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The Study on The Expansion Project of Industrial Automation Technologies Departments in Anatolian Technical/Vocational High Schools and Establishment of Teachers' Training Center In Turkey

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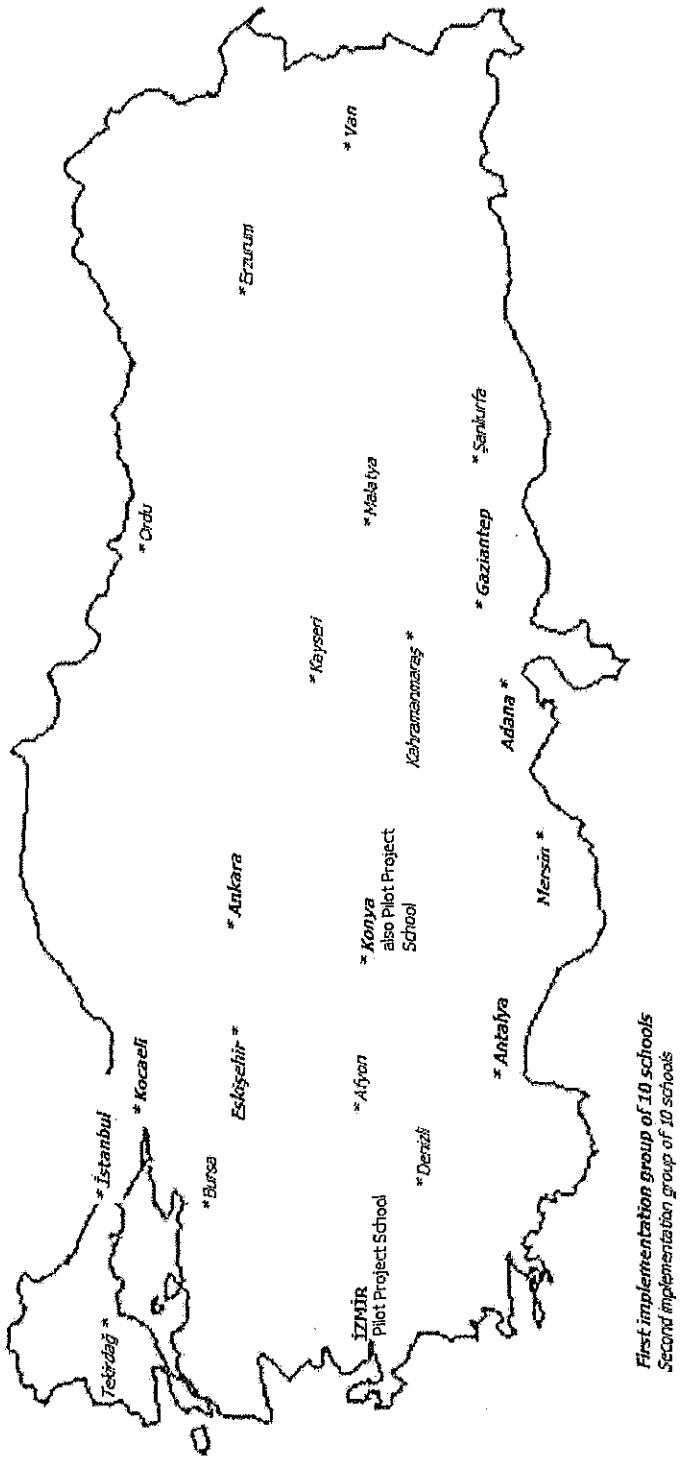
PROVINCES WITHIN EXPANSION PROJECT



ABBREVIATIONS

MoNE	Ministry of National Education
JICA	Japan International Cooperation Agency
VET	Vocational and Technical Education
SVET	Strengthening of Vocational and Technical Education
AML	Anatolian Vocational High School
DBTE	Directorate of Boys' Technical Education
EML	Industrial Vocational High School
ATL	Anatolian Technical High School
TL	Technical High School
MESS	Metal Goods Manufacturers Syndicate
SC	*Steering Committee*
TTC	Teacher Training Center
EU	European Union
KOSGEB	Small and Medium Industry Development Organization
PLC	Programmable Logic Controller
CNC	Computer Numerical Control
PIC	Peripheral Interface Controller
PLD	Programmable Logical Device
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
FA	Factory Automation
IE	Information Electronics
IM	Information Machinery

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1 Introduction

1.1 Background and Overview

The Government of Turkey has been trying to improve the vocational education and training system for years to increase the quality of workforce and to widen the employment opportunities in all sectors of the economy. This effort is particularly relevant regarding Turkey's competitiveness among leading economies of the world and accession to the European Union. Already there are some projects going on within the Turkish mid-level vocational and technical education system, like Strengthening of the Vocational and Technical Education (SVET) Project, as explained in further detail under Section 3.

A vast majority of the population in Turkey comprises of young people, with limited employment opportunities. According to the State Institute of Statistics, unemployment rate for young people (15-24) is 18.2 % (19.7 % in 2004) in general, and 23.2 % at urban areas, where the general unemployment rate is 9.4 % (10.3 % in 2004) and non-agriculture unemployment is 12.9 % (14.7 % in 2004)(1). As can be seen from the figures, Turkey suffers from high rate of unemployment particularly among the young population.

Global competition requires a high quality Vocational Education and Training (VET) system in Turkey. As one of the twenty largest economies in the world and an accession country to the European Union, Turkey has to go through a number of radical changes in the VET system. Most importantly, these changes must address all the fundamental needs from analyzing labor market demands to producing regional and international qualified labor force.

Due to the recent remarkable and steady development and progress of Turkish Industries, it seems to have become a key point for almost all industries how to procure the mid level technical human resources of good quality, and of well flexible capability, in order to achieve further development and progress. This kind of technical human resource demand, which has arisen from every region through the country, as well as from every industrial sector, may be much stronger than has ever been expected. In other words, a key of Turkish industrial progress must depend upon smooth and urgent provision of the high quality mid level technical human resources.

1.2 Ongoing Pilot Project

Given the situation mentioned above, the Ministry of National Education (MoNE) has been expending various efforts to overcome these issues. The pilot project mentioned here may be considered as the starting point of one of the highly effective measures for the eventual solution. This is a pilot project, which has been jointly organized by the two governments, Turkish and Japanese, on the basis of a technical collaboration scheme, since April 2001.

The Government of Japan provides technology transfer to developing countries under a technical cooperation framework through Japan International Cooperation Agency (JICA). JICA has been providing technology transfer to the Government of Turkey for over 40 years under different schemes, one of which is called Technical Cooperation Projects. A Technical Cooperation Project, which normally lasts for 4 to 5 years, consists of dispatching of short and long term Japanese experts, donation of necessary equipment utilized through the implementation of the project, and training of Turkish counterparts in Japan.

One of the ongoing Technical Cooperation projects is titled "The Project on the Establishment of Industrial Automation Technologies Departments in Anatolian Technical High Schools". The project, which has started on April 16, 2001 for a 5 – year period, is being implemented jointly with the General Directorate of Boys' Technical Education at two Anatolian Technical High Schools; Mazhar Zorlu Anatolian Technical High School of İzmir and Adil Karaağaç Anatolian Technical High School of Konya. The ultimate goal of the project is to fulfill the demand of the industry for mid-level technicians in industrial automation technology area by establishing Information Electronics and Information Machinery courses in the Industrial Automation Technologies Departments of Anatolian Technical High Schools. Judging from the curriculum and the graduate profile, it can be readily said that this scheme shall also be catering for the needs of the Service sector, especially for after sales departments of the automotive and durable goods. The project mentioned above is the pilot implementation for the general application in more schools throughout Turkey.

Purpose of the pilot project was to establish and run the Industrial Automation Technology Department which is composed of two sub-departments (Information Electronics and Information Machinery) at the two schools, one is İzmir Mazhar Zorlu Anatolian Technical High School and the other is Konya Adil Karaağaç Anatolian Technical High School (Information Electronics sub-department only), which has been implemented by MoNE and Japan International Cooperation Agency (JICA) since April 2001.

According to the initial curriculum of the departments of the pilot project, high and wide range technical industrial knowledge and practice are given to a student with the newest and the highest vocational education method, as the Anatolian Technical High School education system in the field of industrial automation technology.

Within the Pilot Project, five laboratories that were mandatory to satisfy the curriculum are set up and furnished with required machinery, equipment and test sets in Mazhar Zorlu Anatolian Technical High School.

