

<b>Title of Article</b>	History and evolution of technical education at ITCA-FEPADE and its challenges in the future.
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## 1. SUMMARY

Technical education at ITCA-FEPADE has constituted for the past fifty years a significant contribution to the socioeconomic development of El Salvador and the Central American region, which has allowed the productive and service sectors to be more efficient and effective in their processes, mainly due to the solid theoretical-practical training that has been provided to technical professionals in different areas. The educational model implemented has been characterized by maintaining an adequate balance between theory and practice, this being one of the main factors that has made that through all these years it has been an option for training students and that these when graduating as technicians are demanded by companies in the productive sector. Despite the success achieved, the institution has important challenges for the future, since it will have to make the curricular changes according to the technological changes imposed by the Fourth Industrial Revolution or Industry 4.0.

## 2. INTRODUCTION

Technical education at the Central American Technological Institute ITCA, today the Specialized School in Engineering ITCA-FEPADE dates back to 1970 when the training of technicians in the areas of Electricity, General and Civil Mechanics and Construction began through the careers of Technician in Mechanical and Electrical Engineering and Technician in Civil Engineering and Construction, these careers began with an enrollment of 72 students each, i.e. a total initial enrollment of 144 students.

The students who entered to study the aforementioned careers were bachelors in Letters and Mathematics Sciences and Industrial bachelors from El Salvador and some Central American countries, since the ITCA despite having been an initiative of the Government of El Salvador, was conceived as a strategy to contribute to the technification of the Central American region; the students who came from the countries of Central America to train in El Salvador did so with scholarships for travel and support expenses granted by their respective countries, since all those who achieved their income did so through demanding performance tests in the areas of math, physical and chemical; becoming creditors to a scholarship of studies, paid for by the Government of El Salvador. ITCA had from the beginning the support of the Government of the United Kingdom of Great Britain and Northern Ireland, who was in charge of the necessary equipment for the implementation of the careers, as well as the delegation of technical experts, counselors, teachers and administrators; all this under a Cooperation Agreement signed between both Governments.

It is worth noting that the training of Engineering Technicians at the level after secondary education in the branches already mentioned constituted a very important milestone, until that moment the technical training had been limited to the level of secondary education, being recognized as industrial baccalaureates in different areas; this training was in charge of different institutions between public and private; these industrial baccalaureates were trained to be operational personnel in their respective areas, but they were not prepared to assume coordination functions in work teams, thus existing a gap between higher level professionals such as engineers and architects, among others and operational workers and industrial bachelors; that is why with the experience of the experts of the United Kingdom of Great Britain the training of these middle managers begins in El Salvador and Central America.

The vision of the Central American project was maintained for about a decade, during that period and under the vision that the British experts in conjunction with the national administrators had, other technical careers were implemented aimed at strengthening some sectors related to the agricultural areas, environment and the gastronomic sector; this was evidenced by the careers that were implemented in addition to those already mentioned, these being the careers of Maintenance of Agricultural Machinery, Soil and Water Conservation, and Food Preparation and Service.

It is worth mentioning that the technicians who were trained at that time contributed significantly to the emergence of technical education at the post-secondary level in some Central American countries, as was the case of the Technological Institute of Costa Rica, known as ITCR, the training of technicians in the electromechanical area was an incentive for companies of great prestige and technological advancement of the time to decide to install their manufacturing plants in El Salvador, among them can be mentioned Texas Instruments and AVX Ceramix Corporation, among others.

The cooperation of the Government of Great Britain lasted about a decade, although the Cooperation Agreement was indefinite, the socio-economic conditions of the late seventies that arose in the country led to a civil war, causing the Government of the United Kingdom to make the decision to withdraw as a cooperator leaving the ITCA under the administration of the Ministry of Education of the government of El Salvador.

### 3. DEVELOPMENT

A very important aspect to highlight about technical education in ITCA-FEPADE, is the educational model that was implemented since its inception, this being the one that is known today as a student-centered methodology, which is based on an adequate balance between theory and practice, in such a way that groups of students for the approach of theoretical aspects should not exceed 32 students, subdivided into two groups of 16 for the realization of practical activities of laboratory, field or workshop; the jobs were organized in such a way that for each of them two students could work. All this guaranteed the proper learning of theory and practice; to complement the training, technical field visits were organized to industries and/or companies related to the areas of study; subsequently, the students had to submit an individual report describing the observed processes; Additionally, the students, always organized in pairs, were assigned to carry out a final project consisting of the survey of the electromechanical installations with their respective plans and corresponding calculations, description of the productive and / or constructive processes, among others.

To ensure success in implementing the model, selected teachers were awarded scholarships to train in technical teaching methodologies for periods of six months to one year in England; subsequently, periodic trainings were organized by British experts mostly from the Bolton Institute, an institution specialized in the training of technical education teachers with wide recognition not only in England but worldwide.

