IOAN CUNCEV, member of management council of the AGIR, is senior researcher and a corresponding member of the Academy for Technical Sciences of Romania. His activity is focussed on transport research, projects management, and management of the organizations. He initiated and managed projects regarding logistics, business process reengineering, SME development, European integration of Romanian companies, reengineering and modernization of companies, transition of transports from the modal competition to the integrated multimodal systems, organization and optimization of transport flows, development of intermodality, development and management of the infrastructures, terminal and logistics centres, intelligent use of systems, new technologies, sustainable mobility etc. He elaborated and published over 400 projects and papers having as a main theme – logistics and transports, but also with theoretical developments in the areas related to these.

Resumen

Ya en tiempos antiguos, el Danubio era una especie de corredor que estimulaba y facilitaba el desarrollo socio-económico, el comercio y la movilidad; un canal de intercambio y civilización, que puede servir como ejemplo para las nuevas investigaciones y que debería conducir a una progresión continua del destino natural del Danubio hacia Europa. El emperador romano Trajano creó una conexión directa multimodal (vía de navegación fluvial y terrestre) entre la zona septentrional del mar Adriático y el mar Negro, que incluía el Danubio. Tal vez sea éste el primer corredor europeo, cuyo extremo oriental (el valle de Axios-Carasu) constituye el precedente del canal Danubio-mar Negro que se construiría dos milenios después. En la actualidad, la relación navegable entre el mar Negro y el mar del Norte atraviesa varios países que cuentan con redes de infraestructura de transporte muy desarrolladas. A este respecto, es necesario promover las capacidades intermodales y multimodales del enlace mar Negro-mar del Norte, en un concepto logístico.

Palabras clave: Corredor; navegación fluvial; Danubio; intermodal.

Abstract

Since ancient times the Danube was a sort of corridor that stimulated and facilitated socio-economic development, trade and mobility, a waterway of trade and civilization, which may be a lesson for new researches that should lead to the continued in development of the Danube's natural destiny toward Europe. The Roman emperor Trajan performed a direct multimodal link (inland waterway and terrestrial) between the north area of the Adriatic Sea and the Black Sea, including the Danube. This is perhaps the first European corridor whose Eastern end (the Axios-Carasu Valley) represents the forerunner of Danube-Black Sea canal that would be built two millennia later. Nowadays the Black Sea – North Sea navigation link crosses several countries having strongly developed transport infrastructure networks. In this respect, it is necessary to promote the inter- and multi-modal abilities of the Black Sea-North Sea link, in a logistics concept.

Key words: Corridor; inland waterway transport; Danube; intermodal.

Danube, a corridor from past to future

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The connection of the Danube-Black Sea Canal and of the Maine-Danube Canal to the waterways of the Danube, Maine and Rhine enabled conditions to create the Black Sea – North Sea navigation link. This link crosses several European countries having strongly developed transport infrastructure networks. In this respect, it is necessary to promote the inter- and multi-modal abilities of the Black Sea-North Sea link, by which the whole social-economic activity of its influence area would be stimulated. It means to achieve the characteristics apropriate to the concept of the corridor: traffic fluency along the corridor, intermodal connections and facilities of multimodal transports, warehouses and centres for traffic concentration and distribution, centres for maintenance, trade facilities, free zones, banking and insurance centres, information technology and communication centres and networks, track and tracing systems, hydro-meteorological forecasting network, harmonised regulations, joint solving of ecological problems etc.

The achievement of the complete door-to-door logistics chain in the influence area of the corridor, even from the technological process to technological proces, requires a friendly business environment, which should facilitate the correlation of transport participants' actions, starting with producers, intermediates and auxiliaries that contribute to the development of logistic stages, and ending with the consumers of transported products.

The necessity of co-operation among participants in transports development may be summed up in a multitude of problems which are solved in this way. Among these, there may be: the reduced flexibility of a single transport mode in the achievement of the entire logistics chain, combining long distance transport

Transportes, Servicios y Telecomunicaciones, julio 2006,
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with local delivery/collection transport, the presence of natural communication ways on water courses of the corridor which cross continental roads and railways, the fact that consideration of transport costs and energy consumption (which differ from one transport mode to another) may be achieved by intermodality etc. Co-operation within the corridor represents a solution for the mutual compensation of economic difficulties and taking over the supply and demand fluctuations.