Purpose of the education system is to produce good quality mid level technical human resources with flexible and talented capabilities. The technology of Industrial Automation is considered to be common over almost all industries. Therefore, it is believed that any type of industry may and will accept the graduates. In this context, we could define the department by the pilot project may be able to give flexible technology education on a high level and with a high quality.

First students were admitted in the two schools in the 2001-2002 academic year. Both schools have been accepting students since then. At the present, the first admitted students are in their last year, to be graduated by June 2006. 30 students are admitted to each sub department, therefore 60 students are admitted to Mazhar Zorlu Anatolian Technical High School (Information Electronics and Information Machinery Sub Departments) and 30 were admitted to Adil Karaağaç Anatolian Technical High School (Information Electronics). The students have got favorable responses during their summer practice trainings, which was another point in favor of the dissemination of the pilot project (please refer to Section 3).

1.3 Developments in the Area

Consequently, in the light of the experience gathered through the Pilot Project and its results,

- The MoNE has decided to extend the ongoing application to 20 more schools throughout Turkey (20 including Konya Adil Karaağaç Anatolian Technical High school).
- MoNE is planning to implement the expansion in 2 phases, by accepting students to an initial group of 10 schools and then including a further 10 schools in the scheme.
- The initial 10 schools have already admitted students, along with the pilot projects schools in the period 2005-2006.
- As there will be an obvious need for new and qualified teachers in these new departments, MoNE has already started the construction of a Teacher Training Center, of which building is estimated to be finished by July 2006.
- The schools' names have been decided upon by MoNE, as shown in Table 1.

Name of the School	Province
Merkez ATL EML	Adana
Gazi ATL AML TL EML	Afyonkarahisar
İskitler ATL AML EML	Ankara
Merkez ATL AML TL EML	Antalya
Ali Osman Sönmez ATL AML EML	Bursa
Şehit Öğretmen Yusuf Batur ATL AML EML	Denizli
Atatürk ATL AML EML	Erzurum
Atatürk ATL AML EML	Eskişehir
M. Rüştü Uzel ATL AML EML	Gaziantep
Tarsus ATL AML EML	Mersin (İçel)
Pendik ATL AML EML	İstanbul
Merkez ATL AML EML	Kahramanmaraş
Hürriyet ATL EML	Kayseri
Gebze ATL AML EML	Kocaeli
Selçuklu Adil Karaağaç ATL AML	Konya
Yunus Emre AML EML	Malatya
Merkez ATL AML EML	Ordu
Merkez ATL AML EML	Şanlıurfa
Çorlu M. Rüştü Uzel ATL AML EML	Tekirdağ
Merkez ATL EML	Van

Table 1. Nominated schools for expansion in Provinces

The name of this project is "Expansion of Industrial Automation Technology Departments to 20 Schools and the Establishment of a Teacher Training Center". The purpose of this project is to supply high grade mid level technical human resources educated in the industrial

automation area, through dissemination of the ongoing pilot project to 20 more schools throughout Turkey.

Considering all of the above, and following the decision for expansion, MoNE, on behalf of Turkish Government, requested from the Government of Japan further technical support. JICA has decided to conduct a technical survey to confirm the relevance of the expansion project proposed by MoNE, and has prepared the Tender to invite local consultants for the technical survey, in February 2005.

This study aims to research the justifiability of expansion, to estimate the need for these graduates and to lay out elements of the Expansion Project of Industrial Automation Technologies Department in 20 schools and Establishment of a Teacher Training Center for this purpose. Consequently, the Bidding for the project was finalized and a contract was signed in November 2005.

The MoNE strongly believes that the success of the 20 school expansion project is mainly related to a excellent and well functioning training system for the teaching staff of the industrial automation technology department. Therefore the function of the Teacher Training Center will be playing a key role for the 20 school expansion project.

In the period between the initiation and the end of this study, collaboration projects are accelerated between industrial companies an MoNE: A protocol with Mercedes – Benz Aksaray Truck Factory was signed, with the intention of getting support from the company in setting up laboratories, preparation of textbooks, training staff, monitoring and evaluating the curricula, supplying technical equipment and materials and training facilities in the company premises. Another protocol is signed to provide internal training to gas technologies and machinery teachers in the vocational and technical schools within the Directorate of Boys' Technical Education (DBTE), with Eczacıbaşı- Lincoln Electric Welding Technology Co. A third protocol is in effect, to prepare the workforce of Gedore – Altaş Hand Tools Co. for the new technologies, by DBTE. These, and further planned relations are also indications of the MoNE's strong commitment for the development and reforming of Vocational and Technical education.

2 Objectives and Methodology

2.1 Objectives of the Study

Objectives of this study are:

- To justify the feasibility of the 20 school expansion project and the Teacher training Center (TTC).
- To clarify major equipment for each laboratory and their major functions, as well as major practice items in each laboratory.
- To estimate the necessary amount for the 20 school expansion project as well as the teacher training system.

2.2 Methodology of the Study

2.2.1 Principles

To achieve the objectives and targets, all endeavors are be based on key guiding principles:

a. *Principle 1: Coordination and cooperation among the related parties*

Attaining coordination and cooperation among the key stakeholders to achieve the targeted objectives is vital. In order to ensure and facilitate communication and coordination among the related parties, a committee has been formed, where the representatives from MoNE, JICA, and related stakeholders participate in study related activities. This forum plays an important role in order to ensure involvement and contributions to this study.

b. *Principle 2: Identify Local/Regional/National needs*

Identification of the local/regional needs is essential for the decision on the study of expansion of the industrial automation technology departments to the 20 technical /vocational high schools throughout the country. Local/regional as well as national needs in this regard are identified in close cooperation with related stakeholders from the selected regions.

It must also be noted that even in cases where the establishment of a Industrial Automation Technology Department cannot be justified in one province, as a result of underdeveloped industries in the region, the total national need for the graduates in the scheme may and can offset this situation. Therefore local needs only should not be the deciding factor in the implementation, not only because of the conditions mentioned above, but also because the existence of such graduates might and will encourage industrial investments around the area. Similarly, technical human resource demands of neighboring provinces are also to be taken into consideration.

c. *Principle 3: Industry-School Dialogue and Demand Driven Approach*

There is a gap between industry and VET schools regarding vocational and technical education in Turkey. This is one of the most common problems observed in many VET Systems around the world. There are various efforts in order to fill in this gap between industry and VET schools. A strong and stable dialogue between industry and VET schools is playing an important role regarding quality and relevancy of training delivery. In order to ensure such a dialogue, at the first stage industry representatives are contacted, accompanied by school directors, where the local/regional needs are identified for the industrial automation technology departments within the VET schools in selected provinces. This dialogue will increase the quality and relevancy of training program of the departments that will be established after the study. As a consequence of this dialogue the schools will be able to meet industry requirement of labor force more satisfactorily, increasing the chances of finding jobs.

d. *Principle 4: Training Skilled Workers for the High-Tech Era*

Nowadays any country has realized that human resource is the most essential factor for building the nation so that many are making tremendous efforts to develop capable skilled workers, namely technicians. In the borderless society, there is a need for global view on technical education and training, and high mobility among the skilled workers with global standard for VET. For the high-tech era, technicians must have a grasp of specific technology based on broad basic technical knowledge. Along with the technical advancements, technicians must update their technical capacity to fulfill the tasks required by industry. One of the main objectives of the Ministry of National Education is to meet labor market requirement of skilled workers. It is understood that the expansion project will support this basic national objective of MoNE to train skilled workers for high-tech era. This study will be in line with this policy. Therefore, we conduct a Need Analysis in order to identify human resource demand of industry in present and as well as a forecast for future.

e. *Principle 5: Ensure Sustainability*

Sustainability is one of the key factors of the success of any work. Sustainability depends on the degree of institutional capacity, meeting local demands and active involvement of the related parties. This fact is taken into consideration when making recommendations.

2.2.2 Needs of Industry, Areas of Need

Having said that, the results of the field survey "Qualified Manpower Needs of MESS Members" made by the Turkish Metal Goods Manufacturers Syndicate (MESS) are also worth mentioning (2). MESS is a leading and important group of manufacturers in Turkey and represents the following industries, with 300 members and 120,000 employees:

Motor Vehicle and Trailer Production
Main Metal Industry

Metal Article Industry
Machinery and Goods Production
Office and Data Processing Machinery Production
Electrical Articles Production
Radio, Television and Communication Equipment Production
Medical, Precision Optical Equipment and Clock Production
Furniture Production.

