Mobility for the Mainland: The Contribution of the Railway to the Emergence of the Age of Speed

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Abstract

Railway - not only as a means of transport, but also as a technological invention and a social construction - was mainly responsible for the diffusion of the Industrial Environment. With the Railways broadly disseminated in space, the natural environment was innovated. In England, especially, the transition was gradual, surpassing the previous slow rates of the canals transportation. By contrast, in developing areas such as the Balkans, the gap between pre-industrial and railway transport was enormous, because, until then, the chances for continental mobility were quite uncommon. In general, however, Railways and Industry provoked novel theoretical conceptions such as calculations of risks relating to technology, problems of governance and control of technical systems, energy policy, environmental issues, computational technology, scientific management, globalization and many other areas of development of the technological systems.

Keywords: Railways, Mobility, Globalization

1. Introduction: From the Mines to the Rail

With the exploitation of Steam, the natural environment started being metamorphosed into innovative Power and Speed networks. The steam engines appeared in the seventeenth century: Denis Papin produced a piston steam engine, the first steam-powered vehicle and the first steam cylinder. Thomas Newcomen combined the ideas of Thomas Savery and Denis Papin, to build the first practical steam engine for pumping water, the predecessor of all subsequent thermal engines, including internal combustion engines. At the same time, Isaac Potter manufactured steam engines in distant Slovakia. Mårten Triewald manufactured also a famous steam engine in Sweden, using wood as fuel, and later came to England, where he worked with Newcomen’s assistant to build four new engines (Cardwell, 2004).

Nevertheless, it is generally accepted that the steam engine was first built by James Watt, who tried to reduce the excessive steam loss. Watt thought that the condensation of vapour should occur in an isolated space, the separate condenser, which communicates with the cylinder and allows reducing the losses of latent energy. Around 1780, Watt using gears turned reciprocation of the steam engine to rotary motion. In 1782, he introduced double-acting engine and in 1784 he perfected it with parallel motion of assembled rods. In 1788, he applied the centrifugal speed governor and in 1790 he incorporated the manometer in the steam engine.

George Stephenson built in 1815-16 two improved steam locomotives. Since 1814, he started - with the assistance of R. Trevithick – the manufacture of locomotives connecting transport sectors of production. In 1818, he made the first scientific studies on the resistance of the rail line in connection with the loadings and intersection. In 1823, he founded the world's first locomotive factory. Later he built the locomotive Rocket, which reached a speed of 50 km.

In fact, the railroads were the centuries-old useful means of transportation of raw materials, usually horse-drawn. But even in 1860 there were many who believed that travelling by train may have adverse effects on the head, heart and lungs, especially to the infirm. Until 1870, trains were moving with luggage tied to the roof racks of wagons. Others preferred to use steam only in carriages on public roads, not in rail. They considered the trains too long (Quinn, 1998). The satirical *Punch* was distinguishing the two great powers, the steam and the electricity, emphasizing their value for the improvement of wellbeing (Freeman, 1999).

The expansion of the railway was historically depended on its effectiveness. It is often thought that an investment in rail is profitable when there is a large amount of cargo for movement, i.e. orders of millions per year; thus, in case of high density transport and huge volumes. In addition, the railway transport predominates firmly in middle distances, i.e. from 400 to 1500 km. With the guidance of vehicles in their orbits, trains have - for the same deck width – a much larger capacity than car.

2. Industrial Revolution and Railroad: The Stage of Dissemination

Railway became popular because it is useful, cheap and affordable for all class strata. It is indeed a wonderful way for recreation and daydreaming. Simultaneously, it is an irreplaceable means for the transportation of heavy loads over long distances. Accordingly, railway is related to the emergence of mass consumption society, which is coupled with bulk sale and mass production. At the end of the nineteenth century, the railway and the postal service created large economic areas, as Vahrenkamp (2011) contends.

In the West, the nineteenth century was marked by the emergence of the industrial revolution, which brought about the victory of capitalism, a development that was associated with a number of factors, such as revenues from big trade, population growth, increasingly efficient machines, prevalence of the steam engine, mechanization of the production, development of the textile industry, and generally industrial production (Berstein and Milza, 1997; Papayannakis, 1991).