Cost of transport between Rotterdam and Central Europe (DM/t)

Origin/Destination	Road	Rail	Inland Waterway
Vienna	110.62	124.77	64.47
Bratislava	110.62	126.54	69.01
Budapest	123.90	134.50	72.56
Belgrade	188.50	151.31	77.87

Source: ECMT – RT 108

Joining of some partners from various geographic areas of the corridor- for example, one on the Rhine and one on the Danube- provides a greater stability of services performed, because it is unlikely that transport demand fluctuations occur in both areas at the same time.

The Black Sea-North Sea corridor was first proposed in 1989 and it referred to the influence area of the Rhine-Maine-Danube navigation link/5//6/. Thereafter, it was officially introduced in Trans European Networks at the conference of Crete, but related to the Danube only.

The History tell us that the Danube was a sort of corridor that stimulated and facilitated socio-economic development, trade and mobility since ancient times. This is the denomination it was given – " the way of trade and civilization" in international transport, which may be a lesson for new researches that should lead to the continued in development of the Danube's natural destiny toward Europe.

1. First continental links of the Danube

The geographer Strabon tell us: "The upper course of the river is called Danubius and it mainly flows through the Dacians' country; the lower course, up to Pontus Euxinus and in the vicinity of the Getic people, is called Istros". The Greeks, who knew it climbing on the lower course, before the Romans, gave its Thracian-Getic name coming from the Indo-European: sreu – the one which flows, that is Istros. The Romans, who met it first on the upper and middle course, assigned to it the name Danubius, which may have been taken over from the Celtic population who called this river Donaris. We are talking about two different names for two distinct parts of the same river, separated by a natural obstacle – the Iron Gates Rift with its cataracts.

The Romans considered as a problem to be solved, the barrier to navigation of the Iron Gates, which compelled them to divide their military into two: on the upper and middle course - Classis Pannonica, and on the lower one- Classis Moesica. After Trajan built the Fossa Traiana canal, linking the two water courses (at the same time as the roadway following the river, hanging over the river on wooden planking at Cazane), this fleet was effectively unified. This was the first step toward what we will hereinafter call the "Danube corridor".

Over the Lower Danube, at a ford in the river, was also built the first bridge made up of vessels joined together. According to Herodotus, around the Dobrogean ford on the Danube from Isaccea, around 100,000 soldiers of the Darius's army were transported on the Danube with 600 vessels in order to conquer Scitia in 513 B.C. He set ashore at Isaccea, where he built a bridge of vessels in order to cross the Danube for the South of Basarabia. We could consider the Roman cities on the Lower Danube, together with the older Greek towns and Getic-Dacian settlements, as intermodal nodes of the Danube's corridor.

At the beginning of the second century A.D., the Roman emperor Trajan decided to invade Dacia to the North of the Danube. For this purpose, with the architect Apollodor of Damascus, he finished the highway along the Danube, crossing the area Clisura, a road that Tiberius had began, but was abandoned by Vespasian. He by-passed the cataracts barrier of the Iron Gates, called by natives Gherdap, by building a canal with paved borders, the Fossa Traiana, on the right bank, which allowed the unification of the two military fleets, as mentioned above. According to Ion Ionescu /8/, the Roman canal, fig.1, which existed until 1895, was 3200m in length and had dykes 14m high.

The same architect built the well-known bridge over the Danube at Drobeta, which is depicted on Trajan's Column in Rome, fig.2.

