

Chapter 2

Infrastructural Integration in the Nineteenth Century

2.1 Context

In the second half of the nineteenth century international relations within Europe were shaped by nation-states. The years between 1830 and 1871 saw the foundation or international recognition of six new countries—the German Empire, Italy, Belgium, Greece, Serbia and Romania—followed by Bulgaria, Norway and Albania in the next four decades before the outbreak of the First World War. The international relations between these nation-states were both antagonistic and cooperative. There was no longer a superimposed rule or hegemon, but a group of technically equal ‘sovereign’ countries. The settlement agreed at the Congress of Vienna had been based on a multilateral regime of treaties intended to ensure a balance of power or a ‘Concert of Europe’, but the emerging middle classes in particular believed it could no longer guarantee a stable coexistence of constitutional nation-states with increasingly close economic ties. With some countries’ ambitious plans to expand their political power base the strain on international relations increased further. While the Revolutions of 1848 produced no fundamental changes, they built up pressure to establish regulations, resulting primarily from the growing tensions between two opposite concepts: the state, which increasingly pervaded all spheres of life, aspired to protect the ‘nation’ against external threats by establishing borders and representing it abroad. By contrast, the ‘national economy’ became more and more dependent on economic relations with other countries and would have liked to remove barriers to cross-border trade. A new ‘internationalism’ developed, resulting both in a growing number of intergovernmental events, arrangements or agreements and in intensified cross-border contacts on a transnational level. It was perhaps the latter that marked the real change compared to the previous era of traditional diplomacy. The growing socioeconomic ties opened up new perspectives that would also impact international relations.

The international regime in the second half of the nineteenth century was characterised by these elements:

- (1) The nation-states were not prepared to enter preventive multilateral commitments or agreements. There was no jointly exercised responsibility for Europe. By contrast, the nation-states practiced a form of collaboration which resolved issues pragmatically and on an ad hoc basis. This resulted in a mesh of bilateral relations, but these were not based on any purposefully established intergovernmental or supranational structure. Bilateral agreements were made to govern political as well as economic and social relations, so in this sense it is valid to conclude that the nineteenth century was characterised by bilateralism. Saying this, while multilateral agreements concerning economic, technical or social issues of international collaboration were not as prominent at the time, they became increasingly important, in particular in connection with infrastructural integration.
- (2) International relations not only covered a growing number of socioeconomic policies, but also began to involve an increasing diversity of stakeholders. At the government level, international relations were no longer the exclusive domain of traditional diplomacy, but were increasingly managed by ministerial or administrative staff. As national administrations evolved and intergovernmental agreements required more specific expertise, the cooperation on the interadministrative or transadministrative levels intensified. On the one hand economic, monetary and social policies opened new latitudes for foreign policy, on the other hand economic, monetary and social relations restricted the countries' ability to act in foreign policy matters. In any case international relations became more complex.
- (3) The transnational links intensified during this period. While in the first half of the nineteenth century only a small elite maintained intense contacts with peers abroad, these multiplied in the course of the following decades. Whether politicians, parties and parliamentarians or technicians, doctors and other professionals—all developed increasingly close connections in a more or less institutionalised form. The number of non-governmental international conventions, congresses and associations grew consistently.
- (4) It was not possible to distinguish clearly between intergovernmental and transnational cooperation. Privately organised international congresses attended by diplomats or public administration officials or supported by public funds inevitably became semi-governmental events. Conversely, governmental congresses invited the participation of private sector experts. The blurred boundaries of 'public' and 'private', governmental and non-governmental activities can almost be seen as a distinctive feature of the second half of the nineteenth century.

- (5) Not every cooperation resulted in the creation of an international organisation, but their numbers grew since the 1870s. A significant number of conventions, agreements or treaties established ‘administrative organisations’, ‘associations’ or ‘unions’. Their responsibilities were targeted to the objective of the agreements, but the contents of these were completely new and extended way beyond the cooperation in foreign and commercial policies practised before then. Most of these international organisations had fairly similar legal and organisational structures. It was only after the First World War that international law observed a strict distinction between countries as sovereign entities and international organisations which could restrict the sovereignty of their members. International organisations were not yet subject to international law (although their agreements were treaties under international law), but they were associations established nationally under private law. Ultimately they were a cross-border extension of private associations. They were therefore conceived with a long term perspective, and neither limited in time nor transient.
- (6) Consequently, normative treaties gained a particular significance. While an international normative body which could have passed positive legislation never emerged, some lawyers at the time interpreted the agreements between international organisations as ‘acts of international legislation’. These agreements demonstrated a strong consensus to pursue a common objective and associated tasks. The parties involved were determined to establish these as treaties under international law and not as parallel national legislation. While some maintained that national sovereignty would remain intact, the multilateral agreements in fact imposed certain restrictions. The so-called normative treaties were multilateral by their nature, open to new parties and constituted a legislative document.
- (7) International relations including international economic cooperation, focused on Europe, but the importance of non-European countries grew. Economic barriers between Europe and the rest of the world were gradually lifted, reflected by the growing involvement on non-European nations in economic agreements and organisations. The European signatories were certainly the main instigators and dominated the organisations, while the non-European countries followed their lead, which reflected the prevailing Eurocentric world order with the rest of the world at the periphery.