The change in the means of production became evident in every latitude and longitude by: a) the use of new forms of energy, e.g. where coal is associated with the steam engine. b) The mechanization of production and the emergence of a modern metallurgy. c) A significant growth (around 2% per annum) of innovative industry and a new organization of work that replaced the traditional system of crafts with concentration of capital and people in large production units.

Clearly, with the development of industry in late 18th and 19th century the structure of traffic loads had fundamentally changed; thus, large shipments of building and many other materials became necessary. The emergence and spread of the railroad is arguably the most characteristic change of the industrial revolution. Transferring large volumes at low cost is the groundbreaking and valuable component that renders important economic value in commodity production and circulation. Freight costs with the first rails were four to seven times smaller than with wagons, which reached low speeds, only sixteen km per hour. The railway cost was also smaller than the cost of transportation by boat through shallow rivers and canals.

The first public railway was the line Stockton - Darlington, built in 1825 by Stephenson. In 1830 a railway between Liverpool and Manchester was built. In late 1827, the canal Delaware - Hudson was constructed for the transportation of coal from north-eastern Pennsylvania. The first sixty miles had to be covered by railway, because the trail was uphill (Larkin, 1995).

In 1835 there were 1,600 km of railways in the U.S. and 14,500 km in 1850. In 1837, a railway was built in Russia. In the 1830s railroads appeared in Austria, Germany, Belgium, France and other countries. Between 1850 and 1870, railway construction started in Canada, Asia, Africa, South America and Australia.

The largest increase in the construction took place between 1880 and 1890 and prior to the First World War, when over 20,000 km of railway lines were being built annually. In 1904, the Trans-Siberian started; very important for the Japanese market also. In the early twentieth century, the rail network around the world exceeded one million kilometres.

The railways were the cumulative effect of basic capitalist industries of coal, iron and steel, and the more staring indicator of world trade growth. The railway boom was a blow-up of industrialization in general. Not only boosted a huge demand of coal and many industrial goods; but also, allowing commodities to move faster from the factory to the railway station, it reduced the time needed to sell. This meant faster returns on invested capital, money that could be reinvested to produce more commodities.

Gradually, with the opening in the whole world market, to an extent that has never been reached before, the rise of the railways caused the production of adequate quantities of material goods in order to ensure the early windup of the industrialization of the West (Burns, 1984).

In the mainland, paved road was pushed to the backstage by rail; in the sea the slow and infrequent sailing vessel was displaced by the rapid and frequent steamship. The steam served the need for large shipments of iron, ore, coal, lumber, building materials and many other commodities. Thus, the duration of one consignment to East Asia, which in 1847 was taking at least twelve months, was soon being limited to an approximately equal number of weeks (Marx, 1979).

The new global transport system was reducing the cost and time of transport, while the opening of the interior of new states, provided the European industry with additional markets and increasing quantities of cheap raw materials and foodstuff.

2.1 Caravans, Camels and Railways in the Ottoman Empire

The railway construction in the Balkans was introduced after the War in Crimea, with the construction of the lines from the Black Sea to Danube, from Niš and Sofia to Adrianople and Constantinople, and also the lines Thessaloniki-Belgrade, Thessaloniki-Bitola, Thessaloniki-Istanbul, Izmir-Aydin and Izmir-Cassaba. All these projects were scheduled by the Ottoman government's involvement and assistance, aiming especially at the expropriation of land (Gounaris, 1993).

In April 1869, the Sultan granted to a group of Austrian entrepreneurs the permission to build 1,500 miles of Balkan railways from the Austrian border to Niš, Sofia, Adrianople and Istanbul. This line, an investment of the Austrian Hirsch, was completed between 1872 and 1888.

The Ottoman Ministry of Public Works was founded in 1865. Then, the Ottoman roads were divided into 4 categories: Imperial (width about 7.5 meters), Metropolitan (about 5.5 meters), Regional (about 4.5 meters) and other smaller (about 3.5 meters). But, for example, the imperial road Thessaloniki-Yannitsa was grooved in the summer, muddy in winter and miserable all the time. Approaching the Serbian border, the road was barely crossed. The imperial road leading to Bitola was in a similar condition.

