPOC we can visualize the process of academic performance in a simpler way, identifying the parties involved in it: Suppliers (supplier), inputs (inputs), process (process), outputs (outputs) and customers (customer).

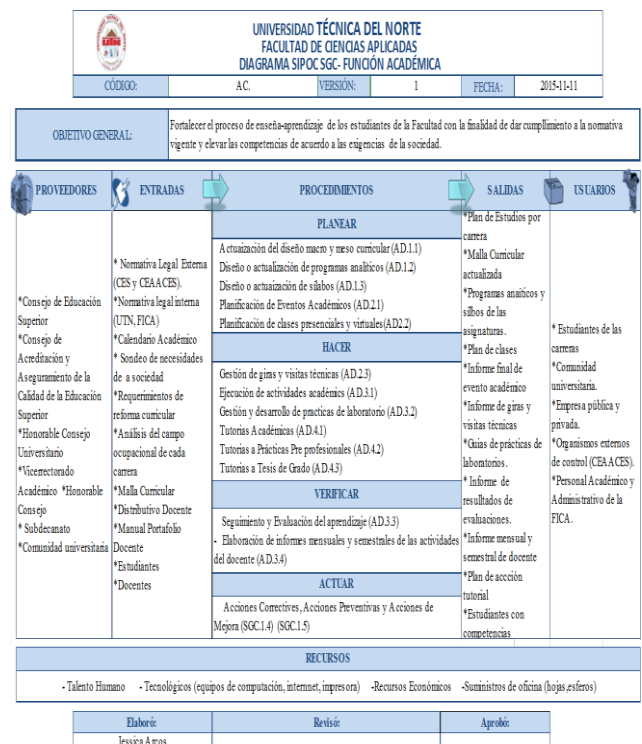


Figure. 4. Diagram function SIPOC Academic FICA

In the process inventory list of processes and procedures for the proper conduct of macro process Academic plasma function. You can also highlight responsible for each process, the procedures for the result or product obtained indicated that procedure

The procedures determined for compliance with the indicators established by the Academic CEAACES to function with its own code is detailed.

COD	NOMBRE	COD	NOMBRE	PRODUCTO/RESULTADO
AD.1	Curricular design	AD. 1.1	Update of meso and macro curriculum design	Curriculum updated Graduate Profile
		AD. 1.2	Design or analytical software update	Analytical program of courses
		AD. 1.3	Syllabus design or upgrade	Syllabi of courses
AD.2	Planning of teaching	AD. 2.1	Academic Planning Events	Activities Report
		AD. 2.2	Planning classes and virtual	Lesson Plan Teaching materials
		AD. 2.3	Management tours and technical visits	Report tours and technical visits
AD.3	Execution and Scholastic Assessment	AD. 3.1	Implementation of academic activities	Lesson plan executed student assessment
		AD. 3.2	Management and development of laboratory	Report labs
		AD. 3.3	Monitoring assessment and of learning	Report of learning outcomes
		AD. 3.4	Preparation of monthly and semi-annual reports on the activities of teachers	Monthly reports for the teacher Semiannual Report teaching activities
AD.4	tutoring	AD. 4.1	Academic tutoring	Tutoring Program Tutoring Final
		AD. 4.2	Pre-professional tutoring	Report Tutoring Final
		AD. 4.3	Working tutoring degree	Report Work completed degree Tutoring Final Report

Table 6. Inventory Academic processes function

In the characterization of processes pertaining to quality management system of the FICA for Academic feature the distinctive features of the process are identified, namely the relationship with other internal or external processes is established, the inputs and outputs of the processes, purpose and scope, officials, suppliers and customers, process controls and displays, records and documents of the same. These characterizations are

generated for each process established for Academic function.

Besides the procedures manual prepared for the academic functioning of the Engineering Faculty of Applied Science contains 13 procedures referred to in the inventory of procedures and to focus on compliance with ISO 9001 and CEAACES evaluation indicators presented.

3.2 Comparative analysis initial and final audit

The figure may show the results of each of the items of item 7 of the Standard for the Academic function of FICA. In the design and development was the highest percentage has increased, from a 18.37% and finally obtaining a 30.61%, this is because in the proposal generated for Academic function has established a specific process for Curriculum Design. In general, an increase of 30.61% in paragraph 7 of the Standard for the Academic evidence function.

ÍTEMS	INITIAL	END	EXPECTED
7.1. Planning service delivery	2,04%	6,12%	10,20%
7.2. User related processes	16,33%	18,37%	20,41%
7.3. Design and development	18,37%	30,61%	38,78%
7.5. Production and service provision	14,28%	26,53%	30,61%
TOTAL	51,02%	81,63%	100%

Table 5. Results initial audit, final and expected to point 7 Academic Function

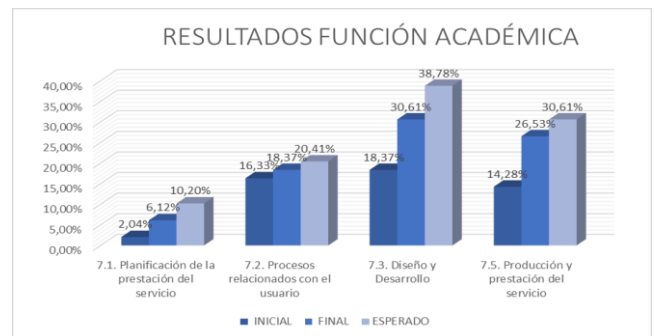


Figure 5. Comparison initial state, final and expected academic performance

3.3 Academic function Improvement Plan

Then the improvement plan where the preventive, corrective and improvement actions applied to the non-conformities detected in the comparative analysis of the academic performance presented.

