

Engineering Education in Turkey: From Ottomans to the Republic

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History of Engineering Education in Turkey

The establishment of higher learning institutions in Turkey dates back to the eleventh century¹. Initially these higher learning institutions were affiliated with the most important mosques and their curriculum consisted of Muslim law and study, and interpretation of the Koran. Their programs were later expanded to include subjects like logic, mathematics and geometry. This tradition did not evolve into a secular positive science education until the eighteenth century.

Ottomans were not behind the west in technological capabilities until the sixteenth century. Indeed, Rodinson² claims a well developed industrial activity in the Ottoman Empire, reporting three to four workers at the production plants in Istanbul. According to this source, technical superiority continued until the seventeenth century. The practices at those times included wet agricultural techniques, water transportation and water lift at the riversides. In wheat and barley processing, mills were used, and water and wind energy were harnessed. Casting of heavy artillery and transportation techniques of these weapons to intercontinental distances were developed. Construction of complicated bridge structures, roads and aqua ducts especially by the famous Ottoman architect Mimar Sinan was outstanding. Çeçen³ in a book he edited on Ottoman technology also distinguishes the sixteen century as the zenith of the Ottoman technological development. Queen Elizabeth has sent industrial spies to learn about the wool dyeing techniques in Istanbul⁴. Furthermore, practices such as flying using self made wings of Hezarfen Ahmed and rocket launch attempts of Lagari Hasan Çelebi were the reflections of the level of technology in the Ottoman Empire. However, as explained above, the educational institutions were based on theological understanding and the Ottoman technology was resting on apprenticeship.

In the fifteenth and sixteenth centuries, there were two main migrations; from east to west, and west to east. The first immigrants were the scientists, artists, musicians of the Byzantine Empire who went to different parts of Europe to be an effective part of the Renaissance and reformation. The second wave of migration was the Jews from Spain who had to leave their country due to mainly religious pressures exerted on them after the wipe-out of Arabs from the Iberian Peninsula. On their arrival to Ottoman Empire from Spain in 1492, Jews brought printing machines with them. Ottoman sultan gave special permission to publish in Hebrew and later in Greek, Armenian, Suryanian and Latin but not in Turkish. So, for centuries no book was

published by the Turkish and Muslim components of the Ottoman Empire. Ottomans unfortunately missed and were not affected much by the Renaissance and did not have reformation like Europeans in the fifteenth and sixteenth centuries⁵.

As a result of the positive developments in the west and lack of it in the east resulted in a Europe experiencing industrial revolution and Ottomans losing ground from the level that they have reached in the sixteenth century. For example, the ship building technology together with the fast advancement of science and technology resulted in a clear advantage for the west. The ships constructed for the Atlantic Ocean were bigger and stronger than the ships built for Mediterranean, Red Sea and Indian Ocean by Ottomans and Muslims. The European ships had a better maneuvering capacity, could go longer distances, and carry heavier artillery⁶. This difference in the technological and naval capacity between European countries and Ottomans resulted in the total destruction of the naval fleet of the latter by the former in the sea battle of Çeşme in 1770. A series of defeats suffered by the Ottoman army and navy in the eighteenth century was mainly on account of outmoded and insufficient armaments as well as lack of personnel capable of using more sophisticated weapons. These defeats of Ottomans made them realize the vital importance of positive sciences. In 1734, the grand vizier of the time ordered a school of geometry to be opened to help upgrade the personal standards of the artillery units¹. The first secular, positive science based higher education institution which was the start of the Istanbul Technical University of today was realized in 1773 under the guidance of the Captain of Seas during the time of the Ottoman Sultan Mustafa III. With its original name "Mühendishane-i Bahr-i Hümayun (The Royal School of Naval Engineering)", the aim of the school was to educate chart masters and ship builders in geometry, geography, navigation, etc. The department of civil engineering was established in 1784. In 1795, the "Mühendishane-i Berr-i Hümayun (The Royal School of Military Engineering)" was established to educate the technical staff in the army. In the same year, Sultan Selim III issued an imperial decree (Kanunname) to regulate the engineering schools. This decree stands as a unique document in the history of technical education. Among several innovative approaches, it made clear that civilians of any social status could be admitted as students and that the schools could employ civilians regardless of their religious nomination. The school even introduced French as a required foreign language in addition to Arabic. In 1847, education in the field of architecture was also introduced.

In 1883 part of the military engineering education establishment was allocated for the training of civilians as civil engineers and architects with the aim of teaching essential skills needed in planning and implementing the country's new infrastructure projects. The School of Civil Engineering then assumed the name "Engineering School (Hendese-i Mülkiye)" in 1909 offering a six-year program of study, and was removed from the military jurisdiction and placed under the authority of the Ministry of Public Works.

