

INDUSTRIAL POLICY AND ENGINEERING TRAINING IN HUNGARY IN THE SECOND HALF OF THE 19TH CENTURY

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Abstract

The first part of the study analyses industrial policies in Hungary in the second half of the 19th century and reviews the products of the most significant factories of the period (Ganz, Röck, Láng, MÁVAG, etc.) as well as the activities of the government supporting national industries. The second part of the study analyses the beginning of engineering training in Hungary and the necessity and conditions of the establishment of an independent technical university.

Keywords: factories, products, industrial policy, engineering training.

The economic and social developments of 19th-century Hungary were determined by three important and interrelated series of events: the Reform Period, the 1848-49 Revolution and War of Independence, and the 1867 reconciliation. The struggle for creating a national language and culture was coupled with establishing large-scale industries in the Western European sense. The impact of the industrial revolution in Western Europe manifested itself in Hungary with some decades of delay.

The first signs of the industrial revolution emerged after 1840, within the so-called Protection Society Movement, as a result of which a number of industrial plants were established. In 1836, the shipyard of the First Danube Steamship Company was opened up in Óbuda, followed by the foundation in 1841 of the Pest Cylinder Mill. In the middle of the 19th century, the screen and scythe making workshop of István Röck, founded in 1802, was already producing self-designed steam engines and machine tools in the plant built at the site of the present main post office building in Petőfi Sándor Street, and in 1859, the first threshing machine was produced. The Ganz factory had a particularly significant role in Hungary's manufacturing industry all the time. Abraham Ganz (1814-1867) started production in his factory in 1845. He made his plant famous all throughout Europe by the chill casting - die casting in present terminology - technique of railway car wheels. (The Ganz factory was located in the area limited by the former

Királyhegy (today in 1996: Bem) Street and Kórház (today in 1996: Ganz) Street, presently the site of the buildings of the Foundry Museum.

Between 1853 and 1866, as many as 86,074 chill-cast wheels were sold to 59 railway companies. From 1874 on, the factory headed by András Mechwart (1834–1907) produced roller mills for the mill industry. In 1896, nearly 60 different types of roller mills were manufactured and the export of complete mills began to all over the world. As many as 30,000 roller mills had been produced by 1907. The forethought of András Mechwart is shown by the fact that he established the electrical section of the factory as early as 1878, where the great triad – Ottó Bláthy, Miksa Déri, and Károly Zipernowsky — produced a transformer in 1885, and later, in the middle of the 90s, the world got to know the electrical wattmeters of the factory. In the middle of the 19th century, the Valero Silk Factory was founded and modern-style production began in Goldberger Textile Dyeing Plant.

It was characteristic of the degree of development of industrial plants that in 1841, there were 6 steam engines with 75 horse power operating in Hungary, which was extended to 45 steam engines and 760 horse power by 1848 [1].

The reconciliation of 1867 had significant influence on the economic, particularly the industrial development of the country. The era of dualism is the period when modern industrialisation emerged, large-scale mechanised industries evolved and developed in a spectacularly rapid manner.

In order to justify this, let us consider the compared annual growth index of the industry of some countries in the period between 1860 and 1913 [2]:

Country	Industrial growth index %
United Kingdom	1.2
France	1.8
Germany	2.9
Austria	3.1
Sweden	5.4
Italy	1.5
HUNGARY	3.5

This table obviously indicates the fact that Hungarian industry was developing dynamically during this period. Between 1869 and 1910, the proportion of industry in terms of employees increased from 10% to 18.3%.

In the time of the reconciliation, 15% of the national income was produced by industry, as opposed to 27% in 1913. Naturally, it was a problem in the development of Hungarian industry that handicraft dominated in this period. Károly Keleti (1833–1892), statistician wrote the following in

connection with this in 1871: 'The greatest number of industrial branches are still formed by handicraftsmen.'

Except for the iron and mill industries, handicraft work and manual processing were characteristic of all the rest at the time. However, a considerable change had been brought about by 1913. Then only 23% of the entire industry was comprised by handicraft.

Which were the most characteristic branches of industry at the end of the 19th century? Iron and metallic industries, machine building, traffic vehicle production, and, from the turn of the century, electrical and instrumentation industries.

The number of employees in the different industrial branches amounted to the following between 1890 and 1910 [3]:

Branch of industry	Number of wage-earners	Increase	Thousand persons 1890-1910
Iron and metallic industry	89.6	148.8	66
Machine building	22.4	78.0	248
Food industry	108.9	153.7	41
Wood industry, car building	80.9	137.5	70
Building materials, chemical industry	30.6	80.6	164
Textile industry	30.5	48.6	60
Leather and clothing industry	232.1	324.3	40
Paper and printing industry	12.4	34.4	177
Power industry	2.4	8.3	139

Amongst the various industries, machine building was the most large-scale type.

