

The Role of Superior Education Institutions on Post-Secondary (Non Superior) Education

José Machado
Eurico Seabra
Mechanical Engineering Department / CT2M
University of Minho
Guimarães, Portugal
{jmachado, eseabra}@dem.uminho.pt

Cristina Reis
Technological Association for the Professional Education of Beira Interior
Covilhã, Portugal
creis@aftebi.pt

Sofia Pelayo
Textile Technological School
Vila Nova de Famalicão, Portugal
SPelayo@citeve.pt

A. Caetano Monteiro
Mechanical Engineering Department / CITEPE
University of Minho
Guimarães, Portugal
cmonteiro@dem.uminho.pt

Abstract —In Portugal, like in other European countries, people with strong professional competencies are encouraged to obtain higher education, no matter their age or their social condition. With their strong professional background and some theoretical aspects linked to scientific and technological domains, they become more helpful for the companies and for the society they belong. Considering these facts, the Portuguese Government developed specific legislation to attract new students for the technological higher education system. This legislation, intends to attract students older than 23, and also aims the improvement of technological education after the secondary school level. Pursuing this goal the Technological Specialization Courses (TSC) were created.

The TSC are post-secondary, non superior training courses that will lead the students to obtain level 4 of professional training, according the 85/368/CEE decision of the European Union Council, published on the European Communities official journal. The TSC also allow people from different professional backgrounds to get technological training. The best students are allowed to access higher education in technological domains (basically in Engineering fields) and/or to the job market relied with the country's technological industries. The TSC are post-secondary, non superior training courses that will lead the students to obtain level 4 of professional training, according the 85/368/CEE decision of the European Union Council, published on the European Communities official journal. The TSC also allow people from different professional backgrounds to get technological training. The best students are allowed to access higher education in technological domains (basically in Engineering fields) and/or to the job market relied with the country's technological industries. Before the beginning of a TSC, the students are submitted to technological tests to determine their profile, which will be taken into account on the initial training, before the starting of the TSC.

In this paper, the success of TSC courses in Portuguese context is demonstrated, and the implementation of a successful partnership between University of Minho and the Technological Association for Beira Interior (AFTEBI) is shown. The illustration of the successful partnership is done by presenting a case study of a TSC in Industrial Maintenance where the best students can pursue their studies in University of Minho, in the Mechanical Engineering Department in order to obtain a Mechanical Engineering Degree. The main role of UMinho (as Superior Education Institution) at different levels of this post-secondary (non superior) education is also discussed and highlighted.

Keywords: Engineering Education; Professional Training; Higher Education

I. INTRODUCTION

In the late seventies in Portugal the “Industrial Schools” have been extinct, under the assumption that equal opportunities meant a uniform non technical secondary level formative path for everybody. Th is transfor mation of the national education system under the Ministry of Education led to the rarefaction of the public offer of technical teaching, but also to the depreciation of the status of technical professions. To compensate the rarefaction or even lack of technicians with formal instruction to fulfill the available job s, industry used to hire people that were initiated in the profession as apprentices, most of the time in situations that configure nowadays illegal infantile work [1].

From the information recently collected relative to professionals’ availability resulted that maintenance and machinery operat or positions presented a deficit of personal, both in quantity and quality [2]. It became evident that there were not enough Programmers/Operators of CNC machines, Metalworkers, Turners, Welders, Engineers, Metrology and Quality Control Technicians to fulfill market demand [3]. The main lacks in adequate professionals to fulfill industry needs occur in specific technical positions in those sectors, mostly technicians for undergraduate positions.

Also very few people respected eligibility criteria and the rules go verning the quality certification, safety and professional appraisal requirem ents of candidates’ curriculum, which turned the hum an resource scarce. The recent worldwide economic slow down increased the difficulties for the less
qualified, for they are less versatile to change profession, to perform new tasks or even to create new jobs.

By the beginning of the nineties the natural generation replacement had shown that skilled technicians and professional intermediaries levels professionals in the industrial and business areas to a level that could no longer be ignored. Also the Portuguese Government inscribed competitiveness as one of the fundamental objectives for the country in the Program, along with fostering the social cohesion.

To achieve these objectives it is imperative that qualified people are available, so that in fact the decisive factor for a sustainable long-term progress, in particular in fast changing societies that are supported by knowledge and information.