Fig 1. Iron Gates canal (1890-1896) and the vestiges of Roman canal /7//1/

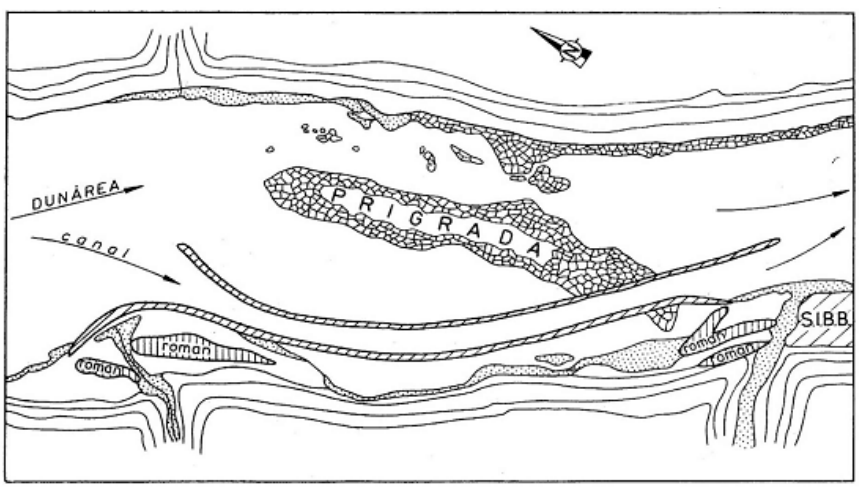


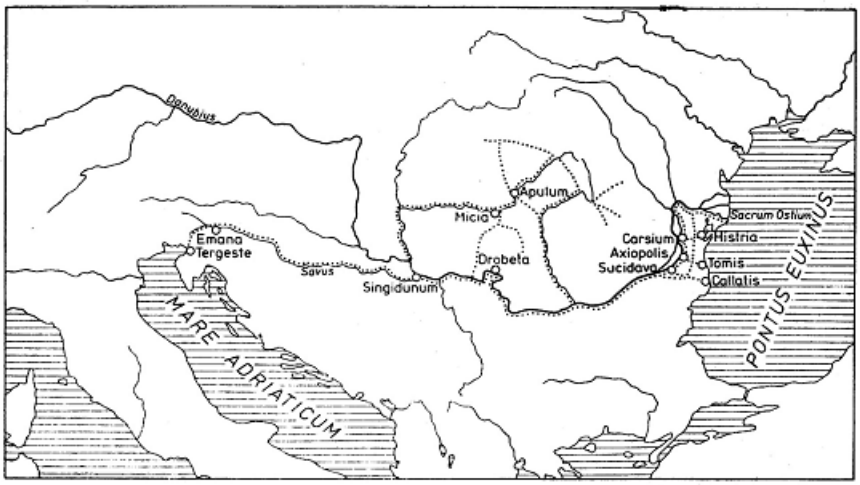
Fig 2. Inaugurating the Roman Bridge at Drobeta (Trajan´s Column, Rome)

Moreover, with these works, completed with the road that was following the right bank of the river and with the navigation canal in the Axios-Carasu Valley, from the ancient Axiopolis (Cernavoda) on the Danube to the Black Sea, near Tomis (Constantza), Trajan performed a direct link between the north area of the Adriatic Sea and the Black Sea. This multimodal link (inland waterway and terrestrial) is perhaps the first European corridor, fig.3. The road had two short transhipments, first between the Adriatic and Ljublianica, an effluent of the Sava, and the second in the Eastern end of Axios-Crasu Valley, which represents the forerunner of Danube-Black Sea canal that would be built two millennia later.

Later on, the intermodality of the Danube was increased when the railway was born. The first railway line of the actual Romanian network, opened in 1854 on the route Bazias-Bela Crkva-Jasenovo-Iam-Racasdia-Oravita /9/, was dedicated to the multimodal transport of the coal from the Anina area to the Vienna by rail and waterway transport with an intermodal transhipment in Bazias port.

Similar, in the passenger transport, it could be exemplified with the trains time table Paris & Londres – Constantinopole (1861), edited by the Chemins de Fer de L'Est et du Nord, which mentioned that the passengers could travel from Paris to Vienna throuth three different railway routes, in about 39-40 hours. From here they could continue their travel to Constantinople on railway route Vienna-Bazias (18 hours and 18 minutes), then sailing on the Danube from Bazias to Cernavoda in 36 hours and 30 minutes, Cernavoda-Constantza (6 hours) and finally, sailing on the Black Sea from Constantza to Constantinopole (24 hours). Thus, it results a multimodal chain between Paris and Constantinople on railway, Danube and Black Sea.

