

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

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**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. 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 the Professional Education of 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. This transformation 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 jobs, 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 operation 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, Mechanicals, Metrology and Quality Control Technicians, Product Development Technicians and other typical technical professions 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 governing the quality certifications, safety and professional approval requirements of candidates' curricula, which turned the human resources scarce. The recent world wide 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 led the shortage of skilled technical and technological intermediate level 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 its Program, along with fomenting the social cohesion.

To achieve these objectives it is imperative that qualified people be available, for that is 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 competition for skilled people in Europe shortened even more the availability of skilled professionals in Portugal. The industry modernization in course and the challenges imposed by the fast changing reality demand 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 that still continue 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 in consequence, the social, cultural and economical growth of the country. More qualified human resources generate larger competitiveness capability along with greater social cohesion. The educational system must be able to better qualify the youths, fighting in particular the high rates of early school abandon (nowadays only half of the citizens aged between 20 and 24 has successfully finished the secondary education level). Also, to solve the inadequacy of the present skills of the workforce to the emerging industrial opportunities, the formative offer must give new opportunities to adults, and promote school recovery and professional qualification, namely to those that are now facing unemployment because their jobs (even when skillful) vanished.

A careful analysis points to the development of solutions on technology learning under a solid technical teaching by trained professionals, to allow the graduates' integration in available work positions in present industrial companies, and to guarantee the adequate updating of the professionals already working, offering the possibility for the acquisition of new skills so making it easier their conversion and professional valorization.

In order to achieve the goals proposed in this work, the paper is structured as follows: section 1 is devoted to the presentation of the facing challenges; in section 2 the characteristics of the Portuguese Technological Specialization Courses (TSC), are presented; in section 3 is discussed the relationship between the University of Minho and the

Technological Association for the Professional Education of Beira Interior (AFTEBI); followed 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 capture of students for higher education; in section 6 is discussed the role of Superior Education Institutions on post-secondary (non-superior) education; finally, on section 7 are presented the conclusions achieved.

## II. TECHNOLOGICAL SPECIALIZATION COURSES

The Portuguese Government assumed, in the "New opportunities" initiative, the minimum referential formation level goal to achieve 12 years for every youngster, having recently legislated the mandatory school frequency until finishing the secondary level or reaching 18 years old [4]. This goal was assumed in couple with the goal of increasing the rate of students attaining technological and professional courses at the secondary education level to at least half the younger population. The bet is not only 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 to professional profiles and skills that are in deficit and highly required.

Knowledge through professional teaching and formation must be conciliated with a qualified professional in the component. Seeking the access to higher education and equal opportunities, and envisaging the engagement of more young and adults with the professional education and formation system, the Government assumed, in its program commitments, to enlarge the formation offer along the life to new publics. It was also decided to involve the higher education institutions in the expansion of the post-secondary formation, in order to grant the articulation between the secondary and superior teaching 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 levels 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 supported the creation of a set of Technological Schools intending the promotion of initial formation in technological areas for youth, in a post secondary level. These courses later acquired the designation of Technological Specialization Courses (TSC), granting Level IV of professional qualification through Technological Specialization Diplomas (TSD). The TSC are especially encouraged in sectors or areas in which the companies are strongly lacking competent technicians, giving the youths a larger warranty of immediate employability, after the conclusion of the apprenticeship.

The technological specialization courses are post secondary non superior level grades, that seek the acquisition of the IV level of professional formation, as defined by the n. 85/368/CEE Decision, of the European Council, of July 16,

that was published in the n. L 199 EC Official Newspaper, of July 31<sup>st</sup>, 1985.

Level IV of professional formation is obtained through the conjugation of a general or professional secondary level formation, with a post secondary technical formation 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 formation 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 responsables 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 (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 professionals 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 in to the University of Minho to enlarge the activity of AFTEBI 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 courses promoted by the University of Minho.

Due to the large spectrum of formative areas 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 UMinho not only for studies prosecution, but more importantly, for scientific approval of the knowledge domains lectured.

Actually the intervention of UMinho 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 formation courses, as it may be observed in Fig. 1. and Fig. 2. Additionally, the employability rate of AFTEBI students, graduated in partnership with University of Minho (Fig. 3.) is high.