In the nineteenth century Ottoman Macedonia, sometimes one stumbled upon herds of camels driven by the unchanging little donkey, loaded with packages of goods, passing slowly along the road, as Gounaris (1993) envisages; horses and mules also, with similar freights; occasionally a caravan of heavy Bulgarian carts dragged by buffaloes; the wheels were never greased and they were squeaking, groaning and screeching with an unbelievable way for civilized countries.

In Southern Greece, however, there was neither rural wagon, not even the two wheeled cart; there were no roads, but only beasts of burden and paths. The road Athens-Corinth is crossed today in 1-2 hours. In the early 20th century it was 4 hours; before the construction of the railroad, in 1880, it was three days in the summer, shore to shore by the Saronic Gulf, and 4 days in winter - in groups only, in daylight, for the fear of robbers.

The other big road from Athens to Thessaloniki, which is covered today in 6-8 hours, it was 2-3 days in 1914; before the construction of the railway to Larissa, it was often 7 days in the summer and 14 days in winter, because passengers were threading along the Aegean Coast or waiting to cross swollen rivers.

In 1903, the zoologist Gottfried Stransky, from Vienna, spent three days, with the steamer of the Austrian Lloyd, to reach Saranda from Trieste. After Saranda, he spent two and a half days, riding on a horse, to get through a good and maintained road to Ioannina, as Enepekidis (1984) conveyed. In the early nineteenth century, the journey from Bitola to Skopje was 28 hours; from Bitola to Kastoria 16 hours, and to Kozani 21 hours.

Moreover, only with the opening of the Suez Canal in 1869, the distances England - India and France - Indochina were reduced by 40% and 50% respectively. In 1934, the Greek owned cargo ship St. Thalassini made two months, to get from Buenos Aires to Dakar. It took another eighteen days to arrive in Londonderry, Ireland. In 1963 the route Odessa - Cuba was taking still about fifty days. The much shorter trip from Navarino to Port Said was taking three days. The passage through Suez was three hours and fifty minutes long (Harlaftis, 2003).

2.2 An Attempt for Industrialization through Rail and Steam

In 1832, political refugees, supporters of Saint-Simon, arrived in Nafplio, Greece. The most famous of them, Gustave Eichtal, was appointed to the Finance Council of State, while Francois Grailland was the one who organized the Greek gendarmerie. These political refugees and optimists proposed to the Greek government a whole range of infrastructure projects such as the opening of the Isthmus of Corinth and the construction of roads. Saint-Simon believed that the acceleration of the transportation was the key for economic progress.

Around 1856, Greece introduced the steam shipping. The general capacity of the merchant marine fleet went from 330,000 tons in 1866, to 404,000 in 1870, while falling to 262,032 in 1875, due to the abandonment of the sail. Legislation was also introduced, to facilitate ship-owning and commerce: building and repairing ports, telegraph (1859), postal services (1862), construction of a limited road network, etc.

Furthermore, the factors that pushed road building were: economic growth, faster rates of urbanization, creation of central railways, and development of internal trade. The inhibitors were the big construction cost of mountain roads and the competition of maritime transport. Other important public works of the period were the drainage of large areas covered by lakes, the digging of the Corinth Canal (1881-1893), the coupling of the Strait of Euripus and the construction of lighthouses.

In 1835, the French Francis Feraldi had proposed the construction of the railway from Athens to Piraeus, gaining the overall approval of the press. At the same time, in England, the railway was the symbol of modern times and the synonym of development. On 16th June 1855, Mavrocordatos's government introduced the bill for the Athens-Piraeus railroad. From 1857 to 1867, four different companies were undertaking the railways task. Eventually, the railroad Athens - Piraeus was completed (8.5 km) in February 1869, within 12 years.

In August 1869, Vitalis, a genius engineer who built the line Calabria - Sicily proposed a 305 km project, which would link Athens to Thebes, Kopais and Parnassus to Kravasara in Amfilochia, where steamships would ensure connection with the Italian line. His plan, however, was dismissed as wacky, as Papayannakis (1982) comments. Proposals were rejected one after another, while the developers couldn't manage to form a company.