Furthermore the installation of new technically demanding industries, and the petition for skilled people in Europe has seen the availability of skilled professionals in Portugal. The industry modernization courses and the challenges imposed by the fast changing reality demanded that the new professionals be prepared not only to fulfill the present needs of the companies, but also to be prepared to permanently adapt themselves to respond to emerging professions in areas that nowadays present already inadequate profiles.

In Portugal, because of remaining low education and professional qualification levels, it is still considered to characterize the great majority of the population in active age, in spite of the progresses already done in this domain in the last decades, this issue assumes special relevance.

It is then imperative to increase Portuguese skills and qualifications to create a potential for new opportunities and to promote both the people intrinsic development, and the social, cultural and economical growth of the country. Moreover skilled human resources generate a greater socio-cultural cohesion. The educational system must be able to better qualify the professionals already working positions in present industrial companies, and to also to be prepared to permanently adaptation themselves to respond to emerging professions in areas that nowadays present already inadequate profiles.

A careful analysis points to the development of solutions on technology learning under a solid technical teaching by trained professionals, to assure that the new generations may reach higher education levels, but also that they get adequate professional qualification prior to enter the job market, namely by providing professional education oriented towards professions and skills that are in deficit and highly required.

Knowledge through professional teaching and formation must be co-ordinated with a qualified professional in section component. Seeking the access to higher education and equal opportunities, and the visage to expand the scope of the more young and adult sectors, is the challenge of the current period. The Gove law must be improved to ensure the implementation of the quality standards in the upper secondary level. It was also decided to involve the higher education in institutions, in order to grant the articulation between higher and secondary education levels and the system’s accreditation, for superior studies pursuit purposes, of the post-secondary formative courses specialization.

To materialize these commitments, the present law promotes a deep reorganization of the technological specialization courses at the level of the entering access, the formation structure and the conditions to access higher education institutions for the graduates of this system.

Being aware of the Portuguese lack of skilled professionals, the Ministry proposed the creation of a set of Technological Schools, intending to set up a technical training system for the graduates' integration in the available work positions in present industrial companies, and to guarantee the adequate up dating of the professionals already working, of fering the possibility for them to acquire new skills so making it easier for them to access professional valorization.

In order to achieve the goals proposed in this work, the paper is structured as follows: sect ion I is devoted to the presentation of the facing challenges; in sect ion 2 the characteristics of the Portuguese Technological Specialization Courses (TSC), are presented; in sect ion 3 is described the relationship between the University of Minho and the Technological Association for Professional Education of Beira Interior (AFTEBI); follow ed by the presentation in section 4, of the main characteristics of the successful TSC on Industrial Maintenance; in section 5 is discussed the success of this TSC and the impact on the situation of the new graduates in higher education; in sect ion 6 is discussed the role of Superior Education Institutions on non-secondary (on-higher) education; finally, on sect ion 7 reflects the conclusions achieved.

II. TECHNOLOGICAL SPECIALIZATION COURSES

The Portuguese Government assumed the "New opportunities" initiative, of the minimum referral form movements level goal to achieve twelve years of education and professional qualification, in particular in fast changing societies that are supported by knowledge and information.

The Portuguese Government assumed, in the "New Generation" Education Institutions on post-secondary (non-superior) level, the minimum referral form movements level goal to achieve twelve years of education and professional qualification, in particular in fast changing societies that are supported by knowledge and information.
that was published in the n. L 199 EC Official Newspaper, of July 31st, 1985.

Level IV of professional formation is obtained through the conjugation of a general or professional secondary level formation, with a post secondary technical form ation and it is characterized by:

- Being a high level technical formation;
- The resulting qualification includes knowledge and abilities belonging to the superior level;
- Mastering the scientific foundations of the different studied areas is not demand, in general;
- The acquired knowledge and abilities in this level allow the assumption of autonomous responsibilities in conception, direction or management.

These courses aim to join the form ation and learning components to the job market demand. The materialization of these objectives is done not only by the promotion of partnerships between formation schools, higher education institutions, but also by involving business responsible and employers, seeking to direct learning activities to effective professional insertion, and to assure actual recognition of the subjects learned for higher education studies pursuit purposes.