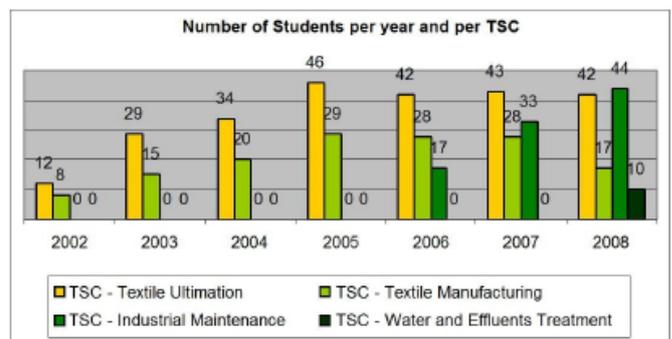


Figure 1. Number of Students per year and per TSC

#### A. Protocols

With the first graduates in 2003, a protocol of studies pursuit was signed, establishing the rules and models 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.

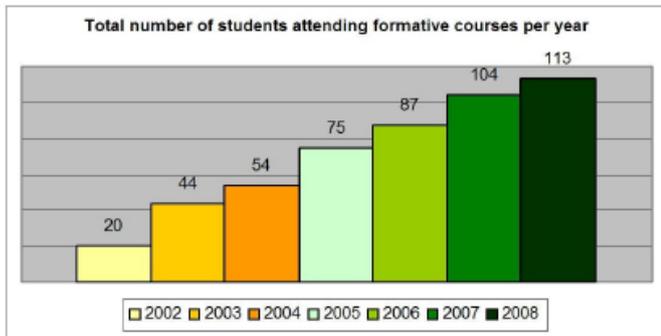


Figure 2. Total number of students attending formative courses per year.

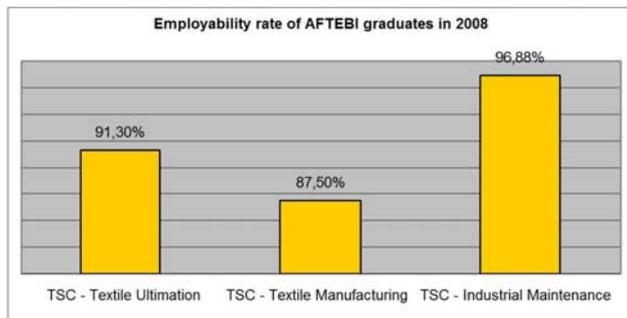


Figure 3. Employability rate of AFTEBI graduates in 2008

#### B. Technological Specialization Courses

In the year of 2009, the following Technological Specialization Courses were active:

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

It is foreseen that the formation areas be kept in the outburst of the scholarly year 2009/2010, with a 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 industrial facilities, for them to produce with quality and guaranteeing the execution of the production 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.

Formation Plan					
Scientific and General Formation Component					
Formation Institution		Association for Technological and Professional Formation of Beira Interior			
Technological Specialization Course		Industrial Maintenance			
Competence Area	Formation Curricular Unit	Work hours		ECTS	Comments
		Totals	Direct contact		
(1)	(2)	(3)	(4)	(5)	(6)
Languages and communication	Technical English	53	32	2	
Citizenship and society	Labor Relations and Law at work	27	16	1	
Organization and Management	Hygiene and Safety at work	40	24	1,5	
Organization and Management	Introduction to enterprise management	27	16	1	
Organization and Management	Cost Analysis	40	24	1,5	
Citizenship and society	Quality and Environment management	53	32	2	
TOTAL		240	144	9	

Figure 4. Formative plan for Industrial Maintenance TSC.