After the independence war, the Turkish Republic was declared in 1923. The republican administration was quick to realize that one of the sturdiest foundation stones inherited was the Engineering School. The government duly transformed it to the Engineering Academy (Yüksek Mühendis Mektebi) and granted university status in 1928. The Engineering Academy continued to provide education in the fields of engineering and architecture until it was renamed as Istanbul Technical University (ITU) in 1944. Finally, in 1946, ITU became an autonomous university including the Faculties of Architecture, Civil Engineering, Mechanical Engineering, and

Electrical Engineering. The engineering programs were reduced to five years from six enforced previously. This development constitutes one of the three main *écoles* in Turkish engineering education.

The second important *école* was started in 1863 by American philanthropists by founding a liberal arts school in Istanbul under the name of Robert College. This was the first American institution of higher learning outside the boundaries of the United States; it was incorporated under the laws of the State of New York. In 1868, the Ottoman Sultan passed a decree which recognized the college as a school and granted to it all the advantages normally bestowed upon educational institutions in Turkey. In 1912, Robert College opened up an engineering school corresponding to a full four-year undergraduate college of engineering in the United States. Lynn A. Scipio of the engineering faculty of Purdue University was appointed as the head of the engineering school which began functioning in the autumn of 1912. In his memoir Scipio⁷ describes his efforts to have Robert College engineering school recognized by the Ottoman government. Most of the engineers, being educated in Germany, were not so friendly to American curriculum. In 1959, the school of engineering had chemical, civil, electrical and mechanical engineering departments⁸. Robert College continued to be an American college until 1971 when it was turned over to the Turkish Government. Most of the norms used during college times were transformed to Boğaziçi University.

The third engineering *école* developed over the years is represented by Istanbul University (IU) and later Ankara University (AU). The history of IU dates back to the Ottoman Empire as well. It is claimed that its foundation dates back to 1453 and even to 1321 by German historian Richard Honig⁹. During the course of time, this institution was discontinued until the westernization trend became strong and reopened again on a more secular orientation as “Darülfünun” in 1846. In 1870 this institution had to be reopened for the third time, and later its status as an autonomous and secular school was assured by law in 1924. In 1933, Atatürk, the founder and the first president of the Turkish Republic, started a reform in the school and changed the name to Istanbul University.

National Socialist Party achieving majority in Germany started another exodus to Turkey, thanks to Atatürk’s welcoming policy to scientists, artists, philosophers and intelligentsia from Germany and other oppressive western states. The scientists pressurized, dismissed, terrorized and humiliated by fascist movements came in numbers to Turkey¹⁰. The second wave of mainly Jewish exodus was well appreciated and the visitors made a landmark in Turkish education. The reformation started earlier at the Istanbul University was carried out by many German, French, Italian, Hungarian, and Austrian professors, and laid the foundation of Turkey’s higher education. These mainland European scientists also affected the science and engineering education. Robert College engineering school was not affected by this major development in Turkey; however, ITU was very much affected since it was the recipient of many of these distinctive scientists. Some of the famous scientists and engineers in the field of chemistry and biochemistry included Felix Haurowitz, Reginald Oliver Herzog, Ernst Magnus-Alslebel, Fritz Arndt, Ernst Buding and Ernst Caspari. Professor F. Arndt is known to be the founder of chemical engineering in IU and Turkey. He learned Turkish and contributed to the development of original Turkish chemical terminology. Apart from the mainland Europe, scientists from Britain also visited Turkey; however, their influence has been minor compared to the mainland

Europeans. The professors who found refuge in Turkey helped to establish a mainly continental European style university system and engineering education in Turkey which constitutes the third *école*. However comparatively speaking the effect of continental European effect is far deeper in social sciences compared to the engineering.

The Development of Universities after the Second World War

After the foundation of the Republic, the Ankara University (AU) started education in 1946. One of the two starting departments was chemical engineering along the continental European tradition and the university developed excellence in mainly political sciences, law, and economics rather than engineering.

As it is the case for many countries, the start of large scale industrialization in Turkey after the World War II necessitated the state to open up technical schools to meet the demand for technical personnel. Atatürk University, Aegean University, Black Sea Technical University were founded between 1955 and 1957. Middle East Technical University (METU) which opened its doors to students in 1956, was intended to serve whole Middle East, therefore instructed in English and was established in the line of Robert College in American tradition. During the founding years, it was supported by the United Nations to provide non-Turkish faculty members. Instruction in English, with the establishment of METU, became a strong component in Turkish higher education especially in engineering education. METU also introduced the trustee management system which was only the case for the American Robert College at that time. Later this system was abandoned and central state management system is accepted.

After the foundation of Hacettepe University in 1968, a new approach was adopted by the Ministry of Education in which universities were established at different locations of Anatolia. By 1981, number of Turkish universities reached to 19¹¹ and a Student Selection and Placement Center (ÖSYM) has been established in Ankara in 1974 to carry out a nationwide contested central examination in response to the demands of increasing number of student applications¹².

Between early 1960's and 1971 a number of private higher education schools were opened on profit motive which was found to be against the constitution therefore they were transformed into polytechnics in 1971 which later were restructured into universities together with other higher education schools and establishments. In 1992, 21 new universities and two advanced technology institutes were founded. Additional universities were founded along the policy of spreading universities all over Turkey. The total number of Universities reached to 53 at the end of 1992.