Fig 3. The old Roman multimodal link between the Black sSea and the Adriatic Sea



Coming back to the ancient time, the Roman Empire was the only one, which dominated the Danube's entire course, and raised for the first time the idea of a link between the North Sea and the Black Sea, by connecting the Danube with the Rhine.

Associations of sailors (nautarum) and rafters (utricularii) are epigraphically attested in several ports of Dacia, and at Axiopolis, at the entrance into Axios-Carasu Valley, a navigators' association from the Lower Danube's course (nautae universi Danuvi) is mentioned /1/.

In the period following Aurelian's retreat from Dacia, the Danube was used by migrating people, without ruling it, as an access way between the East and the Centre of Europe.

From the outset of the Eastern Roman Empire, the limit of Constantinople's interests was in the Lower Danube region. Byzantine Christianity was developing on the background of Greco-Roman commercial and military traditions, revigorated between the VI-th and IX-th centuries by Danubian ports, followed by the highest level of the Byzantine power on the Lower Danube during X-th and XI-th centuries.

The European calling of the Danube was also developed by Genoa in XIII-th and XIV-th centuries, Mediterranean Sea and the Sea of Pontus Euxinus, the real Signora del Mare according to what the Italian poet and humanist Francesco Petrarca was saying.

In those times, a very important road at the continental scale and which was in direct contact with the Danube corridor linked the Black Sea and Balkans with the Baltic Sea passing through Lvov. Romanian principalities facilitated these continental links, which are still present, as then. For example, Alexandru cel Bun granted on October 6, 1408, a privilege to Lvov merchants allowing them to sell

their merchandise in Moldavian towns and to transport through Moldavia the goods bought and brought through the ports from the Danube's many branches. Also, an understanding related to navigation on the Danube was established in 1409, between Mircea cel Batran, the Prince of a Romanian County and the King of Poland, Vladislav, who allowed Lvov merchants to buy and sell goods in all Danubian ports from the Iron Gates to Braila. For this reason, we think that a future official European corridor could be promoted to facilitate the historical traditional flows between the Black Sea - Balkans area and the Baltic Sea, passing through Constantza and Danubian ports and continuing through Iassy, Cernautzi, Lvov, Warsaw, and the Baltic Sea.

When the Turks conquered Constantinople, they became sovereigns of the Bosphorus and Dardaneles and introduced restrictive measures for the trade and navigation in the area. Under the leadership of Mahomed II, the Turks continued to conquer the Black Sea basin, trying to dominate the cities within this area. With the peace treaty of Karlovitz (1699), Turkey was obliged to leave some of the conquered territories, and Austria extended its dominance upon the Danube's middle course, which determined that at the beginning of XVIII-th century, the two powers dominated navigation on the Danube in different parts. To this was added Russia, which by the peace of Kuciuk-Kainargi of 1774, secured the freedom to navigate and trade in the Black Sea, also through straits.

2. Need for international regulations

The conflicts of interest between the great political powers raised the need to solve the problem of navigation freedom on international rivers, and its establishment in an international document. For the first time, the great European powers took a joint decision related to navigation on international rivers, using the opportunity of the treaty signed on May 30, 1814, which provided the freedom of navigation on the Rhine for all countries.

The problem of navigation on the Danube was discussed in 1855 at the Conference of Vienna. It was here decided that the principle established by the Congress of Vienna of 1815 regarding the freedom of navigation on international rivers be extended without any restriction to the Lower Danube, as well. In order to apply these clauses, article 16 of the treaty of Paris provided the establishment of a European Commission, which consisted of representatives from England, France, Austria, Prussia, Russia, Sardinia and Turkey. Its missions were to perform the necessary works from the river mouths up to Isaccea and to supervise so that the principle of free navigation is observed.

As a result of the improvements brought to navigation, the number of cargo and passenger ships sailing on the river increased. In 1857 there were around 2500 ships with 350,000 tons, while in 1860 the port of Sulina handled around 3500 ships with 558,000 tons /3/.