The reinforcement of the technical capacity in these areas constitutes one of 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, facilities' diagrams, manuals, manufacture catalogs, standards and procedures) relative to the equipments, systems or facilities of mechanical, electrical or electronic nature;
- execute out lines and drawings of facilities and connections electro mechanical, 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 the maintenance routines;
- execute the installation of equipments or systems of electromechanical, electrical or electronic nature;
- accomplish the operational, functional or official rehearsals in electromechanical, electrical or electronic equipments, systems 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, electrical or electronic nature, in agreement with the established in the maintenance plan;
- propose modifications in equipments, systems or facilities of electro mechanical, electrical or electronic nature, taking in account the deviations between the rehearsal values and the pre-established parameters;

- execute interventions and to repair the equipments, systems or facilities of electromechanical, electrical or electronic nature in order to improve their operational characteristics;
- propose alterations to the layout of the 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 optimize 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 the 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 of which in industrial context. The formation has a strong practical component, 75% of the total hours of the course being supplied in laboratory/official context. For this formation the facilities of the UMinho, of the Technological CITEVE (Centro Tecnológico para a indústria Têxtil e do Vestuário) – a Portuguese technological center 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 dynamic 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 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 Formation is presented. In this map some notations are used, more precisely:

- in column (3) the total hours of work are indicated as defined in Portuguese Decree-Law n. 42/2005, from February the 22<sup>nd</sup>;
- In column (4) is indicated – among the total hours of work – the direct contact hours (with teacher), according the definition presented at point d) of the article 2<sup>nd</sup> of the Portuguese Decree-Law n. 88/2006, from May the 23<sup>rd</sup>;
- In column (5) is indicated – among the total hours of direct contact – how many hours are dedicated to practical applications, namely laboratory, workshops and/or Project according the point 2) of the article 15<sup>th</sup> of the Portuguese Decree-Law n. 88/2006, from May the 23<sup>rd</sup>;
- In column (6) is indicated the number of ECTS, complying with the European Credits Transfer System, according the Portuguese Decree-Law n. 42/2005, from February the 23<sup>rd</sup>.

Technological Formation Component						
Competence Area	Formation Curricular Unit	Work hours			ECTS	Comments
		Totals	Direct contact			
		(3)	Totals	Practical		
(1)	(2)	(4)	(5)	(6)	(7)	
Basic Sciences and Technologies	Mechanical Technology	80	48	36	3,0	
Basic Sciences and Technologies	Maintenance Welding	80	48	36	3,0	
Basic Sciences and Technologies	Electrical Installations	93	56	42	3,5	
Basic Sciences and Technologies	Electrical Equipments	93	56	42	3,5	
Basic Sciences and Technologies	Electronics	107	64	48	4,0	
Basic Sciences and Technologies	Automation and Industrial Robotics	133	80	60	5,0	
Basic Sciences and Technologies	Diagnostic and Repair Techniques	133	80	60	5,0	
Basic Sciences and Technologies	Technical Drawing	107	64	48	4,0	
Basic Sciences and Technologies	HAVAC Systems	80	48	36	3,0	
Basic Sciences and Technologies	Electromechanical Maintenance	80	48	36	3,0	
Basic Sciences and Technologies	Maintenance Org. and Management	107	64	48	4,0	
Basic Sciences and Technologies	Management of Supply and Stocks	53	32	24	2,0	
Basic Sciences and Technologies	Energy Audits	53	32	24	2,0	
Basic Sciences and Technologies	Project	160	96	72	6,0	
TOTAL		1360	816	612	51,0	

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 partnership protocols 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 these technicians' 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, shoemaking 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 technological 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 allow the companies produce high added-value products. In this scenario, any technological formation course in Industrial Maintenance is, on ly by its existence, a guaranteed success.

The existence on a region like Minho (in the northwest of Portugal) of higher institutions (UMinho) and Professional Schools (ETT) and the cooperation work of those institutions for common objectives (improvement of the performance of the region's industry) based on their 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 the quality and success of the contents/programs of the curricular units that compose the formation plan. Also, some technological Curricular Units are assured by 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 of Industrial maintenance field. This is, clearly, an added value for the TSC on Industrial Maintenance. Also, the knowledge of the industrial reality, by UMinho's teachers, is very important to adapt the pedagogical 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 specially focused on aspects linked with the practical application of the theoretical aspects of the studied matters. As these professionals are going to be – some of them – responsible for maintenance teams on their industrial companies, the theoretical aspects (even if 75% of the total hours of the course are supplied in laboratorial/official/industrial context) are carefully highlighted on their formation.