In 1984, a new brand of university is introduced to the Turkish Higher Education System, namely Bilkent University. Bilkent University was established by a non-profit foundation. Starting in 1992, others followed this new trend and 23 new foundation universities were established. The foundation universities contrary to the diverse spread of state universities are concentrated in the three largest cities of Turkey; Istanbul, Ankara and Izmir. At present, there are 77 (53 state and 24 foundation) universities in Turkey with a student enrollment of 1.7 million, a graduation size of 248000, and an academic staff of 71300¹¹.

Present Status of Engineering Education

In general, the university system in Turkey is engineering dominated. Among the state universities there are only six which do not have engineering schools and among the foundation universities nine of them do not have engineering schools. The foundation universities seem to be less committed to engineering than the state universities. This may be due to larger investment involved in engineering education.

The above mentioned 77 Turkish universities have 80 engineering faculties. The greater number engineering faculties over the number of universities is mainly due to the tradition of technical universities such as Istanbul Technical University running in multitude of engineering faculties. In these 80 engineering faculties, there are 351 engineering departments carrying out education in 44 different programs. Every year over 20000 students start engineering education which is about 15% of the total student enrollment in higher education in Turkey¹³. Contrary to the trends of a decline in the popularity of engineering profession in some parts of the world, engineering maintained its popularity in Turkey over the years. This is further substantiated by the student selection and placement results in which engineering departments has the highest ratings in the preferences of the top 2000 students compared to all other professions¹⁴. Engineers are also in demand in non-engineering sectors such as banking, finance, insurance, sales, and management primarily due to their strong analytical thinking skills.

One of the important parameters defining the quality of education is the student/faculty ratio. The average student/faculty ratio for engineering studies in Turkey is 32. This ratio varies in different disciplines from an extreme of 104 for ceramics engineering and 4.4 for management engineering. The average number of academic staff per department is 10.7¹³. Fourteen programs, most of which are located in large cities such as Istanbul, Ankara and Izmir, have academic staff above the average value, indicating a great difference in staff availability between the most populated three cities and the rest of the country.

Turkish industry is relatively weak in many areas compared to the developed countries and mostly dependent on foreign technology. This situation resulted in a need for engineers speaking foreign languages, in particular English, and instruction in English has become a major issue in engineering education. Moreover, globalization trends in the last decade enhanced the need for English speaking engineers. Today several engineering programs are instructed in English, especially in the foundation universities.

The lack of research and technology development in the industry also results in low interest in PhD level graduate engineering programs. However, there seems to be a demand in master level engineering programs especially in the interdisciplinary areas and business administration.

Recent Challenges for Engineering Education

An important impact of globalization is the industries competing in the international market and professionals utilizing job opportunities across their national boundaries. The movement of engineering professionals in the globalized world brings together the issue of international recognition of engineering diplomas. In parallel to this, another issue that gained equal attraction

is the quality of the graduating engineers, in particular the knowledge, skills, and attitudes necessary for engineers to function in the globalized world of the 21st century. The skills required to address these challenges are summarized as independent and lifelong learning, problem solving, critical and creative thinking, teamwork, communication, global thinking, and change management¹⁵. These skills become especially important for the engineering graduates planning to take advantage of the job opportunities in the global world. Universities are now either feel responsible or held accountable for furnishing their graduates with the knowledge, skills and values required to compete worldwide.

There has been an increasing demand in Turkey towards mobility after graduation. Turkish universities are now facing pressures from incoming students to get international recognition and accreditation. In Turkey, the approval of opening a program is carried out by the Turkish Higher Education Council. However, the quality of the graduating students is currently an issue of the university itself.

The lack of an accreditation body in Turkey forced some universities to seek international accreditation from abroad. Engineering programs have pioneered in getting international accreditation in Turkey. Several engineering programs of Boğaziçi University, Middle East Technical University, Bilkent University, and Istanbul Technical University have received substantial equivalency from the Accreditation Board for Engineering and Technology (ABET).

In 2001, the Engineering Dean's Council of Turkey met to discuss various common issues including quality assurance and accreditation and the Engineering Evaluation Board is formed to establish an assessment and accreditation system for engineering education in Turkey. The Engineering Evaluation Board (MÜDEK) is composed of members from universities, the Turkish Quality Association, Istanbul Chamber of Industry, and the Turkish Chamber of Engineers and Architects. The functioning of this body is in parallel with ABET EC2000, i.e. program accreditation based on continuous quality improvement. At present, MÜDEK is running an experimental assessment procedure for 7 engineering programs of two universities. These programs prepared their self-study reports and received their campus visits in December 2003.

Brain drain is another issue appearing as a challenge tied to globalization. The international job opportunities attract many talented engineers in Turkey, in particular those with advanced degrees. The instability of Turkish economy and the severe economic crises experienced in the last twenty five years, and hence the low income of engineers along with unsatisfactory professional careers enforce professionals seek alternatives abroad.

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Biography

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