In the analysis of the Idea Proposals for the creation of new Technological Schools under PEDIP II (Programa Estratégico de Dinamização e Modernização da Indústria Portuguesa), the second Strategic Program for the Dynamization and Modernization of Portuguese Industry, a concern emerged to use already existent infrastructures in order to make the best use of the incentives that they had been attributed previously, namely under the preceding PEDIP program.

On the other hand, most schools are not supported in autonomous infrastructures, and so larger operation flexibility is possible, including the continuous access to new technologies, methods and formation methodologies, through the celebration of collaboration protocols between Institutions, so avoiding the duplication of investments in the same areas.

This Specialization Courses present advantages for the youth: with strong technological component are lectured by competent technicians. Now are offered under cross collaboration among Technological and Professional Associations, such as AFTEBI, with institutions of the Portuguese Superior Level System, such as the Universities of Beira Interior and Minho, and the Polytechnic Institutes of Guarda, Castelo Branco and Viseu [5].

III. PARTNERSHIP “UNIVERSITY OF MINHO / AFTEBI”

AFTEBI is an Association for Technological and Professional Formation, created in 1997 in the interior center of Portugal, with 12 years of experience in the formation of intermediate level professional students for the industry in various knowledge areas.

The University of Minho (UMinho), founded in 1973, is located in the Minho region of Northern Portugal, a region with a strong tradition of entrepreneurship, essentially of small and medium-sized businesses. The University of Minho was strategically planned with the surrounding socio-economic environment in mind, aiming to contribute to its development.

By 2001 AFTEBI made an invitation to the University of Minho to enlarge the activity of AFTEBI I to the North of the Country. This partnership is now translated in several cooperation forms, formalized through protocols to encompass the following objectives:

- To take advantage of the University human resources (namely in pedagogic coordination of the courses and lecturing) and infrastructures (pedagogic facilities and equipments);
- For Prosecution of studies of the AFTEBI graduates in the 1st cycle superior or courses promoted by the University of Minho.

Due to the large spectrum of formative reas in which AFTEBI is acting, not all of the Technological Specialization Courses are running in the North of the Country, but all of them are validated by the University of Minho, not only for studies prosecution, but also more in portantly, for scientific approval of the knowledge domains lectured.

Actually the intervention of the University of Minho has grown significantly in recent years, not only by the enlargement of the formation areas, but also by the number of students that attend the form ation courses, as it may be observed in Figure 1 and Fig. 2. Additionally, the employability rate of AFTEBI students, graduated in partnership with the University of Minho (Fig. 3) is high.

![Figure 1. Number of Students per year and per TSC](image)

A. Protocols

With the first graduate students in 2003, a protocol of studies pursuit was signed, establishing the rules and forms for the graduates access the superior level courses promoted by the University of Minho. This protocol has been updated whenever any of the institutions introduced changes in their courses, the most recent update having happened in January 2008.
In the year 2009, the following Technological Specialization Courses were active:

- Textile Ultimation;
- Industrial Maintenance;
- Water and Effluents Treatment.

It is foreseen that the formation areas be kept in the outburst of the schol year 2009/2010, with the probable replacement of the textile area by two possible courses to be promoted:

- Industrialization of Fashion Product;
- Fashion Commerce.

The decision will always be made in agreement with the expectations of the industrial area employers, because, besides the increasing youths' qualification and their pursuit of studies, one of the main objectives of this formation is the placement of intermediate professionals in the industry.

IV. TECHNOLOGICAL SPECIALIZATION ON INDUSTRIAL MAINTENANCE

A Specialist Technician in Industrial Maintenance is a professional that, autonomously or integrated in a team, makes the diagnose, prepares, plans out or accomplishes several tasks of corrective, preventive or "on condition" maintenance with the objective of guaranteeing the maximum readiness of the equipments and in dustrial facilites, for them to produce with quality an d guaranteeing the execution of the produc tion programs.

AFTEBI Technological Specialization Course professionals are graduated with a high level of technical specialization in the domain of the Industrial Maintenance (Fig. 4) with a strong practical component in the areas of specialty of the mechanics, electricity, electronics and automation.