On July 13, 1878, by the Treaty of Berlin Romania was acknowledged as a member of the European Commission.

Following World War I, on August 2, 1920, in the hall where the Treaty of Paris had been signed on March 30, 1856 (which laid the bases of the international regime of navigation at the Danube's mouths), opened the international conference that was to establish the political-juridical statute of the river along its entire length of navigation way.

The convention of the Danube's statute was signed on July 23, 1921 by representatives from England, Belgium, Czechoslovakia, France, Greece, Romania (countries which participated in the conference with deliberate right to vote), as well as representatives from Bulgaria, Hungary and Austria. Navigation on the Danube was free of charge, excepting the segments of the river where great construction projects were necessary.

Riparian states established at the Conference in Belgrade of 1948, a new political-juridical regime for the Danube, which provided the freedom to navigate for all merchant ships and equality of treatment for all flags.

History has also shown the need to consider in an integrated concept all waterways of the Black Sea - North Sea navigation link as a preliminary stage in the prospective achievement of Pan-European inland navigation network. In this respect, a transitional institution, which would harmonise the two commissions of the Danube and Rhine, may be necessary.

3. Danubian transport and trade

Riparian states have always understood the Danube's importance. For this reason, they have developed the necessary infrastructure both for river transport and for the co-operation with other transport modes. In the same way they have built fleets for inland waterway transport. For example at

Fig.4 The average yearly traffic on the Danube (mill. tons)

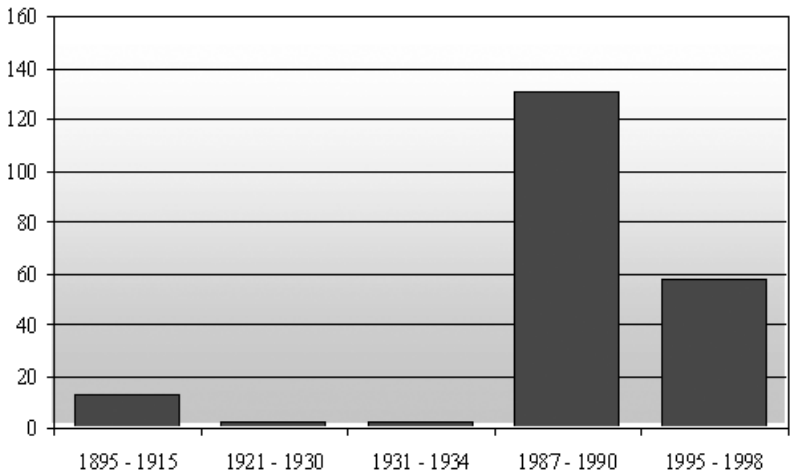
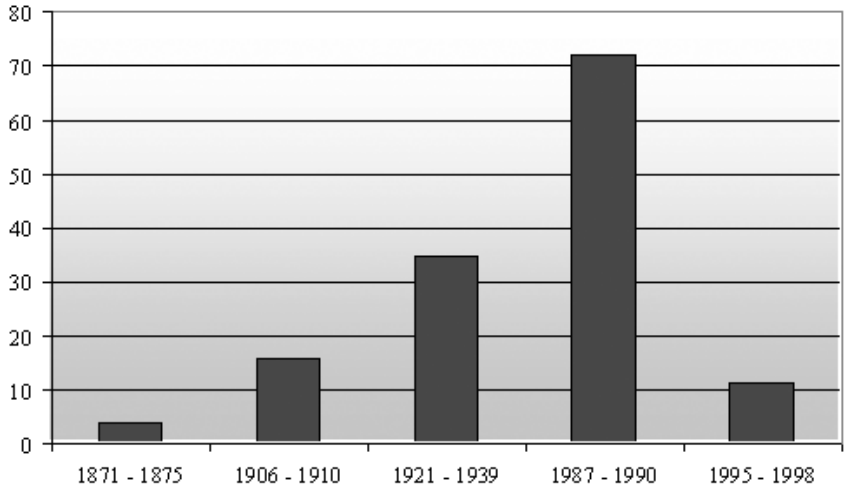


Fig.5 Total traffic over the Sulina barrier in different periods (mill. tons)



the end of the XIX-th century, Romania created the transport service on the Danube, Romanian River Navigation (SNR), which before World War I already owned 14 tug boats, 13 passenger ships, 14 oil tankers and 108 barges totaling 80,000 tons. Aware of the importance of commercial fleets on the Danube, the Romanian historian Nicolae Iorga said: "Do we want the Danube? Let's work, save, and cover the great river with vessels, carrying the product of national labour".