This survey has been conducted in 2004, covers 119 companies with total 68,348 employees in 23 provinces.
The provinces surveyed are:

İstanbul, Bolu, Düzce, Edirne, Kırklareli, Kocaeli, Sakarya, Tekirdağ
Ankara, Adana, Aksaray, Hatay, Mersin, Kırşehir, Konya, Samsun, Sivas, Zonguldak
Bursa, Bilecik, Eskişehir
İzmir, Manisa.

These are the industrialized regions of Turkey, with high concentrations of factories. MESS members, on the other hand, are the top industrialists of the country with technological facilities that can be rated form high to medium.

In the survey, the following issues are examined:

- Education level of blue collar workforce
- Any encountered lack of training and/or competence
- Fields and professions where lack of competence is identified
- Activities to overcome this problem
- Proposals for solution.

According to the compiled results, in the 77.30 % of the companies surveyed, observed low competency levels are concentrated in the following areas: Working with computerized and NC/CNC equipment, CAD/CAM knowledge, electrics – electronics knowledge, electronic material knowledge, basic principles of machinery operation, mathematics, measuring devices and measurement, insufficiencies in applications where special information is a requirement, pneumatics and hydraulics, technical drawing and interpretation, information on technological advancements.

The professions where lack of competency is observed are electric panel assembly, electro mechanics, electrician work, electronics, technical drawing, mechatronics, metal die manufacturing, modeling, NC/CNC operation, automatic control, industrial maintenance, assembly line operation, automotive maintenance and repair, plastic molding, press operations, manufacturing line operations.

As will be seen readily, more than half of the issues addressed here are directly involved with the items of Industrial Automation. Therefore involvement of mid level technical education with high technology is definitely required.

Using the same survey, we can quantify the recommendations to satisfy the demand for the specified manpower:

Recommendation	Percentage
Establishing common training facilities in provinces	74.80 %
Adapting the Vocational Education curriculum to satisfy the needs of the industry	73.10 %
Increasing the dialogue between industry and educational facilities	68.90 %
Job standards should be defined and harmonized with educational standards	69.90 %
Development of programs to arrange the training of apprentices and training students	64.70 %
Restructuring the Vocational Education system, in line with regional demands	60.50 %
Knowledge and competency level of teachers and trainers should be kept up to date applying lifetime education and training.	58.00 %

Table 2. MESS survey results – Recommendations for satisfying blue collar manpower demand in Turkey

As a result of this survey, MESS has prepared and implemented a training program to cater for the needs of their members, on the subjects where a lack of competency is observed as determined above. Details of this training program are given in Appendix 1.

2.2.3 Inception Phase

→ Preparation of Inception Report
→ Study Launch (kick off meeting)
→ Introduction of the team
→ Establishment of the Steering Committee
→ Presentation of Inception Report to the SC
→ Get Comments on the Inception Report.

2.2.4 Need Analysis

2.2.4.1 Need Analysis

→ Prepare Instruments for Need Analysis
→ Contact Schools in Provinces
    → Contact Chambers of Commerce in Provinces
    → Collect other information and data
→ Collect results
→ Analyze results
→ Prepare Need Analysis Report

2.2.4.2 Survey Detail

→ MoNE sends letter of introduction to School in the Province
→Survey staff follows up with e-mail, briefing the School
→School responds
→Schools explains the Expansion Project to the Chamber of Industry
→Survey staff sends the survey forms to the Chamber of Industry to be sent to members

→Survey staff or Chamber of Industry sends the survey forms to the members
→Results are collected and analyzed

2.2.5 Analysis of Training Materials

→Examination of training materials
→Identify comments and revisions on the training materials
→Prepare a draft on the recommendations
→Discuss the findings with JICA and MoNE
→Revise the draft as necessary

2.2.6 Role of Teacher Training Center

→Analyze training needs of teachers
→Define role of TTC
→Define the equipment level of TTC
→Draft a working and staffing plan for TTC
→Discuss the Plan with MoNE and JICA
→Revise the plan as necessary

2.2.7 Major Practice Items and Laboratory Equipment

→Analyze the previous work done by the schools in the Pilot Project
→Analyze the procurement lists
→Interview teachers
→Determine laboratory activities
→Prepare Equipment Lists
→Discuss the lists with teachers and JICA experts
→Revise the lists as necessary

2.2.8 Preparing Implementation Schedule for the Project/Cost Estimation

→Analyze previous works in other phases
→Define jobs/ processes to be implemented
→Define cross links and relationships between processes
→Estimate costs of jobs/processes
→Prepare implementation schedule
→Determine bottlenecks
→Discuss implementation schedule with MoNE/JICA
→Revise implementation schedule as necessary

2.2.9 Preparation of Study Report Including Planning and Recommendations

→Compile all findings
→Analyze all documents and findings
→Prepare Draft Final report

→Receive the recommendations and comments from the SC
→Revise Draft Final Report as necessary.

2.2.10 Scope of Works

In accordance with the study objectives mentioned above, the scope of work for the study is itemized as follows, as laid out in the Terms of Reference for the Study:

2.2.10.1 Fundamental plan of 20 schools expansion project and the TTC program: It is important to collect and analyze relevant data and policies issued by the governmental organizations and industrial sectors. In particular, analysis and recommendation of industrial human resource demand in present and in the future, concerning mid level technical fields is required. This is to be accomplished through a field survey and incorporating existing data. Then justification to introduce the industrial automation technology department over the country is also stressed. The analysis of human resource demand will be on regional and national level. The ministerial decisions to cope with these issues is also important.

2.2.10.2 Plan of Teacher Training Program: The Study for human resource development (teachers training) is also required. Teacher allocation plan for the expansion project, curricula development for teacher training, textbook preparation, utilization of TTC for teacher training is to be addressed.

2.2.10.3 Role of TTC in Vocational Education, centering on education performance in 20 schools: In the expansion project, TTC is expected to play an important role. It will not only be used for teachers' training, but also to increase the teaching quality of teachers in schools, as well as supervising the textbooks and curriculum maintenance for updating.

2.2.10.4 Development and modification of the curricula and textbooks for 20 schools: The curricula and textbooks for the 20 schools and TTC are to be based on the current JICA pilot project.

2.2.10.5 General Implementation Schedule for the plan: The general implementation schedule is to be recommended. The schedule mainly consists of two parts, one is the implementation schedule of the 20 school expansion, the other is the training schedule at the TTC, as well as development schedule of textbooks and curriculum. Well coordination between these two is a key point.

2.2.10.6 Financial estimation of each project implementation process: Estimation of the necessary amount to finance the implementation of 20 school expansion as well as TTC is required. Therefore major items for the financing of the project are 1) procurement of laboratory equipment, 2) development of textbooks for schools and TTC, and development of training program and curriculum for TTC, 3) necessary consultancy fees for implementation supervision of the project and engineering fees.

2.2.10.7 Outlining of major laboratory equipment and practice items: Recommendations will be made for each laboratory' function and major practice items.

2.2.10.8 *Planning and recommendations:* *According to the results of the works* above, a fundamental plan and recommendations for the 20 school expansion project and TTC training program are to be generated.

3 Fundamental Plan of 20 School Expansion Project and TTC Training Program

3.1 Vocational Education System

In general, the Ministry of National Education (MoNE) is responsible for governing the educational system in Turkey. MoNE develops national policies at the central level; Provincial Departments of Education monitor regional practices; and schools run local activities.

Objective, basis, structure and organization of Turkish National Education are determined by the National Education Basic Law numbered 1739 enacted in 1973. In line with this Law, the education system is divided into formal and non-formal education.
Turkey's overall policy is to increase participation rate in Vocational and Technical education (VET), particularly on the secondary level. Almost all the governments have emphasized the importance of vocational education in their programs during the last forty years.

Vocational education is under four directorates of MoNE. These are:

- Directorate of Boys' Technical Education
- Directorate of Girls' Technical Education
- Directorate of Tourism and Commerce Education
- Directorate of Apprenticeship and Widespread Education.

Law number 3308 for many years has guided the Turkish vocational and technical education system. Recently, the legislation for the VET system has been changed. Law No. 4702 allowed graduates of vocational and technical high schools to enter post-secondary vocational schools without entrance examination, improved the structure and functioning of provincial boards of vocational education, opened the apprenticeship program to everyone above the age of 15, and devoted a special taxation fund, which was established previously for compulsory education, also to secondary education until the year 2010.

VET services in Turkey are provided both by formal and informal institutions. Formal institutions, in the form of Vocational and Technical High Schools, offer four-year degree programs to graduate students as skilled workers and technicians, respectively. With a decision taken by the MoNE on 7 June 2005, the duration of education in all general high schools and vocational/technical high schools was determined to be 4 years. At the end of Grade IX, students are free to choose between the introduced vocational area and continue their education in that field.