The reinforcement of the technical capacity in these areas constitutes the fundamental objectives for the modernization of the industrial companies, and these graduates will be prepared to:

- analyze technical documentation of diverse nature (sketches, drawings, facities' diagrams, manuals, manufacture catalogs, standards and procedures) relative to the equipment, systems or facilities of mechanical, electrical or electronic nature;
- execute outlines and drawings of facility-electromechanical, electrical or electronic circuitry, as a support to the maintenance activity;
- prepare the tools, materials, components, and parts that are necessary for the development of maintenance routines;
- execute the installation of equipment or systems of electromechanical, electrical or electronic nature;
- accomplish operational, functional or officinal rehearsals in electromechanical, electrical or electronic equipments, syste ms or facilities, so assuring their conformity with the specifications of the project and quality standards;
- follow the performance of the equipments, systems or facilities of electro mechanical, elec trical or electronic nature, in agreement with the established in the maintenance plan;
- propose modifications in equipments, systems or facilities of electromechanical, electrical or electronic nature, taking into account the deviations between the rehearsal values and the pre-established parameters;
execute interventions and to repair equipment, systems or facilities of electromechanical, electrical or electronic nature in order to improve their operational characteristics;

propose alterations to the layout of systems, productive or operating equipment, with the objective of improving their performance;

elaborate technical reports about the accomplished interventions;

do maintenance plans, based in the historical reports of the equipments, systems or facilities of electromechanical, electrical or electronic nature;

cooperate with the productive area, with the objective of optimizing the resources and to reduce unproductive times;

detect mistakes and technical deviations that may happen, to analyze them and to propose solutions;

develop technical relationships with suppliers of equipments, to analyze the adaptation needs of the technologies to the specificities of the company;

analyze the equipment needs and provide their acquisition;

promote and apply preventive maintenance practices.

By the conclusion of the TSC plan of formation, it is expected that the students possess a set of competences, not only at the level of the theoretical knowledge acquisition but also at the level of its practical implementation.

The TSC of Industrial Maintenance has the duration of 1560 hours, 600 hours of which in industrial context. The formation has a strong practical component, 75% of the total hours of the course being supplied in laboratorial/official context. For this formation the facilities of the UMinho, of the Technological Centre for textile and clothing industry, and Industrial companies are used.

Students are stimulated to develop knowledge interests at the levels of know-how to do and know-how to be, seeking creativity and innovation. Also they are taught about industrial needs for workers, with their profile, in order to assure their own development, that collaborate by guaranteeing the apprenticeship of all the students that benefit in consequence of good job perspectives.

The Pedagogic Coordination of TSC of Industrial Maintenance, from the Department of Mechanical Engineering of the UMinho, is supported on a group of specialists and technicians of each area that come not only from the educational system, but also from industrial origin. Program contents and methodologies are periodically checked and adjusted if needed with the objective of meeting the real needs of the industry. In Fig. 5 the part of the formation plan that corresponds to the Technological Form ation is presented. It includes the main notations used, more precisely:

<table>
<thead>
<tr>
<th>Competence Area</th>
<th>Formation Curricular Unit</th>
<th>Work Hours</th>
<th>Direct Contact</th>
<th>ECTS</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Mechanical Technology</td>
<td>49</td>
<td>40</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Mechanical Electronics</td>
<td>40</td>
<td>30</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Mechanical Mechanics</td>
<td>40</td>
<td>30</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Electronic-Electronics</td>
<td>50</td>
<td>40</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Automation and Industrial Electronics</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Design and Repair Techniques</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Technical Drawing</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Industrial Engineering</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Industrial Mechanics</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Industrial Management</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Management of Safety and Health</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Energy Audits</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Basic Sciences and Technologies</td>
<td>Project</td>
<td>45</td>
<td>35</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>1560</td>
<td>1200</td>
<td>600</td>
<td>80.0</td>
</tr>
</tbody>
</table>

Figure 5. Technological component plan for Industrial Maintenance TSC.

The main factor of success of this TSC is connected, fundamentally, with the vicinity of the industrial business and the correct detection of their need for intermediate technicians, and to the establishment of partnerships with Entities, Schools and Companies, that guarantee the high patterns of quality of the supplied formation.

The success of this TSC may be measured by the high demand in the industry being translated, consequently, in high employability rates.

V. DISCUSSION – TSC ON INDUSTRIAL MAINTENANCE

The industrial network of the north of Portugal is characterized by industrial companies of small or medium-size dedicated to the textile, mechanics, shoe making and wood industry. These companies have been very active and versatile being competitive so far.