The National Association of Hungarian Manufacturing Industrial Company Owners recorded the following in its annual report of 1903: 'Hungarian iron industry and machine building are some of the things worthy to be proud of in our country, because, as it is widely known, they strongly and successfully compete with foreign industries in terms of quantity and by their quality, particularly.' The Ministry of Commercial Affairs gave voice to a similar opinion: 'Even as early as the 80s of the past century, machine building in Hungary was one of the most developed branches of industry' [4].

In a part of the iron works, the technological innovations of the industrial revolution were gradually introduced, and later on, during the years following the reconciliation, cheap mass steel production began by applying

Bessemer's¹ and then Martin's² process. Brothers Emil and Pierre Martin from France patented for steel production the alternating flame, regenerative furnace system invented in 1856 by the German Siemens³ brothers. From the 1860s on, large-scale industrial developments sped up in food industry as well.

Besides the factories of Ganz, Röck, and Schlick, the Láng factory, MÁVAG, and the Weapon and Machine Works founded in 1891 played an increasingly important role. In 1868, László Láng (1837–1914) established a machine building workshop in the former Váci Boulevard (presently Bajcsy-Zsilinszky Road), but he was intrigued, from the start, by the development of gas machines, the most significant power machines of the period.

His new factory was entered in the Company Registry on 4 December, 1873, opened up in outer Váci Road, at the present site of the factory, where steam engine production soon began. The amount produced by the factory satisfied the demand of the whole country in 1896.

The production of the three biggest machine works in Budapest — GANZ, MÁVAG, and SCHLICK — increased from 11 million crowns to 150 million crowns between 1880 and 1895. In the 1880s, the turnover of the machine works in Budapest, with the annual output amounting to as much as 85 million crowns, surpassed the total of all the works in Bohemia and Moravia.

The most highly developed branch of machine building was vehicle production, provided with continuously expanding markets by the establishment of transport infrastructure, the railway network, and river steamship traffic.

In the Óbuda shipyard of the Danube Steamship Company established in 1836, 300 steamships and 700 barges were built between 1839 and 1895, that is, in hardly 60 years. The factory had considerable orders from abroad, therefore three more shipyards were built at the Újpest Danube bank in the 1860s [5].

The international recognition of the results of railway vehicle production at the end of the 19th century is also indicated by the fact that the twin-cylinder rapid-transit railway engine produced by MÁVAG was awarded the grand prize of the 1900 Paris World Fair.

In the development of engine technology, a revolutionary change was brought about by the carburettor or atomizer, the invention of Donát Bánki (1859–1922), professor at the Technical University, and János Csonka

¹Sir Henry Bessemer (Charlton 19 January, 1813 – London 15 March, 1898) British engineer and inventor

²Pierre Martin (1824–1915)

³Friedrich Siemens (1824–1904)

(1852–1939), head of the machine workshop of the Technical University, published on 11 February, 1893 [6]. German engineer Wilhelm Maybach (1846–1929) submitted his patent only on 17 August, 1893. However, he patented the carburettor as an independent structural component, this way he could provide greater protection for it.

On the basis of the patent application of Donát Bánki and János Csonka, it can obviously be established that they were the first in the world to formulate the principle of the carburettor. Its structure was basically the same as today and spread all around the world. The name of the design originates from them as well. This invention, produced by hundreds of millions today, laid the foundations of automobilism. Bánki, however, went on foot to the Technical University from his villa in Rose Hill all his life.

When the carburettor was invented, there were no motor cars in Hungary. The first one was a Benz car in 1895. Motor car manufacturing began in Hungary after the turn of the century, and bus as well as truck production at the beginning of the First World War.

Besides vehicle industry, agricultural machine building is also worthy of attention in the second half of the 19th century. The first threshing machine was produced in 1859, as it was mentioned earlier, and the steam locomobile driving the threshing machine in 1861, both in the machine works of István Röck. The largest agricultural machine works of the monarchy, an affiliated company of the Austrian Hoffer and Schrantz firm, was opened up in Kispest at the turn of the century. As regards the country, the machine workshop of Ede Kühne (1839–1903), who had immigrated from Germany to Hungary in the 1850s, developed into an important agricultural machine works.