In Turkey, there are 4 types of mid-level schools for VET, differing in curricula and in the relative weight of foreign languages taught. These are Industrial Vocational High Schools, Technical High Schools, Anatolian Technical High Schools and Anatolian Vocational High Schools.

Anatolian Vocational and Technical High Schools' curriculum contains relatively more foreign language hours per week. The departments in these schools, with curricula close to those of Industrial Automation sub departments are:

Department/School	Industrial Vocational (EML)	Technical (TL)	Anatolian Technical (ATL)	Anatolian Vocational (AML)
Computers (hardware)	x	x	x	x
Computers (software)	x	x	x	x
CNC	x	x	x	x
Computer Aided Industrial Modeling (*Wood and Metal sub* departments)	x			
Electrics	x	x	x	x
Electronics	x	x	x	x
Hydraulics/pneumatics	x	x	x	x
Plastics working	x			
Plastics Technology	x			x
Telecommunications	x	x	x	x
Industrial Electronics	x	x	x	x
Control and Instrumentation Tech.	x	x	x	x
Machinery	x	x	x	x
Microtechniques	x	x	x	x
Medical Electronics	x	x	x	x
Machinery - Modeling		x		
Automatic Command			x	x

Table 3. Current Departments in Vocational and Technical High Schools, with curricula closest to Industrial Automation Department.

These departments mostly share common subjects and currently have the same number of hours of vocational subjects in the curricula, however, the content of vocational subjects and the number of practice hours are not adequate to keep up with the developing needs of the industry. Now under the SVET scheme, a modular approach is being adopted and these modular textbooks are to be prepared to cater for industry's needs.

The total duration of education in Anatolian Technical and Vocational High Schools, in which the expansion project will be implemented, used to be 1 (preparatory class) + 4 years, before the recent developments. At present it is 4 years, without a preparatory year. This decision is put into implementation in the 2005-2006 academic year and will only cover those starting in this academic year and onwards. By this application the MoNE is planning to spread foreign language teaching primarily to other grades.

As a result of the abovementioned changes, teaching hours of field courses have been significantly reduced at Anatolian Technical High Schools. It might be said that this reduction of time will negatively affect the training delivery process of occupational skills. In order to minimize these negative effects on vocational training, more efficient teaching-learning methods should be used, the curricula shall have to be revised and effective practical training should be done in companies during summer practice periods. With the latest arrangements, there are various vocational and technical educational applications for different age groups. Widespread education is mainly for apprentices. A drawback of the old

vocational education system was most of the graduates would opt for university education, because of low employability, therefore leaving a gap in the mid-level labor force.

It has been seen that Ministry of National Education (MoNE) is making serious efforts to strengthen education concerning advanced technology issues in the recent years. As well as establishing new departments such as industrial automation and mechatronics; workrooms and laboratories of some other departments (electrics, electronics, and mechanics) were equipped with PLCs, hydraulic and pneumatic training kits and sets. In this context, strengthening and dissemination of MoNE's industrial automation departments strategy should be assessed as a part of its objective of developing the education concerning advanced technology. SVET project is also an important part of the MoNE's approach.

Turkey has been taking great steps toward harmonization with European Union through EU funded projects and technical infrastructural developments especially after 17 December 2004. Establishing the Vocational and Educational Standards, which is an important step towards strengthening of vocational and technical education, along with the establishment of National Qualification System, where certification and accreditation shall be coordinated nationwide, are the milestones during these steps.

SVET is a five-year project resulting from an agreement signed between the European Commission and the Government of Turkey, and has a total budget of € 58.2M. The project aims at strengthening Turkey 's VET system rather than imposing an alien structure. Turkey 's international trade, its political ambitions for joining the EU, and its promotion of domestic and international investments give the project an urgent international dimension. This also implies that Turkey has to harness all its economic resources, and also that a degree of decentralization is inevitable since much of its industrial and economic activities are regionally based. SVET supports strengthening of vocational education, increasing the dialogue between social stakeholders, reforming the education system inline with lifetime education principles through developing modular education and meeting the needs of the business world with educational conditions.

Any effective vocational education and training system depends on its congruence with the dynamic forces of the labor market and its respect for the culture it serves. The dynamics of the labor market depends on the needs of industry and commerce (the demand side, often – but by no means always – definable at a more centralized level) and the availability of trained individuals (the supply side, definable at a more local level) to meet them in their current form and adapt to them in their future form.

The project finds itself at the centre of a debate about the relationship (actual and desired) between labor and education; of another debate about central, provincial and local responsibilities; and of a third debate about the likely career path of VET graduates.

The project staff has conducted workshops and studies and held interviews and meetings in a determined effort to gather and understand as much relevant information as they could. The final decisions will have to be taken by the Turkish decision-makers. However, the project staff are going to provide access for the decision-makers to current international VET activities and recent decentralization experiences.

The final outcome of the project should be a strong VET system supported by a National Qualification System with national and international credibility.

Turkey has officially participated in the Socrates (general education), Leonardo Da Vinci (vocational) and Youth programs of EU since April 2004. Leonardo Da Vinci is also aimed to increase the quality and effect of vocational education. It has a budget of €1,150,000. This project is for the people who have received vocational education, students, trainers, new graduates and young workers. Modernization of Vocational and Technical Education Project is also under way, within the financial support schemes of EU accession process.

It should also be emphasized that 23 of 50 courses planned by General Directorate of Boys' Technical Education were on the advanced technology issues for the year 2005.

In the 2004-2005 academic year, 28.174 students have received education from Anatolian Technical High Schools and 328 of them are industrial automation department students.

3.2 Government Policies

The Mid Range Program for 2006 – 2008 (3) directly reflects the Turkish Government's latest policies relevant to vocational education, among other issues. In the Program, targets, policies and priorities are announced for the said period. Main aspects relevant to subject are:

- Development of Human Resources is one of the Main Targets under Section I.
- Under Section III, Subsection A, Development of Human Resources and Increasing Employability:
    - To increase the quality of education, curricula will be updated to promote innovation and research.
    - In vocational education, transition activities for a modular and flexible system to cater for the needs of the job market shall be accelerated.
    - To be able to supply the qualified manpower needed by the business world, mechanisms shall be established to strengthen the cooperation between education system and the labor market.
    - Collaboration shall be established between vocational and technical high schools and vocational colleges, on the basis of program unification; education shall be provided in cooperation with the industry.
    - Using widespread education, human resource supply in the area of Information Technologies shall be supported, to ensure employment of the young.
    - Necessary arrangements shall be made to have a more flexible workforce.
- Subsection D, Minimizing Developmental Differences Between Provinces:
    - Through labor force analyses in suitable regions, employability shall be increased through applications where labor force quality is increased and entrepreneurship is supported, consistent with human resource demand and Small and Mid Level Businesses strategy.
- Section IV, Sectoral Policies, subsection A, Education:
    - Curricula shall be modified to increase the quality of first- and mid- level education, based on innovativeness, research, teamwork, original and entrepreneur thinking.
    - In the mid- level education, a structure change shall be provided based on program diversification, instead of school diversification.
    - Application of Information Technologies in education shall be widespread.
    - In house education and training for the teachers, necessitated by the reorganization of education system has the highest priority.

- Physical area, teacher and equipment needs at all levels shall be fulfilled, minimizing the differences between provinces.

3.3 Need Analysis

Objective of the study is to justify the 20- school expansion through a need analysis, and consequently, to determine the need for the establishment of Teacher Training Center. To achieve the justification of dissemination of schools to 20 provinces, the following instruments are used:

- A field Survey; encompassing mail surveys and interviews with schools and with Chambers of Industry.
- Obtaining data and recommendations from high – tech companies such as automotive factories,
- Analyzing secondary data obtained through previous surveys.

The need analysis for establishment of the Teacher Training Center is explained under Section 4, Plan of Teacher Training Program.

To carry out the field survey, the provinces where the 20 schools are located were divided into four groups and to visits were to be paid to one province in each group, whichever represents the characteristics of the region suitably. These regions were Istanbul/Kocaeli (Marmara), Eskişehir/Ankara/ Konya (Mid Anatolia), Adana/Antalya (Mediterranean) and Gaziantep/Urfa (southeast Anatolia). Provinces that were not going to be visited were planned to be contacted and surveyed by e-mail.