The political discussions over railways emerged from the following events: In the 1850s the national railway networks were formed. In the decades from 1850 to 1860, national networks were linked between each other. From the late 1860s onwards the states started seeking for new outlets in transportation.

International competition around transportation referred to two different commercial routes: a) the British-French, who reached up to Marseilles or Brindisi; and by ship to Suez, and from there to India, b) the German-Austrian line Vienna - Istanbul - Baghdad (with a deviation to Thessaloniki).

3. The Origins of the Trikoupian Positivism

In 1882, with Trikoupis' government, a decade of railways started. During this first decade (1883-1892) the average annual increase in active network was 91 km per year. In the second decade (1893-1902) the increase did not exceed 15 km per year. Thus, in 1902, a total of 1,065 km operated, whereas the final contracts for another 520 km were signed, to be constructed gradually until 1910 (65 km per year).

Those twenty years were stamped by the Trikoupian positivism, as Papayannakis (1982) noted. But Trikoupis was a political expression of a general trend of an epoch insisting in favour of progress, technological development and rational social life.

The main backer of the railway construction was the state, borrowing from foreign credit institutions and individuals (by 30%). The total cost reached 250 million drachmas. Until 1893, only 145 million had been spent, while the state's participation was 5 million per year, i.e. 5% of the annual budget or 13% of the public debt. The railway investment demanded a 2.5% of national income. 65% of the funding came from sources outside Greece (mainly English), i.e. mostly public and private loans.

Meanwhile, in 1895, a quite strange book was being published in London, unsigned: *The true history of the Piraeus-Larissa Railway and Refutation of the Published by Messrs. Eckersley, Godfrey & Liddelow, Concerning the Greek Government*.

According to the anonymous authors, the Greek government had entrusted the project to English investors who had neither experience nor the necessary prerequisites. Then, the investors assigned parts of the project to sub-investors, and they to other sub-investors etc. However, Trikoupis had treated them leniently, consenting to pay for the rails and bunks an amount of 3,000,000 francs, long before works begin.

All Greek governments of that period dealt the specific investors with the utmost mildness and indulgence, even though defective constructions were being identified in many parts of the line, as in Lianokladi. The authors of the book (*The true history,* 1895), two years before the Greek-Turkish war, catch up even to inform brokers and readers that Greek civil personnel were anxious to complete the railway taking any risk.

3.1 The construction and its results

The first five years falsified initial hopes, as only 540 km had been given to traffic. Overall, in the decade 1882-1892, some 900 km of railway lines were built. Trikoupis could not foresee that the network would take 25 years to built, and not five, as calculated.

After the bankruptcy, followed by the war in 1897 and the International Auditing, the project completed only in 1909; then, from 1901 to 1909 another 600 kilometres were built. In 1914, the Greek State had 1,371 km of railways. In March 1918, the first train from Athens reached Thessaloniki. In July 1920, the first Simplon - Orient Express was launched from Paris to Athens.

But the railroad, attracting for a short time (during construction) a large percentage of workers, could not quickly compensate the expenses made for payroll. Once recruited, thousands of workers had to be paid for a heavy manual labour; manufacturers were forced to make pauses in the progress of the projects and to expect the gradual operation of small parts of line to cover the capital deployed.

A second explanation for the lower proportion of profits refers to each and every large business. The funds of these companies are the biggest ones; but compared with the smaller funds and large (per cent) profits of small companies, the huge companies may not present big profits.

Very large companies with extremely high contribution of fixed capital, such as railways, do not yield the average profit rate, but only a part of that. Otherwise, the general rate of profit would fall even further down. This is why, in railways and other large technical systems, a great mass of capital finds a direct field of action by the form of shares.

3.2 Ports, mainland and rail

The railroad offered broad and regular transport services to scattered ports and inland towns. Thus, an important characteristic of the Greek network were the lines linking towns with ports. These lines connected: Pyrgos with Katakolo; Lavrio with Athens; Volos with Larissa; Kalambaka with Volos; Messolongi with Kryoneri; Piraeus with Patras; Kyparissia with Kalamata; Isthmus with Nafplio; Athens and Thebes with Chalkis.