Some of their products were recognised internationally as well. Their seeding machine, presented at the 1900 Paris World Fair, was purchased by the visiting Persian sovereign.

Hungary could contribute to the development of electrical industry by several inventions and products. Although the patent for the direct-current generator was received by the German Friedrich Siemens (1826–1904) in 1867, Hungarian physicist Ányos Jedlik (1800–1895), professor of the Pest University of Sciences, had credibly recognised the principle of the direct-current generator as early as 1858, and he soon completed his first engine, which was placed in the equipment store of the university in 1861 [7].

The year 1879 brought about a great change in the development of lighting technology. In Menlo Park, America, Edison's incandescent lamps were lit. Incandescent lamps made possible to provide economical internal lighting systems capable to be divided into small units. In Europe, this

success was brought by the test lighting of the Paris opera house, in the preparation of which a Hungarian engineer, István Fodor, also participated.

The experiments at the Ganz factory were directed by Károly Zipernowsky (1853–1942) [8]. Arc lamps with 8-hour operation capability were managed to be produced. Such arc lamps illuminated the facade of the Savings Bank in Kálvin Square, Budapest, in 1879. At the time of the Szeged flood as well people worked by the light of the lamps produced by this factory.

In 1882, the lights were lit up in the National Theatre. This was the third theatre in the world, after London and Brno, which was equipped with an electrical lighting system.

Public utility current supply did not only serve for lighting, but also made it possible to provide supply for electric motors, thus exerting considerable influence on other fields of industry as well.

The first public utility electric plant was opened up in New York in 1882. In 1884, electrical arc lamps were used for lighting in Timisoara, and in 1888, the owner of the mill at Mátészalka lighted the streets of the town as well. The network in Budapest was installed from 1896. (By 1935, 100% of the towns and 40% of the villages in Hungary were electrified.)

One of the conditions for the industrial applications of electrical energy was, however, to establish a power distribution system which is economical even in the case of greater distances. The solution was provided by 3 excellent engineers at the Ganz factory, Ottó Titusz Bláthy (1860–1939), Miksa Déri (1854–1938), and Károly Zipernowsky (1853–1942).

Their invention was the transformer, presented at the Budapest National Exhibition in 1885. The new system of current distribution revolutionized electrical engineering.

The Ganz factory immediately began to produce transformers. In the same year, a smaller-sized power plant was transported to Switzerland and a transformer network was built up. The transformer brought about worldwide success. The Ganz factory could hardly deliver the orders.

The Ganz factory began to produce electrical tractor engines as well. It assumed an important role in electrical railway traction, too. The renowned designer of the factory, Kálmán Kandó (1869–1931) greatly contributed to it [9]. The so-called Kandó engines met with international success. At the beginning of the 20th century, the Val Tellina railway in Italy was built with them. (The invention of Kálmán Kandó, the phase-reversing electrical engine was the first in the world to set off for its test trip between Budapest Western Railway Station and the town of Dunakeszi on 31 October, 1923.)

In 1896, a high-voltage power plant was built at Ikervár, near Sárvár, which supplied the area and Szombathely as well as Sopron with electrical energy using the hydraulic power of the river Rába.

Bell's 1876 patent, the telephone was put into operation in Budapest as well in 1881. Tivadar Puskás (1844–1893), employed by the Edison Corporation, played a significant part in the application of telephone centrals [10].

Simultaneously with industrialisation, the issue of highly qualified expert training was brought up on the basis of the increasing demand for engineers.

The two-pole debate between Vienna and Pest about university-level engineer training evolved around the question whether the conditions in Hungary had been ripe enough for independent engineer training. In the *Institutum Geometrico-Hydrotechnicum* [11], founded in 1782, surveying and water regulation engineers were trained, therefore the demand for engineers by the industry – mechanical, chemical, etc. —, could not be satisfied this way given the properties of the training.

On 24 November, 1833, József B. Brudern, of foreign origin, left two thirds of his assets to the province of Pest in his testimony, so that the studies abroad of young technical people could be financed until the 'Polytechnicum Institutum was established'.

On 9 April, 1836, during the 1832–36 parliament in Bratislava, the Estates and Orders passed their resolution by virtue of which a national committee should be set up for the establishment of a technical university. The immediate launcher of the establishment of the technical university was Gábor Lónyai, delegate of Zemplén county. It was recorded as follows in volume 337 of the *Parliamentary Reports* edited by Lajos Kossuth: 'At the district meeting held on 29 March . . . Lónyai submitted a motion as truly wished by the Orders of Zemplén that a national committee be elected in the course of the present parliamentary diet in order to establish a polytechnical institute (polytechnicum institutum).'