To establish the HR demand, two Survey Forms and an Interview Questionnaire are prepared. The Survey Forms contain a cover letter, briefly explaining the background of the project, government policies in this area and the graduate profile, including the curricula of the departments. Including the curricula has been necessary, because the concept of Industrial Automation Department is rather new. Although Vocational and Technical high schools with similar departments but somewhat lower curriculum have been existent in Turkey (Vocational Education System), the quality of the graduates could not keep up with the requirements of the developing technology and this has been observed by the industry in the employee profile. Therefore explanation of the graduate profile and the jobs they could undertake, in local industrial terms, was considered to be a necessity.

The first Survey Form is intended to have a company's present and future needs for the graduate profile of the Industrial Automation Departments (Appendix 2), and the second form (Appendix 3) is aimed to obtain the same data and estimations from the Chamber of Industry, in general terms for their member companies, through incorporating the Chamber's information on the general position of the companies in the area, investment policies, regional advantages and drawbacks and technological advancement level of the local industries. The forms were checked by MoNE and approved for use.

The questionnaire (Appendix 4) is used to get in–depth information and opinions from the school and the Chamber of Industry. The school part of the questionnaire is intended to collect information on:

- Physical situation of the school,
- School's level of information on the expansion project,
- Availability of space,

- School's relations with the industry,
- Position and aspirations of graduates after finishing school.

On the other hand, the questionnaire would provide information on the following, from Chamber of Industry:

- The Chamber's level of information on the Industrial Automation Departments project,
- Their perception on the expected contribution of the Project on the industry,
- Chances of future employment of the graduates,
- Possibility of arranging long term summer practice training,
- Possibility of forwarding the Survey Forms to their members.

In the beginning of the activities, MoNE has sent a briefing letter to the concerned schools, explaining the Study, its objectives and the role of the consultant, with the intention of collecting data and information from the industrial companies. This letter was immediately succeeded by another letter from the consultant's Study team to the schools, again briefing the school, and requesting information on:

- Physical situation of the school,
- School's level of information on the expansion project,
- Availability of space,
- School's relations with the industry,
- Position and aspirations of graduates after finishing school.

Survey Forms for the Chambers and member companies were also included for information. Then telephone contacts were established to follow up. After establishing contacts, the Survey forms were sent to Chambers.

The provinces to be visited were selected according to the size of their industries, having more or less representative characteristics of the area they are situated in, and on the responses obtained by previous contacts. These provinces are İstanbul, Ankara, Gaziantep and Antalya.

As the survey progressed, it became apparent that e-mail surveys would not provide sufficient data for justification, other means to assess the human resource demand had to be implemented. This supporting work is based on a recent survey by Small and Medium Industry Development Organization (KOSGEB).

As an additional resource, automotive companies were contacted separately, to have the Survey Forms for Companies filled, and to get their opinions on the whole project. Results of these works are represented under Field Study Results.

3.4 Industry's Needs – A General View

To have a global view of the HR need in the provinces, we refer to the results of the current KOSGEB survey (4). In 17 of the 20 provinces where the expansion is planned, there are 28,839 small to mid- size companies, with approximately 580,000 employees. 39.48 % of these companies use computers in production or research and development, 22.88 % have PLCs, CNCs, robots or any combination of the three and 27.40 % have computer networks. Considering that 50 % of these companies are planning expansion in production, with a

simple calculation, at least 14,000 companies will be investing in machinery and roughly 30,000 extra jobs will be available in the coming years.

As a footnote, we should add that the graduates of Industrial Automation departments can and will be employed in the service sector as well. Home electronics and computers with internet connections are being increasingly popular and sophisticated and there is a need for servicing these. After sales service centers of white goods and vehicle manufacturers, hospitals, hotels, call centers and telecommunications are some examples where these graduates will be employed.

3.5 Field Study Results

In the field study, it was planned that 4 provinces representing the regions should be visited, interviewing Chambers of Industry to obtain the human resource demand for the graduates of Industrial Automation Departments. Demands for other regions were to be determined through an e-mail survey.

In effect, 7 provincial schools and Chambers of Industry are visited, of which 6 are within the scope of this study. Aegean Chamber of Industry was visited because this is the only regional Chamber, covering 4 provinces. Therefore it was planned to make an investigation of the data that Chambers of Industry might have.

During the survey, communication difficulties were encountered with some provinces. Consequently there was no response from 5 of the 20 school areas. Therefore it was not possible to get results from these areas. Furthermore, it is a general observation of this survey that Chambers of Industry do not readily have the human resource information of their members; this is valid especially in bigger and developed provinces, where the contacts between the Chamber and its members are not well established. While there are a number of reasons for this, addressing these reasons is outside of the purposes of this study.

Results of visits:

HR demand results for visited areas are tabulated below:

Province	Present demand	Future demand
İstanbul	no data	no data
Ankara	no data	no data
Gaziantep	no conclusive data	no conclusive data
Antalya	400	800
Denizli	663	939
Malatya	no data	no data
İzmir(Aegean)	no data	no data

Table 4. Human Resource Demand Figures in Visited Provinces

Visited provinces and the interviewed persons are:

Province	School	Chamber of Industry
İstanbul	Hüseyin Topçu, Director, Pendik ATL TL EML	Harika Öztürk, Osman Hazinedar, Istanbul Chamber of Industry General Secretariat
Ankara	Yusuf Göbül, Assistant School Director, İskitler ATL	Oya Görkmen, Ankara Chamber of Industry
Gaziantep	Abdülkadir Kalyenci, School Director, M. Rüştü Uzel ATL AML TL	Kürşat Göncü, Secretary General, Gaziantep Chamber of Industry Yusuf İ. İymen, Assistant Secretary General
Antalya	Hasan Özen, School Director, Merkez ATL AML EML TL M. Emin Emlek, Assistant School Director	İsmail Çetin, Secretary General, Antalya Chamber of Trade and Commerce
Denizli	Kudret Yemişçioğlu, School Director, Şehit Öğretmen Yusuf Batur ATL TL EML Kadir Ateş, Assistant School Director İsmail Doğru, Technical Teacher	Dr. Bülent Uygun, Secretary General, Denizli Chamber of Industry Can Deligöz, Capacity and Expertise Specialist
Malatya	Hüseyin Kaya, School Director, Yunus Emre AML EML	Sait Kabadayı, Secretary General, Malatya Chamber of Industry
İzmir (for reference only)	Satı Çalışkan, School Director, Mazhar Zorlu ATL AML EML	Mustafa Orhon, HR Chief, Aegean Chamber of Industry Başak Öztan, Information Group

Table 5. Interviewed Persons at Visited Provinces

Additional information collected from visited provinces:

İstanbul:

School:

- The school has the space allocated for the departments.
- They are informed on the project.
- Relations with industry is good because the graduate year students are having continuous practice in the industrial companies in the periphery.
- Grauates are working in the industry, but the number of graduates willing to attend college is increasing.

Chamber of Industry:

Main industries in the area: Textiles, Metals, Chemicals, Food.

The Chamber represents 250 of the top 500 companies in Turkey, with a 17 percent employment and 35 percent contribution to gross product within the total industrial production companies.

- The Chamber is informed through the Survey Form only.
- It can be said that the project will contribute to the industry, regarding the fact that the biggest HR need of the industry is in the mid-level technical workers with good education.
- Regarding the results of the Chamber's annual HR demand analyses, it is observed that member companies need staff with industrial automation knowledge.
- Long term summer practice training can be provided.

Ankara:

School:

- The school has the necessary space allocated.
- They are well informed on the project.
- Relations with industry is good because the graduate year students are having continuous practice in the industrial companies in the periphery.
- The school has contacted the chamber of industry on the subject.
- There will be no problems for graduates finding employment.

Chamber of Industry:

Main industries in the area: Transportation and motor vehicles, Electrics, Food, Mining, Petroleum and Chemicals.

- The Chamber is informed on the project.
- They are already conducting trainings on similar subjects therefore there is a need in this field.
- Survey Form for Companies is sent to the members.

Gaziantep:

School:

- The school has the necessary space allocated. Planning is ready.
- They are well informed on the project since March 2004.
- Have very good relations with the Chamber of Industry and with the companies.
- They have also contacted industry and held briefing meetings on the subject.
- Graduates opt to enter Vocational colleges by 15 %, Universities 2 %. Rest are employed directly.
- Total entering college level schools migt be around 10 %, rest will be employed directly.

Chamber of Industry:

Main industries in the area: Textiles, Automotive OEM, Metals, Chemicals, Paper, Food, Electrics/Electronics

- The Chamber has been briefed.
- The Chamber sees the project to be in line with the ongoing development projects.
- Employability will definitely be 100 %.
- Long term summer practice is an item they support.
- Survey forms are sent to members.