Nowadays, these industrial companies are object of profound changes due to the national and international situation, particularly related to globalization of the economy.

The industrial network of the north of Portugal is characterized by industrial companies of small or medium-size dedicated to the textile, mechanics, shoe making and wood industry. These companies have been very active and versatile being competitive so far.

Nowadays, these industrial companies are object of profound changes due to the national and international situation, particularly related to globalization of the economy.
These companies are undergoing great transformations - from a situation where they based their competitiveness on non-skilled low cost labor - to a new reality where they must adopt a strategy to develop and produce innovative products with high level of added value. In this context the technical formation of workers, more or less qualified, is the key for the success and especially the technological formation of well trained technicians for operating and maintaining the industrial equipments is crucial. These equipments are technologically sophisticated and all the companies produce high added-value products. In this context, the technological formation in dustrial Maintenance is essential, on the basis of its existence, a guaranteed success.

The existence of a region like Minho (in the north-west of Portugal) or higher in situations (UMinho) and Professors Schools (ETT) and the cooperation work of those institutions for common objectives (in improvement of the reality of the region's industry) base on the technological resources sharing (physical and human resources) is a strategic and useful service for the industrial companies, for the region's people and respective quality of life, and for the country.

The TSC on Industrial Maintenance of the ETT is coordinated, from the pedagogical point of view, by University of Minho. This fact brings the guarantee of quality and success of the other curricular units. To assure this, several teachers from University of Minho. UMinho shares with ETT some teachers, highly qualified, for organizing and teaching some technological curricular units, related with key areas in industrial maintenance field. This is clearly, an added value for the TSC on Industrial Maintenance. Also, so, technical knowledge of the industrial reality, by UMinho’s teachers, is very important to adapt the technical contents of the curricular units, directed to the real needs of the industrial companies. This solid knowledge of the industrial reality is the result of many years of cooperation between UMinho and industrial companies of the region.

Due to the teaching load, the TSC on Industrial Maintenance is severely focused on aspects linked with the practical application of the theoretical aspects of the studied matter. As these professionals are going to be – some of them – responsible for the maintenance team on their industrial companies, the technical aspects of some (even if 75% of the total hours of the course are supplied in industrial companies, the theoretical aspects of the studied maintenance field are essential. UMinho’s teachers, highly qualified, for organizing and teaching some technological curricular units, related with key areas in industrial maintenance field. This is clearly, an added value for the TSC on Industrial Maintenance. Also, so, technical knowledge of the industrial reality, by UMinho’s teachers, is very important to adapt the technical contents of the curricular units, directed to the real needs of the industrial companies. This solid knowledge of the industrial reality is the result of many years of cooperation between UMinho and industrial companies of the region.

The aspects related to Com petence-Based Education [6] are highly considered during their formation. The concept of competence-based education may facilitate learning [7] in a society of rapid change and complexity. The so-called theoretical formation and the posterior application on practice [8] gives to these students after the conclusion of the TSC, strong skills on domains related with Industrial Maintenance.

Complementarily, on the eir formation, several areas like mechanics, electronics, informatics, automation and robotics (Fig. 5) give to these students, skills that are highly valued and searched by the industrial companies. Commonly very good maintenance technicians may be found in the region, but their basic formation is on only one of the above mentioned areas. The fact that this TSC formation has a solid and complete coverage, considering all the areas of the field of industrial maintenance, gives the trainees a basic formation with a high level added-value. Nowaday, one of the past, the industrial companies incorporate complex devices that in the future may be used, and any operator/maintenance technician that needs to interact/repair with these devices must have a complete and solid background at several and complementary fields related with Industrial Maintenance.

In the practical/training classes, as in the project developed in industrial companies, advanced teaching techniques are used [9], namely advanced formalisms and informatics tools in order to give the student a faster and more detailed description of the reality that they will find at work in real world. These tools are very important for the 4th technicians that are expected to assume, in the near future, responsibilities of leadership on their companies.

As a result of this reality, presented above, the students of the TSC on Industrial Maintenance are well accepted and searched by industrial companies and they reveal to have the necessary and adequate skills adapted to their needs.

But the real capability of the students of the TSC on Industrial Maintenance, are not only interesting for industrial companies. UMinho, too, is a possible choice for them, in order to continue their formation in the domain of Mechanical Engineering.