As in so many of the attempts of the Reform Period, including university-level engineer training, count István Széchenyi played a memorable part. As he formulated in his work titled 'Credit', published in 1830: 'The number of scientific experts constitutes the real power of the nation. Not the fertile plain, the mountains, the minerals, the climate and the rest contain public strength, but the genius that can utilise them. There is no truer weight and power than the human brain' [12]. On 13 March, 1839, count István Széchenyi raised the following issues in the delegation instructions for the county of Pest: 'The already existing building of the Ludovica military institute should be converted to a technical university institution

and his Majesty should be supplicated for its approval immediately at the beginning of the parliamentary session.'

In the meantime, the educational committee of the governor's council, headed by Alajos Mednyánszky, also started considering the proposal of 1836. The work proceeded slowly. The report was completed on 16 March, 1842. The final draft that the free royal town of Pest should establish a school of industry instead of a technical university 'was approved and put into effect by supreme resolution', dated in Schönbrunn, 12 June, 1844. The School of Industry was inaugurated on 1 November, 1846. It also formed part of the efforts to establish a technical university in the 40s when Lajos Kossuth visited Széchenyi and offered 20,000 florins from the amount collected for him during his captivity for the establishment of the technical university. Széchenyi had some designs made – most probably by József Hild, the famous architect – for the School of Industry to be built, the site for which Szervita Square was chosen in Pest (presently Vth district of Budapest).

The first director of the School of Industry was Mihály Karácson [13]. Eight departments were founded. The professor of mathematics was József Arenstein, that of geography and product knowledge Antal Mihálka, and Károly Jubal taught drawing (he was condemned to death as a consequence of his revolutionary activities in 1853). In the following years, Károly Nendtvich became the professor of chemistry and technology, and József Sztoczek became a colleague at the department of physics.

After the defeat of the war of independence, instruction in Hungarian language was discontinued in the School of Industry, and in academic year 1850–51 measures were introduced to unify the School of Industry and the Institute of Engineering, then in 1854 it was transferred to the Castle area.

On 30 September, 1856, Franz Joseph declared the School of Industry to be an institution of higher education under the name of Joseph Polytechnicum. In 1860, instruction in Hungarian language was restored and József Sztoczek (1819–1890) was elected director-general instead of Lambert Mayer, and instead of Polytechnicum, the denomination used was Royal Joseph Technical University, but the institution continued to remain within the organisational framework of a university of sciences.

The number of students gradually increased: in academic years 1866 through 1868, the institution had 250 students, and in 1870 through 1872, as many as 409 students.

During the struggle for an independent technical university and Hungarian engineering training, the National Association of Mechanical Engineers was established in 1855, and later, on 5 August, 1866, the Society of Hungarian Engineers was formed in order to 'promote technical affairs in

Hungary'. Amongst the founders were Imre Steindl, Miklós Ybl, Frigyes Schulek, András Mechwart, József Sztoczek, and Ernő Hollán.

After the reconciliation of 1867, new vistas were opened for technical higher education as well. József Eötvös, minister of religious and public education affairs, played a significant role in this.

On 7 April, 1870, the house of representatives put the 'reorganisation of the Royal Joseph Technical University' [14] onto its agenda among discussing several important items.

In the justification for the proposal, József Eötvös explained: 'since mathematics and natural science are just as highly researched and lectured on as in other universities of the country; whereas at the Technical University, students are supposed to acquire just as high scientific skills and qualifications as, for instance, students preparing for the legal and medical career at the university. I deem it expedient to declare by law that the Technical University has equal standing to the other universities of the state and then it should be organised as a chief university educational institution' [15].

The house of representatives passed the proposal, and by his superior resolution dated 10 July, 1871, the king 'confirmed the internal organisational by-laws of the royal Joseph Technical University'.

Accordingly, academic year 1871-72 was opened on a self-governmental basis at the Technical University. In order to celebrate this important event in its development, a general assembly was held on 7 January, 1872. Rector József Sztoczek emphasized the following at this festive general assembly: 'we left Pest as a young School of Industry, and now, after 18 years, we have returned as an ambitious university having the necessary departments and self-government ... We shall return as a university of great future' [16].

Industrial policy and engineering training: in Hungary, in the second half of the 19th century these two concepts were intertwined, and their realisation launched a small nation on the way to find Europe and the whole world. Their results, achieved by knowledge and eagerness to act were recognised by the world. All this is not only history but a message and a lesson for today.

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