Among all Greek ports, however, only Piraeus expanded largely. This phenomenon is another side of what is usually called unidirectional or uneven development. Anyway, the development of transportation infrastructure requires, among other, thriving urban centres, developed cities. But under the feudal system of Byzantium the city languished; furthermore, the withering of the city worsened by the Ottoman feudalism, with a subsequent impact on transport. For example, while in classical times the journey from Athens to Corinth was lasting two days; and while in Roman times, even with cobblestones streets, it was lasting fifteen hours, nevertheless, during the next centuries absolutely no progress was made, but, on the contrary, regression.

Therefore, ‘the effort to endow the country with roadway was able to flourish only around the small towns located on or near ports, in seafarers’ towns that live and work focusing on the overall game of local exchanges’, as Synarelli (1989) stressed.

Railroad, however, was the first utility that gave non-discriminatory, fair, broad and regular transportation to the scattered Greek ports and inland cities such as Tripoli, Lamia, Thebes, Livadia, Larissa etc. Thus, not only met local development needs of coastal areas, but offered a serious network of concentration and coordination of the ‘backbone’ of the country.

3.3 Banks and Ship-owners

Not only ports, islands and towns changed, but also villages, countryside, agriculture, manufacture and trade were being also metamorphosed. The change in circumstances with the appearance of the train offered illustrious images: ‘Perhaps the same people - or at least the same type of entrepreneur - who a few years ago invested part of their funds in a small steam mill or olive press, or even spinning manufacture, now they build these big depots along the railway line, where the selection of qualities, the weighing and packaging of raisins take place’, as Agriantoni (1986) elucidates.

Papayannakis, moreover, identifies two additional reasons that accelerated the construction of railways in late nineteenth century Greece: a) The phylloxera epidemic in the French vineyards was pushing France to request raisins for their cheap wines. This event opened up a huge market from 1872 to 1892. Thus, the production and export of raisins, which constituted the bulk of Greece’s total exports, increased dramatically. b) The economic crisis that broke out in 1873 and contracted the global economy over the last quarter of the nineteenth century, although enforcing political isolationism and aggressive imperialism, turned, however, investments towards new markets and innovative profitable placements. Hence, an investment shift was directed to the dependent countries, where interest rates were 5 or 6 times larger.

This development led to place funds in the form of loans in dependent countries such as Greece, and support their industrialization. Lending to the Greek government is, nevertheless, characterized as ‘predatory’ by Dertilis (1977). Clearly, there was a flow of funds to Greece and, despite the difficulties in the years 1883-1888, development started because of the opening of the Suez Canal in 1869, the Corinth Canal in 1891, the international trade, e.g. export of Ukrainian wheat in Greece, and the further increase in commodities exchanges. This progress contributed to the creation of a new ruling class, consisted of steam-ship owners. Meanwhile, the global recession and the foreign trade crisis had the paradoxical effect of creating for the first time a domestic market in Greece, facilitated in 1884 by a tariff war.

However, resale economy and imperialism maintained their significance for the country: From 1881, banks in Frankfurt and Dresden involved in major railway loans. Ottoman Greek businessmen participated also, such as Syggros, who built mines and railways and established banks for the control of credit and public annuities.

Simultaneously, around 1904, Germany managed to create another pole of influence in Greece, through the collaboration between Deutsche Bank and National Bank of Greece for the joint establishment of the Bank of East; an ambitious investment program that extended beyond the Greek territory, throughout the Ottoman Empire and the Christian Balkans, claiming to jeopardise the leadership of Great Britain and France, as Moskov (1978) insisted.

4. Evaluation of the Greek Railway Project

After a short period of growth, the average number of passengers per kilometre remained remarkably stable; the volume of goods transported per kilometre showed a slight upward trend; the average distance in transfers remained stable, both for passengers and for freight. The mobility was decreasing in the hinterland, regarding both passengers and goods. With the exception of exportable commodities, the transported goods consisted of surplus production and the minimum necessary for survival goods that could not be produced by the village. All these indicate that the Greek province had not yet been liberated from pre-capitalist relations, such as the small family farm, the home consumption, the limited exchange relations and low mobility.