As a strategic University, UMinho intends to have the best students in all the domains. In the particular case of Mechanical Engineering, the possibility of having students with a practical background acquired in industrial companies is very interesting. This fact brings the possibility that UMinho’s teachers, highly qualified, for organizing and teaching some technological curricular units, related with key areas in industrial maintenance field. This is clearly, an added value for the TSC on Industrial Maintenance. Also, so, technical knowledge of the industrial reality, by UMinho’s teachers, is very important to adapt the technical contents of the curricular units, directed to the real needs of the industrial companies. This solid knowledge of the industrial reality is the result of many years of cooperation between UMinho and industrial companies of the region.

As a formalization of this idea the agreement signed between UMinho and AFTEBI considers this possibility and allows the access to the Integrated Master on Mechanical Engineering of University of Minho – of the five best students of the TSC on Industrial Maintenance. This agreement respects and is in accord with the Portuguese Decree-Law n. 88/2006 of May the 23rd. This Decree-Law defines the rules for the TSCs and provides the possibility for the students who finish their studies in the Integrated Master on Mechanical Engineering domain. As a result of this reality, presented above, the students of the TSCs, of continuing studying on Higher Education Institutions.

The selection of the students, for accessing the Integrated Master on Mechanical Engineering of University of Minho, is done taking into account the average classification that they have obtained in their studies, the possession of some competence equivalences of the curricular units, the possession of some competence equivalences of the curricular units, and provides the possibility for these students to continue their studies in the Integrated Master on Mechanical Engineering.

As a result of this reality, presented above, the students of the TSCs, of continuing studying on Higher Education Institutions.

The selection of the students, for accessing the Integrated Master on Mechanical Engineering of University of Minho, is done taking into account the average classification that they have obtained in their studies, the possession of some competence equivalences of the curricular units, the possession of some competence equivalences of the curricular units, and provides the possibility for these students to continue their studies in the Integrated Master on Mechanical Engineering.

As a result of this reality, presented above, the students of the TSCs, of continuing studying on Higher Education Institutions.

The selection of the students, for accessing the Integrated Master on Mechanical Engineering of University of Minho, is done taking into account the average classification that they have obtained in their studies, the possession of some competence equivalences of the curricular units, the possession of some competence equivalences of the curricular units, and provides the possibility for these students to continue their studies in the Integrated Master on Mechanical Engineering.

As a result of this reality, presented above, the students of the TSCs, of continuing studying on Higher Education Institutions.

The selection of the students, for accessing the Integrated Master on Mechanical Engineering of University of Minho, is done taking into account the average classification that they have obtained in their studies, the possession of some competence equivalences of the curricular units, the possession of some competence equivalences of the curricular units, and provides the possibility for these students to continue their studies in the Integrated Master on Mechanical Engineering.
objective point of view, mainly based on the analysis of their students' curriculum. This is possible because of the co-operative nature of the students, allowing them to identify the best students to pursue their studies in the University.

In the academic year 2008/2009, the five places available for the Integrated Master on Mechanical Engineering of University of Minho were completely taken and concurred. For these five places, twelve students. This shows the interest of the students, for continuing their studies on the University and the utility of this strategy to attract different publics for Higher Education Institutions.

Being this year the first year that the experience is carried out, the first semester evaluations show that these students have had satisfactory results. A more complete evaluation, about the performance of these students, will be done in the final of the first year; until now, it was not possible because the first year is running. Moreover, the first conclusion that can be confirmed is that these students — because they have a basic background on several domains of Mechanical Engineering, as explained to some aspects and concepts related with informatics, automation and industrial robotics — have more performance of these students, will be done in the final of the first year.

The model so far presented is still in its earlier implementation day s. Concerning the part icular case of the UMinho/AFTEBI partnership in Industrial Maintenance, only two courses have been completed, and a third is going to finish this year. Anyway a discussion may start about the role that the High Education institutions are expected or should play in the definition and support of the post-secondary training/educational activities. As a matter of fact it must be written agreements between the institutions involved, allows an alternative via to access higher level. This alternative may lead in future to a more equitable alternative to the lower levels, by defusing the anguish of a precocious decision.