Antalya:

School:

- Enough space allocated, laboratories are ready to be furnished.
- School is well informed.
- They have contacted the industry on the subject, have good relations with the companies. Companies see the School as a source for finding technical staff they need.
- Percentage of graduates going to universities is around 30 %.
- This percentage might be 20 % in the case of Industrial Automation graduates.

Chamber of Industry:
Main industries in the area: Food, Textiles, Consumer products. The Chamber is also the Chamber of Commerce.

- Briefed twice on the subject.
- Employment chances are 100 %.
- Long term summer practice can be provided.
- Survey forms are sent.

Denizli:

School:

- Ample space to set up laboratories.
- Well informed on the subject.
- Relations are very good with industry.
- 2 % of the graduates attend university. 90 % might want to attend night courses of colleges.
- The graduates will not opt for college when appropriate job opportunities exist, which will be the case for this project.

Chamber of Industry:
Main industries in the area: Textiles, Mining, Cable.
Highly automated textile industry. Very big exports in textiles and marble.

- Well informed by the school.
- Since automation level of textile and rock cutting industries is increasing in the area, the contribution will be good.
- Summer practices will be readily arranged.
- Survey forms sent.

Malatya:

School:

- School is informed.
- An existing unused area will be allocated for this purpose.
- Industry is birefed on the subject, also telephone contacts are made for the survey.
- Attendance to university is around 2-3 %. No unemployed graduates once they complete the military service.

Chamber of Industry:
Main industries in the area: Food, Paper, Metal goods, Plastics, Textiles.

- Well informed on the pilot project.
- This will be an important contribution, considering the integration of the industry to developing technology.
- No problems with the summer practice trainings.

Therefore in the visited regions:

- All schools are ready for implemantation as far as information an physical area is concerned.
- All schools have established good relationships with the industry and informed the provincial Chamber of Industry on the subject.
- Although the graduates' preferences tend towards attending universities and colleges, thie option will be less favorable considering the quality and direct employability of the graduates.
- The industry representatives believes that this project will greatly contribute towards fulfilling its HR needs.
- Long term summer training can be provided to increase the efficiency of training and for accustomization of students to the industry and vice versa. Since this type of graduates is just being introduced to the industry, this is an important issue.
- Employability will never be a problem.

In addition, HR demand figures of Chambers of Industry that are not visited are:

Province	Present demand	Future demand
Erzurum	660	585
Kayseri	740	348

Table 6. Human Resource Demand Results, Obtained from Provinces not Visited

Automotive companies in Bursa-Kocaeli region are contacted to establish their HR demands and to get recommendations, as automotive is a high-tech employer of Industrial Automation. The companies and the persons contacted are:

Company	Contact
OYAK-Renault	Tunç Başeğmez, Factory Director
Tofaş	Osman Soyoğul, Factory Director
Honda	İsmail Sümer, Assistant General Manager

Table 7. Contacted Persons at Automotive Companies

Recommendations of automotive companies:

Automotive companies need staff familiar with high technology. For this purpose they are having to train the new staff for long periods. Making the summer practice trainings for the students longer will help them to complete the necessary orientation quicker and the promotions/payment levels will be better in shorter times. A foreign language is required. Since some automotive companies have plans for higher technology equipment, there will be a definite need for these graduates. The companies are already planning to contact the pilot schools to find employees. Results of the interviewed automotive factories are:

Company	Present demand	Future demand
OYAK-Renault	1195	326
Tofaş	109	136
Honda Turkey	17	8
Toyota	no info	no info
Total	1321	470

Table 8. Human Resource Demand Figures for Automotive Companies

Therefore, overall quantitative results for field survey:

Province	Survey forms sent (e-mail/fax)	Number of survey forms returned	Chamber of Industry estimate	Estimated demand, present	Estimated demand, future
Afyon	313	1	-		
Ordu	unknown	-	-		
Ankara	2775	3	cannot provide		
İstanbul	n/a	-	cannot provide		
Kayseri	150	9	yes	740	348
Eskişehir	n/a	-	-		
Konya	unknown	-	-		
Adana	n/a	-	-		
Denizli	212	6	yes	663	939
Erzurum	n/a	-	yes	660	585
Antalya	2000	2	yes	400	800
Gaziantep	1500	20	yes	inconclusive	inconclusive
Malatya	n/a	-	cannot provide		
Bursa	n/a	-	-		
Mersin	n/a	-	-		
Tekirdağ	n/a	-	-		
Van	n/a	-	-		
Kocaeli	n/a	-	-		
Şanlıurfa	n/a	-	-		
Kahramanmaraş	n/a	-	-		
İzmir (Aegean)	150	-	cannot provide	-	-

Table 9. Overall Results of Field Survey

In the tables, "present demand" means the hypothetical need for the graduates, if they were available at the present. This figure is only meant to have an idea on the order of requirements of the area. Similarly, "future demand" figures represent the additional requirement of the companies, for these graduates in the next 5 years, and are to be used for the purposes of this study.

Return rate of the survey is quite insufficient to give tangible and meaningful data. Therefore using secondary data has become a necessity. Referring to the same KOSGEB survey data (4), we have numerical information on:

- Machinery park
- Information technology infrastructure
- Use of computers and computerized machinery for production

- Use of computers and computerized machinery in for research and development
- Investment plans for the future.

To establish the HR demand, the companies are classified according to their number of employees in 4 groups, with 0-9, 10-25, 26-50 and 51-150 employees. Then a minimum number of Industrial Automation graduates assigned to each group; respectively 0, 1, 2 and 4. The degree of automation in a company is expressed in terms of these factors:

- Machinery park that contains PLCs, CNCs, robots and any combination of these,
- Use of computerized equipment in production and/or research and development,
- Having an information technology infrastructure.

Therefore the calculations are based on three assumptions:

- A company having any of the items under "degree of automation" is a candidate to employ a graduate,
- That company can and will need to employ graduates in proportion to its size, in numbers described above,
- Number of companies in each group is calculated using the biggest percentage value making up the degree of automation.

To determine the demand for the future, a similar logic is followed. Only this time, considering the increasing degree of automation in the industries in case of new investments, plus the predicted popularity of Industrial Automation Departments, the employment ratios per company are assumed to be 1, 3, 4 and 6 for the respective categories. Increase in the demand is calculated from the percentage of the companies which plan to invest to increase only the production capacity, leaving the figures for capacity increases in other fields (marketing, research and development, etc) out. Therefore a rather conservative approach is adopted, to avoid overstated figures.

Interpreted results for 18 provinces, only for companies under 150 employees:

Province	Present	Future
Adana	282	465
Afyon	244	403
Ankara	2236	3851
Antalya	370	650
Bursa	2922	4802
Denizli	695	912
Eskişehir	250	396
Erzurum	660	585
Gaziantep	521	1021
İstanbul	10077	13992
K.Maraş	210	263
Kayseri	445	625
Kocaeli	478	694
Konya	863	1588
Malatya	89	130

Mersin	325	621
Ordu	56	64
Tekirdağ	468	531
TOTAL	20531	31008

Table 10. Interpreted Human Resource Demand Figures from KOSGEB Survey, for companies having less than 150 employees

It will be seen that for Denizli and Antalya, calculated figures are very close to those obtained from Chambers of Industry. Combined results, therefore, are obtained using the above table, replacing the figures where conclusive Chamber of Industry data is available, and adding automotive companies' (which are situated in Bursa and Kocaeli) demands:

Province	Present	Future
Adana	282	465
Afyon	244	403
Ankara	2236	3851
Antalya	400	800
Bursa	2922	4802
Denizli	663	939
Eskişehir	250	396
Erzurum	660	585
Gaziantep	521	1021
İstanbul	10077	13992
K.Maraş	210	263
Kayseri	740	348
Kocaeli	478	694
Konya	863	1588
Malatya	89	130
Mersin	325	621
Ordu	56	64
Tekirdağ	468	531
Automotive	1321	470
TOTAL	22805	31963

Table 11. Combined Human Resource Demand for the Next Five years, in Eighteen Provinces Plus Automotive Companies in Bursa and Kocaeli.

The above table mainly represents the human resource demand only for companies below 150 employees, plus three automotive companies. In reality, the demand will be much higher. Consequently, future demand in the coming 5 years for the Industrial Automation Department graduates will be at least 32,000 job positions in the addressed provinces, where the annual supply will be 1200 graduates. Therefore dissemination of the pilot project to the provinces is a necessity to fulfill the demand of industry.

Present physical situations of the visited schools are adequate for the establishment of Industrial Automation Departments, as far as infrastructure and areas to be allocated for new departments are concerned, with the exception of Ordu Merkez ATL AML EML.