Academic Management nonconformity 7.1 function (planning service delivery)

Description: It is found that the results of the planning of the implementation of the activities of the Academic Function of the Engineering Faculty of Applied Sciences have not been submitted yet to improve the methodology of operation of the Faculty.

Root Cause Analysis: is deemed to have failed to consider the results of the planning of the implementation of the activities of the academic performance because the Quality Management System has not yet been implemented and therefore the results of the processes and planning procedures were not considered to improve the methodology of operation of the FICA.

Action Plan: a detailed list of activities to be developed to eliminate the detected nonconformity.

- ✓ Implement the proposed socialize and established processes for Academic Function stakeholders quality management system.
- ✓ Present the results of the planning activities of the Academic Senior Management and staff function involved in each of the processes of realization of educational services

Academic Management function nonconformity 7.2 (user-related processes)

Description: on the review of requirements related to the educational service that FICA does not ensure that service requirements are clearly defined and that the Faculty has the capacity to meet the requirements defined is detected.

Root Cause Analysis: This is because the establishment, documentation, implementation and maintenance of quality management system is a new proposal, therefore still no revisions were done to the requirements related to the service before providing the service users.

Action Plan: a detailed list of activities to be developed to eliminate the detected nonconformity

- ✓ Define techniques to meet present and future needs of users.
- ✓ Propose methods to know if it is determined and meet the requirements of users and if these are clearly defined.
- ✓ Conduct periodic by qualified FICA the ability of the Authority to meet the requirements of the user's personal reviews.

Academic Management function nonconformity 7.3 (design and development)

Description: is detected in the design and development of the Academic Function that inputs are not reviewed to check that they are suitable, in addition to the requirements are complete, unambiguous and not contradictory.

Root Cause Analysis: This is because it is not yet implemented the quality management system and therefore the processes established for the design and development have not been carried out and planned to conduct reviews of the elements of entries and validations design and development to know if the service offered will satisfy user needs.

Action Plan: a detailed list of activities to be developed to eliminate the detected nonconformity

- ✓ Establish a methodology for reviewing the inputs, ie inputs for each process established for Academic function are appropriate.
- ✓ Perform design validation and development in the case of the Academic Function of curriculum through surveys.
- ✓ analyze the survey results and determine user satisfaction regarding service
- ✓ Identify opportunities for improvement based on the results obtained by the analysis

Academic Management nonconformity 7.5 function (providing the service)

Description: is detected in terms of the processes of educational service that validation does not demonstrate the ability of these processes to achieve planned results. Also regarding the property of the user is detected in case of damage to property Faculty user does not report it.

Root Cause Analysis: it considers that the validation in the case of service validation can not be performed until this service has not been executed; in the case of customer property that is given because it has not been established channels or means to enable communication with the client if they are lost, damaged or considered in any inappropriate way to use user information and therefore no records of such communications are.

Action Plan: a detailed list of activities to be developed to eliminate the detected nonconformity

- ✓ Conducting surveys at the end of each course, training course or career users to validate the service provided by the Academic Function.
- ✓ Analyze the survey results and determine the ability to achieve planned results
- ✓ Define channels or media to inform the user if any assets owned by you are lost, deteriorate or otherwise.
- ✓ Making records of communications from users.

Conclusions

Internal audits are developed to meet FICA compliance with respect to the ISO 9001: 2008 and the indicators established by the CEAACES for Academic function, obtaining in the case of a default ISO 9001 audit 75% of the points analyzed other than paragraph 7.

Paragraph 7 of the standard was analyzed for each of the tasks set by the LOES (Management, Academic, Research and Liaison), in the case of Academic feature a default of 49% was obtained at this point. In contrast, in the audit of the indicators of academic performance CEAACES a fulfillment of 69% of the evidence requested for this function was evident.

By analyzing and evaluating the results of internal audits to the FICA it was able to identify each of the key processes and procedures that will enable the proper performance of the activities of the Academic function in compliance with the requirements of ISO 9001 and evaluation indicators set by the CEAACES.

The design of the quality management system for the FICA was made based on the requirements of ISO 9001: 2008 and in compliance with the requirements set forth in the Evaluation Model Careers CEAACES. The design included the development of a quality manual consisting of four functions established by LOES (Management, Academic, Research and Bonding), which aims to establish and describe the guidelines of quality management system in order to provide one quality services.

The comparison between the initial audit results and the proposed design for the FICA allow SGC demonstrate the great impact achieved through the implementation of the present work, reaching a 81.63% compliance with the requirements of ISO 9001 : 2008 Academic function and a 68.05% in general at the Faculty.

To prepare improvement plans is considered non-conformities found in the comparative analysis; with this input activities to compliance with the non-conformities and therefore compliance with the requirements of ISO 9001:2008 raised

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