The University may act in diversified grounds in respect to the learning/teaching activities. As a matter of fact it must be stressed that the University is responsible for the scientific preparation of the bulk of the teachers of the system, but the research activities committed to the Universities in Portugal are also responsible for the development of the national technical issues. Any discussion about technology, at any level, should involve the main actors in the country, either from the side of the teachers or of the students (the co-matchness) and the producers of knowledge (Universities and Polytechnic Schools) and also from the providers of trainees and ultimate beneficiaries of the system.

According to IQF, (Institute for Quality in Formation) the learning model must be structured in a group of phases, processes and instruments that, as a function of the needs and readiness for the entities and professionals that intervene in the formation.

The formation including apprenticeship in context of work, guaranteed by the Schools through a Pedagogical Coordination of the courses that contacts and selects the housing companies, process an d support solutions, t hat can be explored and used in different ways, that is, as a function of the needs and readiness for the entities and professionals th at intervene in the formation.

As a potential receiver of the trainees that may want to proceed studying and taking in account other motivations for formation credits acquired in the Technological courses may be considered for prosecut ion proposes, t he use of the University must be involved in the actual design of the courses.

However limited nowadays, the number of students positions offered by the University may increase as the Courses become more consolidated and recognized by the society.

The issues linked to the evaluation, seem to be fundamental for the understanding of the effective role of the formation while instrument of development, according with Lima Santos and Pi na Neves [11]. It assumes special importance in the materialization and regulation of the formation actions from the evaluation being a systematic dynamic and intrinsic process, to the formation process, cont ributing to the promotion of their global success.

The formation must be conceived from the start considering the needs, to design the formation project, to organize the didactic sequences, in order to bring to the technical and didactic resources and to prepare support equipments.

In this context, Parry [12] referred that a formation activity performed well happe ned when “the rig hgt trainees (taking in account the process of selection made) develop the knowledge, the competences and the necessary attitudes (cont ents of the formation), through means, strategies and appropriate teach ers
(process), in a certain time and in a certain space (context), fulfilling the initial expectations (…) (objectives and expected results for the acting).”

VII. CONCLUSIONS

Among the reasons motivating the efforts of launching and supporting technological specialization courses, the most important is undoubtedly the high number of skilled people that is needed every year and that must undergo a training process.

It is well known that experience improves performance. Although the amount of experience needed to achieve a certain level of performance varies with the individual and personal characteristics, some experience is always desirable.

Creation, improvement and/or adaptation of methodologies that improve adequacy to the needs felt by the companies will not only improve the employment rates among youngsters, but also may allow to minimize or overcome the inadequacy of skills occurring due to technical knowledge change.

In this context, the TSCs provide some solutions:

• From the student’s point of view, a better formation by the end of the secondary level is provided, enlarging the capacity to access the job market;
• From the companies’ point of view, the availability of new graduates enlarges the access to a more qualified work force;
• From the formation schools point of view, for instance AFTEBI, the accomplishment of its mission results in a better and wider professional formation of a larger set of people;
• From the higher education Institutions (like the UMinho), the contribution to the quality improvement of the technological specialization courses of (through their pedagogic coordination) and by the attraction of its best students for continuation for superior studies in a very important area for any developed country, engineering;
• From the national point of view, the creation of conditions to improve the technological capacity of the country and a larger set of people;
• From the formation schools point of view, as for instance AFTEBI, the accomplishment of its mission results in a better and wider professional formation of a larger set of people;
• From the companies’ point of view, the availability of new graduates enlarges the access to a more qualified work force;
• From the national point of view, the creation of conditions to improve the technological capacity of the country and a larger set of people;
• From the student’s point of view, a better formation by the end of the secondary level is provided, enlarging the capacity to access the job market;
• From the companies’ point of view, the availability of new graduates enlarges the access to a more qualified work force;
• From the formation schools point of view, for instance AFTEBI, the accomplishment of its mission results in a better and wider professional formation of a larger set of people;
• From the higher education Institutions (like the UMinho), the contribution to the quality improvement of the technological specialization courses of (through their pedagogic coordination) and by the attraction of its best students for continuation for superior studies in a very important area for any developed country, engineering;
• From the national point of view, the creation of conditions to improve the technological capacity of the country and a larger set of people;

The University must be involved with the forming entities and the companies in the definition of the global objectives to reach and activities to develop, and also in the assessment of the C ourses, in order to assure the technical quality of the formative proposal, its coherence and robustness.

REFERENCES