The modal split on Romanian foreign trade - 1910 (tons)

	Import	Export
Danube	382,452	3,189,530
Constantza	159,625	1,009,171
Rail	229,458	280,226
Total	771,535	4,478,927

The potential of the Danube as an international corridor is clearly expressed by the volume of goods transported through the Iron Gates, fig.7. For example, if during 1906-1910 only 2,669,963 tons passed the Iron Gates, in 1920–1925, the goods transported through this sector increased to 3,198,011 tons, in 1926-1930 were transported 6,857,282 tons and during 1935-1939 their quantity increased to 11,348,852 tons.

Fig.6 Romanian inland waterway transport (mill. tons)

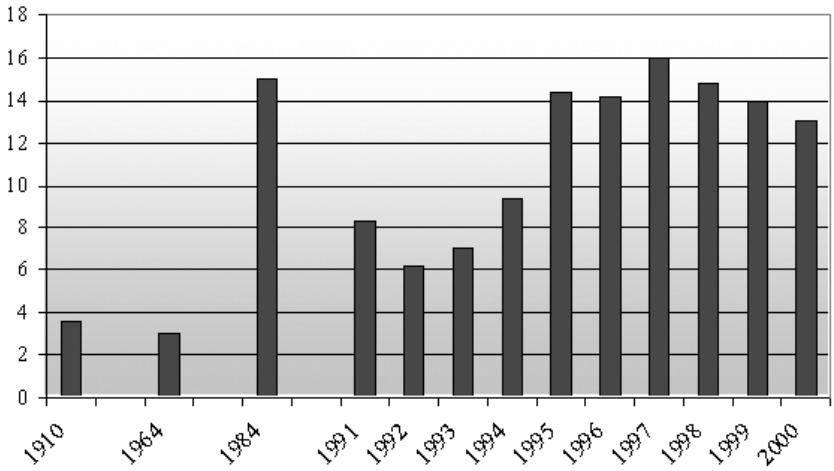
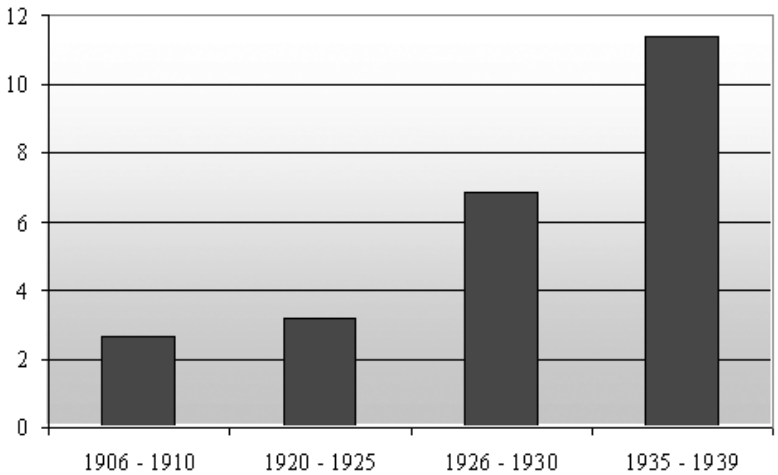


Fig.7 Traffic volume through Iron Gates (mill. tons)