The aspects related to Competence-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 solid 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 their formation, several areas like mechanics, electronics, informatics, automation and industrial 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. Nowa days, more than in the past, the industrial equipments incorporate complex devices that interact between them, 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 level 4 technicians that are expected to assume, in a 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 capabilities and skills of the technicians, that finish 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 and based on competence-based education concepts - highly focused on the Bologna declaration [10] becomes interesting to attract these students, namely the best ones of the TSC on Industrial Maintenance, for their graduation on Mechanical Engineering domain.

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 23<sup>rd</sup>. This Decree-Law defines the rules for the TSCs and provides the possibility, for the students that finish their 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 the end of their TSC on Industrial Maintenance. Recognizing the previous quality formation of the students, it is, also, previewed the possibility of some equivalences of Curricular Units, when the students are admitted to the University. The actual decision any possible Curricular Unit equivalence belongs to the Director of the Integrated Master on Mechanical Engineering and it is regulated by the point 27th of the Portuguese Decree-Law n. 88/2006 of May the 23<sup>rd</sup>. This decision is taken, from an

objective point of view, mainly based on the analysis of the students' curriculum. The possibility of equivalences is one important point to motivate the best students to pursue their studies in the University.

In the scholar 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. That 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, related with mechanics, electronics, informatics, automation and industrial robotics – have more facility to understand some aspects and concepts related with the domain of Mechanical Engineering, when explained to them by the first time, and when compared with the other students that have not this basic background. It must not be forgotten that this students, despite having a basic background on several technological fields, are performing students too (they were the best of the TSC on Industrial Maintenance) and they can be an added value for the respective industrial units, after their graduation.

## VI. THE ROLE OF UNIVERSITY IN THE POST-SECONDARY (NON SUPERIOR) LEVEL TEACHING

The model so far presented is still in its earlier implementation days. Concerning the particular 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. Also it may be important to widen the look to the entire educational system, with particular emphasis in the developing technological subset that nowadays is growing under the umbrella and support of ministries other than the Education Ministry, like the Ministry of Labor or the Social Affairs, alongside with the conventional educational system, ruled by the Education Ministry.

In despite of the equal opportunities rhetoric of the late seventies that lead to technical formation disaster in Portugal, the technical courses made their way simple because they are a basic need in a developed society.

The experience reported above is only one case in the Portuguese reality nowadays. Different social and technical environmental realities must certainly be encompassed by different solutions, and the risk of wrong decisions is also diminished by the diversified offer that can be designed this way.

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 to foster development, in particular in technical issues. Any discussion about technology, at any level, should involve the main actors in the country, either from the side of the end users of the skills (the companies), from the producers of knowledge (Universities and Polytechnic Schools) and also from the providers of trainees and ultimate beneficiaries of the system (the society).

According to IQF, (Institute for Quality in Formation) this learning model must be structured in a group of phases, processes and support instruments from the conception of programs, courses and pedagogic solutions, that can be explored and used in different ways, that is, 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 Pedagogic Coordination of the courses that contacts and selects the housing companies, usually interested in the technicians under formation given is a guarantee not only to employment, but also to adequate choice of qualifications to be acquired.

The diploma obtained in the technical courses engaging the possibility of accessing Higher Education Studies, granted by written agreements between the institutions involved, allows an alternative via to access higher level. This alternative may lead in future to a more equilibrated choice at the lower levels, by defusing the anguish of a precocious decision.

As a potential receiver of the trainees that may want to proceed studying and taking in account that some formation credits acquired in the Technological Courses may be considered for prosecution purposes, the University must be involved in the actual design of the courses.

However limited nowadays, the number of student 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 Piña 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 formative process, contributing to the promotion of their global success.

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

In this context, Parry [12] referred that a formation activity performed well happened when “the right trainees (taking in account the process of selection made) develop the knowledge, the competences and the necessary attitudes (contents of the formation), through means, strategies and appropriate teachers

(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, 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 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 also a sustainable development of the Portuguese society (either at the level of the companies by the availability of more specialized technicians, or by the fact that some of them may access higher education, that, otherwise, would not be possible).

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 Courses, in order to assure the technical quality of the formative proposal, its coherence and robustness.

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