In the late 1880s to 1890s, the military and railway activity delimited the available funds. There was also the factor of the lack of raw materials. At the same time, from the early 18th century until the 19th century, the English iron production became twentyfold bigger and the Belgian tenfold. On the contrary, in Greece, the construction of railways didn't fulfil the purpose for which it was decided. In developed countries, in the third quarter of the nineteenth century, the construction of railways contributed to capitalist transformation and industrialization. In Greece, however, the majority of raw materials were imported, and also the technicians were French and Swiss.

Dertilis (2005) saw this irony in the myth of the Greek Railways: such an investment could not become productive, since Greece does not have enough iron and coal to generate network industries and rail materials. In fact, many historians, such as Dertilis, believe that shipping competes, degrades and defeats trains.

Of course, this is a false and careless remark, since: a) Shipping only benefits could derive from the extension of the railway. b) Competition may be well managed to prove beneficial. c) The modernization procedure is - first and foremost - synchronization of the production and transport.

But how could we explain this miscalculation? Dertilis believes that the funds invested in the railway halted the capacity of the Greek commercial fleet from 1860 to 1901. Thus, he underestimates the great feat that was achieved during that same period, i.e. the transition from sail to the steam. The defectiveness of his analysis is clearly illustrated by his claim that the most promising area of the Greek economy [shipping] and the wealthier segment of the domestic bourgeoisie [the ship-owners] were sentenced to a long hibernation by the appearance of the railway!

However, it is completely misleading and simplistic to identify and isolate a supposed issue of unfair competition between rail and shipping. The fleet of steamships was growing rapidly: 8,244 tons in 1875, 44,500 tons in 1890, 144,975 tons in 1895, 492,500 tons in 1914 and 893,650 tons in 1915, corresponding to 475 ships. A partnership with the railroad, both in Greece and in the Mediterranean, only positively might motivate the shipping business.

5. Railway: The First Large Technical System

The railroad had a vital role in the emergence of the new industrial world. It was the first large technical system. The term Large Technical System (LTS) denotes elaborated and vast technological networks, which are broadly disseminated in space, acquiring a complex social and technical character; for example, electricity, railroads and telephone networks. These systems include industrial companies, utilities, investment banks, books, articles, academic teaching and research programs, legislation, natural resources, raw materials, coal, turbine generators (turbo), transformers, transmission lines, etc.

In the generalized model of the LTS there are three main phases: The first phase begins with a radical invention, supplying new technological systems, which are developed, mainly with public access and integration in the economic and political field, in order to become viable. During the invention and development phase, the inventors - engineers solve critical problems. This first phase ends with the promotion of innovation in such a way that it acquires effective use. The second phase, which may occur at different times in the entire history of the systems, is diffusion. The third phase maximizes systems through competition and stabilization, which means: Rationalization, Effectiveness, and Intensification of capital.

During innovation, competition and maximizing, the manager and the engineers take crucial decisions. Later however, during stabilization and rationalization, the funders - engineers and the consulting engineers, especially those who have political influence, often solve the critical problems associated with the size and momentum of the system (Joerges, 1988).

The development of large technical systems, hence, introduces many different factors into play and especially large-scale factors, such as equity funds, banks, and governments. These inventors, organizers, and governors of technological systems prefer more hierarchy, so the schemes tend over time towards a hierarchical structure.

The large technical systems are social constructions but, simultaneously, they formulate society (Cooper, 2011). This is also a belief of the engineers, who related apprenticeship in engineering education with the work of engineering and human relations (Quinn, 1998). A similar view of the function of the LTS is presented by Edward W. Constant II (1987). Technological knowledge is in the hands of the community. Collectives of artisans and other professionals may work together to create a system. The completion of this multifaceted process involves a complex organization, which the author identifies with techno-structure, theoretical term introduced by John Kenneth Galbraith (1967).

We can find a primal depiction of the aforementioned concepts in the works of Grenville M. Dodge and his associates (Dodge, 1910). In his book *How we built the Union Pacific Railway*, he describes, with a rough vernacular, the stages of the expansion of the railroad in the U.S. In the photos included in the book, we can see the huge bridges and other structures, but also the fiery look of the creative leading builders of the railway.