During the past fifty years of ITCA's existence, a diversity of technical careers have been implemented in different areas, which were usually identified by the heads of academic departments through conversations with representatives of the different sectors, interested in these areas or through the analysis of information related to trends in socioeconomic development available, however, it could be said that for a long time the emergence of areas and careers was carried out empirically and intuitively. It was not until the beginning of the nineties, the year in which the ITCA becomes administered through an agreement by the Business Foundation for Educational Development, FEPADE, which is why it was known from that time as ITCA-FEPADE; whereas the design of careers was done in a more technical way; at that time and with the decision of the government of El Salvador, the institution was modernized in terms of facilities, equipment, teacher training and administrative and curricular aspects, investing an amount of sixteen million dollars; all this under the advice of experts from the Alfred State College of New York of the USA, it was precisely under his direction and advice that methodologies began to be used to identify areas of development and therefore the need for technical professionals; among these we can mention the curricular commissions and strategic workshops with representatives of the productive sectors, in the same way they begin to systematically use curricular design methodologies well known and used in different parts of the world for curriculum design, such as the so-called DACUM workshops (acronym for Developing a Curriculum).

In the last two decades, the institution has systematized the realization of studies of curricular relevance to validate the relevance of the careers of the curricular offer, as well as to anticipate what should be the areas, careers and levels in which technical professionals need to be trained in order to contribute to the productivity and competitiveness of the different productive and service sectors of the country.

On the other hand, also in the last two decades, systematic attention has been given to the methodological training of teachers by venturing into the competency-based training methodology, for which the cooperation of institutions with extensive experience in the application of this methodology, such as the National Learning Service, was managed. SENA of Colombia and the National Technical University of Costa Rica.

In order to validate the methodology in the curricular design of the careers was implemented in a selected career and a comparative research was carried out in order to determine the advantages of this, the results obtained were favorable to the competency-based training methodology, giving rise to the institutional decision to migrate all careers to a competency-

based training curricular design and to systematize the methodological training of the teachers in the application of this methodology; it is important to mention that this methodology although it considers very important theoretical aspects that aim to give greater prominence to students in their training, is compatible with the philosophy of "learning by doing", which dates back to the times of education theorists such as John Dewey, being consistent with the original educational model of training centered on the student already mentioned that sought to maintain an adequate balance between theory and practice.

ITCA-FEPADE has significant challenges for the future, this as a result of the disruptive technological change that occurred in the last decade known as the Fourth Industrial Revolution or Industry 4.0, which is characterized by the use of digital technologies, Artificial Intelligence and internet of the Cosas, as well as a widespread use of ICT, capable of carrying out activities autonomously without the intervention of human beings, this allows the creation of products with greater effectiveness and efficiency eliminating the barriers of the physical and the digital in the production processes.

This phenomenon makes it necessary to rethink the orientation and approach of the technical and engineering careers of the regular curricular offer of ITCA-FEPADE, so that the curricular designs take into account this fact, since it is expected that gradually the manufacturing companies, mainly the large ones, will reconvert and implement the technologies associated with the Industria 4.0 in its production processes; the countries of the first world are the pioneers in this regard and are advancing in this transformation in an accelerated manner.

In the case of El Salvador, it should be considered that the reconversion will probably not be as accelerated as is happening in other countries; however, there are conditions to ensure that this will not be very slow, one of them is the implementation of the 2020-2030 Digital Agenda promoted by the Government of El Salvador, through which it is intended to implement a set of actions that seek to integrate all the actors that participate in the development of the country through innovation and the application of ICT, this will create the conditions for companies and institutions to reconvert and implement in their production processes and in the services provided to the population, the technologies associated with Industry4.0; there is no doubt that this obliges the Institution, not only to continue carrying out studies of curricular relevance that validate the curricular offer and that at the same time allow to anticipate the technical professionals that are they will need in the short and medium term, but also to review the curricular designs of all the careers offered to aspirants to train as technicians or engineers.

Another challenge that the institution will have to face will be the management of the necessary resources to achieve the ideal equipment for the realization of the practices of the students, which must be in accordance with these technologies and more importantly, train teachers in technical and pedagogical aspects so that they train future technical professionals with the necessary and sufficient skills so that they can insert themselves without difficulties into a world of work that will require of them the mastery of such technologies.

#### 4. CONCLUSIONS

By way of conclusion, it can be said that ITCA-FEPADE has played a very important role in the training of technical professionals from El Salvador and the rest of the Central American countries, who have contributed to improving the productivity and competitiveness of the productive sectors and therefore to the economic growth of the different countries of the Central American region.

ITCA-FEPADE has implemented an educational model during its existence, which has proven to be successful, mainly by combining theory and practice in a balanced way, has experienced variations in terms of curricular design methodologies and learning by students, but has always retained the philosophy of being student-centered; on the other hand, it has been possible to systematize the identification of areas and therefore careers that are required to contribute to the socio-economic development of the country,

The challenges that ITCA-FEPADE has for the near future are great since they imply adapting to the technological changes imposed by the Fourth Industrial Revolution or Industry 4.0 so that its role as a training institution for technical professionals continues to be significant and of great support for the development and socioeconomic growth of the country.

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##### II. EXPERIENCE

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