Ship`s flags on the Danube /3/

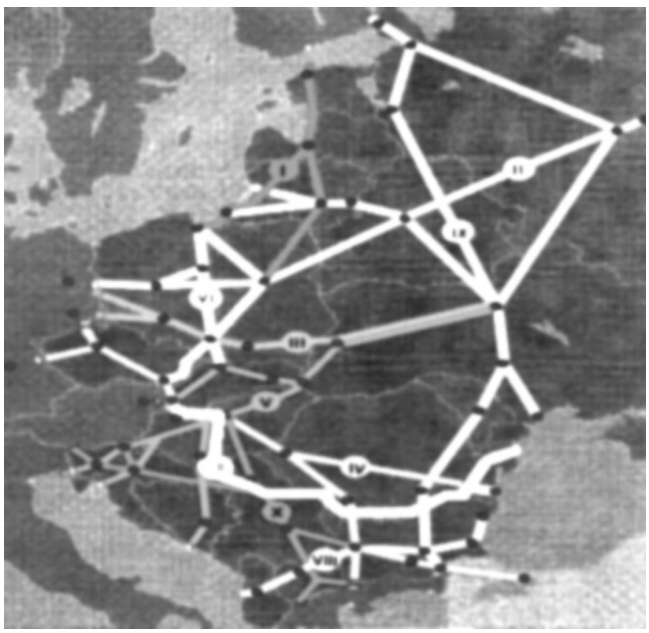
Country	1911-1920	1921	1938
England	32.52	29.95	8.70
Austrian-Hungary	13.16		
France		11.54	0.70
Germany		-	7.30
Greece	19.2	11.96	30.40
Italy		14.89	20.50
Romania	6.99	8.93	20.60
Turkey		0.01	0.33
Hungary		-	1.19
USSR		0.93	0.78
Other countries		21.79	9.50

4. Intermodality as a driving force for networking

A strong cohesion factor comes from the modern transport technologies, which require and enable the intermodal transport (containers, swap-bodies, ro-ro etc.) in in the sense that they separate the vehicle from the freight unit, make uniform and typify the handling and storing facilities which transfer the freight between modal networks. Although important steps have been made in road and railway containerisation, there are still many things to be done in order to generalise this transport technology, especially on the waterways of the Black Sea – North Sea link. This last remark is valid especially for the Danube riparian economic zones, mainly due to the insufficiency of infrastructures, to the reduced number of river terminals etc. In this respect, it is necessary to eliminate these deficiencies, although they involve heavy investments. For instance, increasing the number of container terminals or logistics platforms alongside the corridor can stimulate the container traffic through its potential attraction. Significant is the precedent on the Rhine, where a large number of new terminals putting into service starting in 1980, led to the change of the container traffic dynamics, by raising the growth rate against the preceding period and the world level, as well. Although an intermodal terminal taken separately does not represent much, a multitude of terminals represents a system structure generating traffic flows of intermodal loading units (ILU), regular lines, associations of forwarders and carriers, networks of enterprises for building and repairing of ILU and specialised transport and handling means, intermodal port services, and a large variety of regional and international forms of co-operation.

The intermodality of the Black Sea – North Sea Corridor has a systemic interdependence with the seaports located at the ends where there is a tendency for concentrating even larger consignments of containers, swap-bodies and other logistics boxes in accordance with the growth of the transport capacity of ship-carriers. An influence is due to the inclusion of some of these ports among the ports of call of the overall container sea services including round-the-world services. The Black Sea – North Sea Corridor itself will witness new organising systems of intermodal transport through the development of river ports and railway terminals as concentration junctions of the traffic towards the seaports located at the ends or towards other continental corridors and routes. In their turn, these junctions will be attended by feeder and intermodal cooperation services. The regular and stable services on the transport chain interact with the increase of the demand for these services. Although the regular service of ILU can operate with a deficit in the beginning, it must be sustained because it will gradually win the confidence of the customers, thus contributing to the extension of these technologies in the corridor area (corridor effect). The initial difficulties of the regular service, as well as their further stability can be solved in a most favourable way, only by co-operation of the logistics factors involved in supply chains. Intermodal and logistic co-operation is all the more necessary if we take into account the fact that the Danube crosses most European corridors, as one may also notice in the map in fig.8.

Fig.8 The Danube as a member of Helsinki Corridors



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