Dodge was one of the most important railwaymen in nineteenth century and Chief Engineer of the Union Pacific Railway from 1866 to 1870. He supported the construction of the project by the state and met, for this purpose, with President Lincoln. The president promised to help and support but did not want to fund it. Finally, this railway was constructed privately.

The contemporary themes of historiography around the large technical systems are very broad and diverse; including problems of detection of risks that could be caused by technology; problems of governance and control of technical systems, of energy policy, defence issues, safety of flight, computational technology; and they are extended to many other areas of development of technological systems.

5.1 A construction shift and a revolution in the perception of time

Modern rail transport is the result of a long process of network development and processing of individual parts such as rails, stations, wagons, traction, signalizing devices and media. Mining, metallurgy and large-scale industry are closely linked to the beginning of the railway. Apart from fuel and water, railways use tons of metal, especially iron and steel.

During the interwar period, iron was being imported from Belgium, where prices were cheap and machining facilities very young. In the late nineteenth century, steel became replacing iron. This does not mean that innovation always enters properly and according to the needs. The modernization, for instance, was satisfactory in signalizing, which became effective in the twentieth century. But in the case of brakes, innovations were not progressing: In 1893, 90% of U.S. freight wagons lacked the appropriate air brakes. In the event of a decoupling of wagons, the air pipes were cut and the brakes were not working in the decoupled part of the train.

With railroads, the need for fast transmission of information intensified. The electric telegraph was born to respond to the requirement to control the movement of trains. The first railway telegraph was installed at the Great Western Railway of Britain. In 1842, the Great Western Board ordered an advanced telegraph. Around 1848, 1,800 miles and 200 cities had been covered by the Great Western Telegraph in Britain.

Samuel F. B. Morse built the experimental telegraph in 1844, along the railway Baltimore - Ohio. However, the manager of the company treated him with suspicion. In 1849, in Erie railways, Charles Minot tried to build the telegraph line New York - Erie. But his successor, Daniel McCallum, tapped fully and highlighted the importance of the telegraph for railway. In France, the electric telegraph was first tested at St. Germain. In fact, electricity was introduced in France with signalizing.

The telegraph was associated with another change brought by the railroad, a revolution in the perception of time. Watches existed for centuries, but before nineteenth century, the concept of fixed (standard) time was not yet introduced. Meanwhile, Hans Christian Andersen argued that the railroad was a 'magical horse' disappearing space. The abbreviation of space by time should be one of the most popular concepts of the nineteenth century.

In fact, the 'fixed time' was an invention of the railroad. Timetables with arrivals and departures were fundamentally important for the railways and became a necessity for passengers. Especially when commuter trains emerged in the urban centre of Boston. The result of all these developments was that in 1849 all railways were synchronized with the so-called 'Boston time'. Later, on November 18, 1883, six hundred civic railroads abandoned 53 different arbitrary times and adopted a fixed train time with the, familiar to us, time-zones (Salsbury, 1988).

5.2 Diffusion in the Age of Steel. Globalization

The British transport policy until 1830 was organized mainly around the family and the local community, developed along the canals financed by local businesses, without any homogeneous urbanization. But in the middle of the Victorian Era, the railways became the emblem of managerial capitalism, in which ownership and control were completely separated.

In England, by 1830, there were already 1,500 miles of railways. In 1837, the Grand Junction Railway started up, and in 1838 the company line London - Birmingham. The first line-trunk to Scotland opened by the Edinburgh - Glasgow line, in 1842 (Ransom, 1998). The British network reached 2,570 km length in 1842, and 9,790 km in 1850. But only in the late nineteenth century, a complete and increasingly urbanized society of big cities became manifest. Then, the railroad was incorporated in the body of a new compensatory culture, coinciding with the emergence of significant social forces, expressed clearly and visibly in the reforms of 1832 and 1867 (Freeman, 1999).