3.6 Results of Current Pilot Project

The following has been accomplished in the 2 schools during the pilot project:

- Laboratories are set up and furnished,
- Curricula is prepared,
- Textbooks are prepared, translated and printed, covering 32 subjects,
- 25 teachers are trained.

Nine teachers also received additional training in videoconferencing sessions held on 2-3.02.2006, on the subject of " 2-Motor driven programmable sumo robot design and assembly".

In 2004 and 2005, 83 students have gone for summer practice training in the industries, within the Pilot Project. Total number of practice training periods is 114 (some students have been trained for two periods). Industries involved include automotive factories, automotive OEM suppliers, foundries, electronic goods manufacturers, machinery producers, refineries, chemical and petrochemical plants in İzmir, Konya, Kocaeli, İstanbul and Gebze regions. The students were involved with high - tech assignments such as:

- Quality control with instrumentation
- Printed Circuit Board manufacturing
- Maintenance
- Research and development
- Assembly line operation
- Automation.

Success rate among the students, according to relevant employers' reports is 92 % "Excellent", the rest being rated as "Good". Judging from the comments of the employers, it is apparent that these students will be able to find jobs readily in a variety of industrial sectors, given their training and capabilities. Comments of the immediate supervisors in the companies include job opportunities for these graduates. In this manner the new system was introduced to the industries and industrial employers have had a chance to observe these students on the job, resulting in favorable responses.

Representatives of JICA have visited some industrial areas, namely Van, Ankara, Eskişehir, Gebze, Pendik, Konya, Antalya, Afyon, Kayseri, Kahramanmaraş, Şanlıurfa, Gaziantep, Mersin and Adana to introduce the coming Expansion Project and to give an idea on the curriculum and the graduate profile of these new departments to the schools and the relevant Chambers of Industry. So far 19 of 20 provincial schools have the necessary infrastructure for the implementation of the project.

3.7 Analysis of Training Materials

Training materials are considered under two headings; laboratory equipment and textbooks. Training materials of the Pilot project schools were examined and analyzed through reviewing of procurement lists and existing textbooks, examining laboratories and via interviewing teachers and JICA project leader at Mazhar Zorlu ATL.

Interviews were conducted with:
Mazhar Zorlu ATL School Director Satı Çalışkan
Technical Teacher Hasan Yıldız

TechnicalTeacher Gürcan Bıldır
Workshop Chief Murat Özdeveci
JICA Project Leader Yasuo Suzuki.

It is observed that some equipment and materials delivered for the pilot project are superfluous. Therefore a review was necessary to reduce the equipment lists to what is really required. Examining existing laboratories and following the comments of staff; an equipment list necessary to establish the required laboratories is drafted, discussed with JICA project management and then finalized (see Section 9). Final lists are also used to estimate the cost (Section 8).

For the textbooks, it is the common understanding of the JICA project management and the Pilot project school staff that the existing textbooks are not quite adequate for the intended purpose. Since the beginning of the pilot project in April 2001, after the preparation of the curricula, JICA experts were engaged in developing textbooks on 32 subjects. The textbooks are prepared in English, and then translated into Turkish, while JICA experts transferred the technology to Turkish Teachers. However, the time allocated for these activities fell short of the requirements and consequently the sophistication of the textbooks are considered to be lower than satisfactory level. In addition, there are many changes to be incorporated into the textbooks in the light of the experience gained during the Pilot Project period. The MoNE is planning to use the textbooks in the 20 schools within he expansion project. However, these textbooks definitely need reviewing:

- Basic Practice of Information Technology: Only Excel is taught within this subject. The content of textbook is to be revised to include less Office programs and more basic information technology.
- Basic Practice of Industrial Works, Electricity and Electronics: These textbooks need to be revised to contain more device/circuit technology and measuring technology, to contain analogue filters, semiconductor theory and more active/passive circuit practices in coordination with each other.
- Industrial Mathematics I and II: These two subjects should be combined, to accommodate for the 4-year education. Then the textbook should be reviewed to avoid repetitions. Most important aspect is the teaching method of items such as Laplace and Fourier transforms, as these items should not be too highly sophisticated.
- Microcomputer Technology. In the existing textbook first part deals with PIC "C" language programming and second part with control technology with PICs in assembler language. The first part should be incorporated into a new Computer Programming Languages subject.
- Mechatronics: Existing textbook is not sufficient in hydraulic and pneumatic devices but these actuators are still popular in Turkey. Also, the semiconductor theory should be moved to BP Industrial Works or to Electricity and Electronics.
- Feedback Control: A textbook was not prepared for this subject.
- Computer Control Technology: Textbook mostly contains "C" language, whereas this should be included in Computer Programming languages.
- Industrial Management: Inclusion of this subject is appreciated by the industry side but needs refinements. Statistical mathematics and quality control technology should be more emphasized.
- Network Systems: Textbook needs to address more practical items.

There are two new proposed subjects, namely Robotic Software and Computer Programming Languages, which need to have new textbooks. This is supported by the Mr. Y. Suzuki's report of 17.10.2005 on the subject.

In conclusion, existing textbooks need to be reviewed, checked for repetitions, coordinated and revised accordingly.

Therefore, in relation to 2.2.10.1;

- Vocational Education system in Turkey does not cater for the demands of the industry at the present
- Government policies are in favor of the strengthening of VET system; this issue has found its place in the Government Programs
- Need analysis for human resource shows a big demand for the graduate profile of industrial automation department
- Conditions of expansion schools are adequate for implementation
- Results of current project indicate successful acceptance of the students by the industry
- Textbooks for the schools need to be reviewed and rewritten.

4 Plan of the Teacher Training Program

Planning for the teacher training shall take the program, timing and necessary preparations into account, to satisfy the objectives of the system.

A training program needs to address the following:

- Objective(s) of program
- Short- and long-term targets
- Timeframe for training
- Curriculum, subjects and syllabus
- Training material
- Trainee information
- Trainers
- Training premises
- Measurement and evaluation.

Therefore, program for teacher training for the expansion project is laid out as follows:

4.1 Objectives:

The teacher training program is aimed to supply qualified teaching staff for the Industrial Automation Departments of vocational high schools throughout Turkey.

4.2 Targets

Short-term targets:

- Supplying necessary teachers with required qualifications for the expansion project within the timeframe
- Generating knowledge to be utilized in preparation of training materials and textbooks for the schools
- Establishing evaluation methods for the performance of TTC and the education in the schools where Industrial Automation departments are implemented.

Long-term targets:

- Review and development of curriculum and training materials when necessary
- Establishing relationships with the industry to ensure continuous development of curriculum and training materials
- Making the TTC a technology center monitoring the needs of the industry and the worldwide technological developments in the area
- Providing a lifetime training base for the existing and next generation teachers.
- *Ensuring the education of qualified mid-level technical human resources for Turkey in the* field of industrial automation.

4.3 Timeframe:

Timeframe allocated for the training of necessary teachers in the implementation is three years from the start of training. Since a curriculum has still to be prepared, it is necessary to match the TTC training to the constraints of the expansion project. As indicated in the General Implementation Schedule (Section 7), schoolteachers therefore will need to be trained within 25 week courses, 35- to 40-hour weeks; in a total of 1000 hours of theoretical and practical training, to keep up with the education program in the schools.

4.4 Curriculum, Subjects and Syllabus:

A curriculum shall have to be prepared to deliver the necessary courses to the teachers. However, taking the student curriculum into account, the subjects and syllabus for the training is proposed to be in the following manner:

Theoretical subjects:

1. Industrial Mathematics: Algebraic function, expansion in series, complex function, differential and integral, differential equations, Laplace and Fourrier transforms, statistics, waiting theory, system availability.
2. Electronics engineering: Circuit analysis theory, semiconductor theory, electronic circuit theory (analogue and digital), communication and electronics engineering, electronics measurement.
3. Information technology: Basic information theory, software, hardware, communication an multimedia technology.
4. Operating System, computer networks and server construction: Operating systems, network and web systems, server construction.
5. Programming languages: Computer processing, Visual Basic, C, assembler, other control languages.
6. Digital signal processing: Mathematical preparation, signal wave spectrum and Laplace/Fourrier transformation, circuit analysis by "s" function, time and frequency domains, differential equation solving by "s" function, filter theory.
7. Computer control technology and control languages: Computer control interface, control devices, control languages, sensors and actuators as control technology, CAD and CAM.
8. Mechatronics, robot and factory automation technology: Sensors and actuators as a device element, robot control system, control software, factory automation design.
9. Embedded device technology: Devices with PIC and PLC, programming.