On the other side, the special case of the Italian railways shows all the characteristics of romantic optimism in favour of national progress and prosperity. With railways, the Italians hoped to increase national income, gain internal integration and bridge the gap between rich north and the poor south, altogether with integration and inclusion of Italy in the group of large economic powers of Europe.

During the 1860s the Italian Statistical Office, led by the internationally recognized statisticians Pietro Maestri and Luigi Bodio, began collecting information for development in the Italian region. The same time, in Lombardy, farmers were investing in improving their crops and researching on advanced agricultural practices (Schram, 1997).

In the first decade after unification, benefits from access to the Italian market were mainly gained by the rich regions of Lombardy and Piedmont. On the other side, the small population and the small number of cities in the south prevented the thickening of the railway network. In 1885-6, there were 4,022 km of railway lines, in the south of Italy, and 45,914 km of roads; while in the limited centre of the country there were 2,176 km of rail lines and 23,612 km of roads, and in the north 5,004 km of rail lines and 61.241 km of roads. Italy, quite early, in 1905, nationalized its network.

In the USA, after the war in 1812, the successors of Jefferson, Madison and Monroe, had doubts about whether the Constitution allows the Federal Government to participate in the construction and operation of canals and main roads. Therefore, such plans were left to the states. By the time the railways were becoming an alternative means of transport, many states experienced financial difficulties with overly ambitious plans for canals. Hence, the vast majority of the first railways were the result of private efforts, sometimes undertaken in partnership with local cities or occasionally in collaboration with local governments (Salsbury, 1988).

In the 1850s, the public railroad in the U.S. had four trunk-lines: Baltimore - Ohio, Erie, New York Central and Pennsylvania. The first two, were receiving direct government support at the start. The railroads were promoted because they acquitted merchants from expenses to carry from ship to ship, canal, lake or river. By 1860, 48,000 km of lines had been built in the U.S. and in 1869 the line Council Bluffs, Iowa - Sacramento, California was built, from the shore of the Pacific to the Atlantic.

Nevertheless, in England, before the eruption of the scandals with railway shares, the financial participation of the state was brushed aside as unnecessary; in France the state started the project and cooperated with private capital. In 1842-46, 50% of rail investment in France was made by the English capitalists of the company London & South Western.

In Belgium, the young state took only the construction, as in the multi-divided southern Germany. In Prussia, however, the initiative belonged to the private capital. In 1855, Germany had 7,500 km of railway, mainly public.

The nationalization took place in 1875 in Bavaria, in 1876 in Saxony and until 1887 in Prussia. In Austria-Hungary also, the state eventually prevailed. Meanwhile, the railroads appeared in other countries: Switzerland's first line, with a length of twenty-four km, from Zürich to Baden, was opened in 1847. In Russia, in 1847, St Petersburg was connected to Moscow. In 1854, steam railways opened in India and Australia.

The first railway line in Japan, connecting Tokyo with Yokohama, 27 km, opened in 1872. Although this country lacked heavy industry, in 1907 Japan had already acquired 10,760 km of railways and 2,000 locomotives. Japan accomplished also to manufacture its own steam engines, thus in 1915 stopped nearly all imports (Ransom, 1998).

In August 1895, with the introduction of steel, the average speed of the train London-Aberdeen reached 63.5 miles per hour. The maximum speed was being developed in Wellington, reaching 100 miles per hour (Bond and Nock, 1975).

6. Conclusions

Mobility and Globalization became and remained permanent characteristics of the Industrial World. An environment without mobility had already been unconceivable. The role of Railway was critical to this transformation. Railway mania, looms, banks, bonds, urbanization and liberalism were openly interrelated throughout the industrial era (Wallerstein, 2011). The centralisation of the modern states, e.g. the USA, with the intra-city transportation, the bridges, the train-ferries and the telegraph, were also business and products of the Age of Steel and Railways (Martin, 1984).

On the contrary, the backwardness of underdeveloped areas such as Eastern Europe was evident until the liberation of the serfs and the participation in the international trade, after the construction of the railway network. This also caused a shift from wine to grain production, which made Budapest, together with Minneapolis, the world's largest milling centres (Chirot, 1991). However, bureaucracy and military expenditures prevented the expansion of the railways network.

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