Practice subjects:

1. CNC machine operation practices: CAD and CAM programming, CNC machine operation.
2. Robot design and assembling practices: Robot design, assembling.
3. Factory automation practice: FA design, FA practice.
4. Design and assembly of electronic circuits and measurements: Filter circuits (analogue and digital), analogue amplifier and oscillators, feedback circuitry, digital circuitry (register and memory).
5. Control and programming practices: Mechatronics and system design, programming for sensors and actuators.

4.5 Training Materials:

From the input gathered through interviewing pilot project teachers, time distribution in the TTC should be on 50 percent theoretical and on 50 percent practical subjects. To ensure the delivery of these subjects, major items of TTC laboratories should be:

- CNC Machine operation practice; CAD and CAM programming operation and CNC machine operation
- Robot Design and Assembly Practices, using PIC; Robot design and Robot Assembling
- Factory Automation Practices; Factory Automation design and Factory Automation operation
- Design and Assembly of Electronic Circuits and their measurements; design and measurement of Filter circuits (analogue type), Filter circuits (digital type), Analogue amplifiers and oscillators, Feedback circuitry, Digital circuits (register and memory)
- Control and Programming Practices; Mechatronics and system design and Programming for sensors and actuators.

To effectively deliver these subjects, two laboratories shall be adequate. These are:

- A Computer and Electronics Laboratory; with the purpose of practicing on computers, networks, servers and programming, electronic control technology and mechatronics, design and assembly of electronic circuits and their measurement.
- A Control and Robot Laboratory; with the purpose of practicing on robot technology, motor control, actuator practice, machine/CNC operation and factory automation.

The equipment that will be required to set up these laboratories is given in Section 9, paragraph 9.2.

Textbooks shall have to be prepared for both theoretical and practical subjects. Preparation of the curriculum and the corresponding textbooks for TTC needs expert input, therefore foreign assistance should be used. Initial material for textbooks shall be gathered from the existing school textbooks. Amount of work to be done here can be calculated taking the practice of student textbook preparation as a basis. Following the reasoning in Section 6, time required to prepare textbooks for 14 subjects is 58 man*months, which can be accomplished by 5 experts in 1 year.

4.6 Trainees:

In Turkey teachers for vocational and technical high school used to be supplied from two sources, conventional engineering faculties and the Technical Education Faculties. Since 2000, only teachers originating from Technical Education Faculties are allowed to teach in vocational and technical high schools. In the Faculty teachers receive education for 4 years before they are appointed to a high school.

The teachers to be allocated for the subjects under the Industrial Automation departments shall be selected among those who have graduated from the Electrics, Electronics, Computers and Machinery sub departments of the Faculty.

This has been proved successful by the pilot project, and these teachers shall be trained in all subjects of the Industrial Automation to provide capability and flexibility, as was the case with the pilot project.

Existing Technical Teachers in the vocational and technical schools do not really have the background required to teach in the Industrial Automation subjects. These subjects, which require a high degree of basic knowledge supported by laboratory practice, are not in the curricula of the Faculty of Technical Education, where technical teachers are graduated. To teach these subjects, considerable laboratory experience with Industrial Automation training materials has also great importance, which is not in the scope of the normal technical teachers. Within the pilot project, 25 teachers for 2 project schools have had to be trained in Japan to receive training on the Industrial Automation subjects.

To implement the project in the 20 schools, with the curricula laid out under Section 6; 11 technical teachers per school will be necessary, as calculated by MoNE, making a total of 220 teachers. This is based on the proposed curriculum of the schools, which necessitates 218 teacher*hours in the Electronics sub department and 220 teacher*hours in the Machinery sub department, weekly. Since the teachers will be running 40-hour weeks, 11 teachers are necessary for one Industrial Automation department in a school. 7 trained teachers are already on duty in Konya Adil Karaağaç, which has implemented Information Electronics sub department within the pilot project. These 7 teachers will only need to be trained on the Information Machinery subjects. Therefore total number of teachers that need training is initially 213.

Selection of teachers to be trained in the TTC will be undertaken by the MoNE, with regard to MoNE criteria.

4.7 Teachers:

Discussions with teaching staff lead to the concept of TTC training in 15-teacher classes. Therefore four teachers will be necessary to train the 60 teachers present at the TTC. Since there will be 2 laboratories at the TTC (see Section 5), 2 groups will receive theoretical subjects when the other 2 are practicing in the laboratory. Existing teachers who have participated in the pilot project are to be utilized as teaching staff in the TTC. All of these teachers shall be available to teach at the TTC on a rotational basis.

4.8 Training Premises:

A Teacher Training Center is under construction beside İzmir Mazhar Zorlu Vocational High School, estimated to be completed by July, 2006. The center is planned to accommodate maximum 60 trainees at a time and includes laboratories, classrooms and administrative office in addition to boarding facilities (please refer to Section1, paragraph 1.3). Please also refer to Section 8 for a visual description of TTC.

4.9 Measurement and Evaluation:

To ensure the effectiveness of the training program, the following are proposed:

During the delivery of the courses, attendance to the classes should be:

Theoretical:	70 % minimum
Practical:	80 % minimum

Scores enough to be satisfactorily complete a course:

Theoretical subjects:	75 points over 100
Practical subjects:	75 points over 100

When mid-course exams and quizzes are planned according to the curriculum (for theoretical subjects) and in case of laboratory projects, the weight of these should be 40 per cent, with a final exam score weight of 60 per cent.

Long-term evaluation of the program should be based on the performance of the trainees (scores) and of the graduates, providing an area for continuous development.

The fundamentals for the TTC operation are (also see Section 5, Role of the Teacher Training Center):

- 4 teachers are necessary to train the technical teachers.
- Curriculum and textbooks shall have to be prepared for the TTC.
- Teachers for TTC can be selected among those who have been already trained in Japan. There are 18 trained teachers in İzmir Mazhar Zorlu High School and 7 in Konya Adil Karaağaç High School.
- Since the first 10 schools shall be educating Grade X students next year, there will be a need for the teachers on the subjects of Grade X.
- Teachers in TTC shall teach on a rotational basis, to make efficient use of time.
- The TTC is scheduled to be finished by July 2006.

Therefore, headlines for teacher training program shall be:

- First trainee group for Grade X of 10 schools can be trained in March – April 2006.
- Following groups can be trained in groups of 50 to 60, six-month periods.
- The first training shall have to be effected in the existing Mazhar Zorlu premises.
- Periods should start in August each year, to be able to train two 60- teacher groups to catch up with the academic year start date.
- Curriculum and textbooks for teacher training can be prepared through external help, like a technical collaboration scheme, and needs at least 5 full time experts.
- For Grade X teachers training, existing student textbooks can be used for the transition period.

Please refer to the General Implementation Schedule for details.

Consequently (2.2.10.2);

- Necessary school teachers for the 20 schools shall be trained in the TTC, which is currently under construction.
- There will be at least two laboratories and two lecture rooms allocated for the purposes of the training.
- For the training curriculum, program and textbooks need to be developed within a year by external experts.
- Four of existing trained teachers will be instructing in the TTC on a rotational basis.
- Teachers will be trained in groups of 60, to catch up with the subjects to be taught in expansion schools.

5 Role of the Teacher Training Center

The Teacher Training Center is to assume a very important role in the Industrial Automation Departments Project (2.2.10.3). TTC will serve primarily:

- As a school to train teachers for the Industrial Automation Departments,
- As a technology center to keep watch on the technological developments in the world and in the Vocational Education with its applications
- To centralize and distribute the generated knowledge
- To establish relations with the industry and the business world, in order to contribute to the training of the students for mutual benefit.
- To develop and review training programs and curriculum,
- To prepare textbooks for the schools,
- Control the implementation of the Industrial Automations Department establishment project.
- Supplying lifetime training to teachers to keep them updated with the technological and educational advancements.
- Developing techniques to effectively transfer knowledge to the students,
- Establishing methods to monitor the effectiveness of the teaching system, both in TTC and in the schools.

With these attributes, TTC can also serve as a training facility for other countries' technical teachers as well. It is important to note that running the TTC should be undertaken permanent and specialized staff. Hierarchically TTC is going to be an Internal Training Facility, reporting to the Directorate of Boys' Technical Education. Management of TTC will be undertaken by a School Director; accompanied by an Assistant Director and secretariat.

From the operational point of view, TTC is planned to typically accommodate groups of 60 teachers, in 25-week periods for the purposes of training teachers for the implementation project.

Operation concept of TTC will be:

- Flexible,
- Participants planning their own practice,
- Available around the clock,
- Run by permanent and specialized staff,
- Aimed to increase the teaching quality of teachers.