2.2 Sectoral Development

2.2.1 *Railways*

For many European countries, the railway epitomised economic and social advancement in the nineteenth century. It was one of the key drivers of industrial

transformation and, coupled with various effects, moulded economic and social change. The railway system rapidly emerged as the characteristic transport infrastructure of the time and as an essential prerequisite to cross-border passenger and goods transportation. Between 1840 and 1913 the European railway network rapidly expanded from around 1865 miles to more than 215,000 miles. Even regions at the European periphery without access to national and international connections in pre-industrial times were now connected to the network. However, the integrating effect of railways across borders could only be achieved by international standardisation (Tissot 1998).

In the early stages of development until the mid-nineteenth century, European railway systems primarily became aligned through market forces, without any attempt by railway companies or governments to achieve standardisation cooperatively. There were no negotiations between railway companies in different countries when one adopted the standards of another. The major domestic stakeholders would certainly have discussed the adoption of standards from abroad. Stakeholders even engaged in espionage to find out and reproduce technical specifications of neighbouring railways. In the early days, the alignments were predominantly of a legal and technical nature, which can be explained by the technological edge the United Kingdom had over other countries. During the first half of the nineteenth century the British railway industry enjoyed a monopoly, and the continental European railway companies therefore adopted British specifications. This applied particularly to the track gauge which was adopted almost universally across Europe and at least ensured a minimum level of compatibility between national railway systems. While the knowledge about the operation and development potential of railways was still limited and connections between the networks were sparse, governments rarely intervened to ensure operational and technical standardisation. As for legal standardisation, the situation was obviously quite different. Railway legislation in different European countries developed fairly similar basic structures, although their standardisation was never discussed. However, the German and French legal systems both played an influential role in Europe and prevented a similar standardisation to the one achieved in the case of gauges. The competitive market standardisation phase was comparatively brief and was already coming to an end when the first cross-border rail link between Aachen and Liège was established in 1843. Nevertheless, there had been sufficient time to lay the groundwork and standardise the basic parameters, which prevented a major divergence in technical development.

Market standardisation by competition was not an option for all international standardisation issues—leaving the market to align timetables for example was not viable. Gradually a growing number of countries or railway operators entered bilateral agreements. Each cross-border rail link was covered by a separate agreement, resulting in a large number of individual agreements with similar contents. From the mid-1840s until the 1870s, bilateralism was the distinctive structural characteristic in the railway sector, and continued to play an important role afterwards.

Bilateral agreements were usually initiated by railway operators and governments which often championed the demands of business stakeholders. In most cases the agreements were established following the same procedure. One of the parties initiated the contact by written communication, then both parties exchanged and negotiated their ideas and requirements in writing. Meetings were only held if complex issues or major differences of opinion had to be resolved. As the number of multilateral organisations and agreements grew, meetings decreased as the parties were able to use existing bilateral agreements as a blueprint.

These bilateral agreements predominantly included technical and operational aspects which required standardisation as a prerequisite to enable cross-border rail traffic. The first cross-border connection was the railway line between Cologne and Verviers which operated a regular train service between Prussia and Belgium from 1843. The oldest border station between the two countries was established in the Belgian town of Herbesthal, providing passport inspection and customs clearance. In the early 1850s fare structures were negotiated for the first time. These spurred a mesh of bilateral and multilateral agreements on fares, but it never evolved into a uniform European tariff system. Therefore in the early 1870s a patchwork of different domestic and international tariff agreements and rates existed in Europe, which would outlast the whole of the nineteenth century.

As was the case with many infrastructures, the separate state-run and private railway networks clashed for the first time on a large scale on the territory of the German Confederation (*Deutscher Bund*). The need for a multilateral cooperation therefore became obvious at a very early stage. The German Confederation had no central authority which could have enacted uniform regulations. The first multilateral structures were created in 1846 when ten Prussian railway administrations founded the non-governmental 'Union of Prussian Railway Administrations' (*Verband preußischer Eisenbahnverwaltungen*). The initiative originated in the Prussian Ministry of Finance which preferred to negotiate domestic railway regulations with a stakeholder organisation of railway operators rather than separately with ten different companies. In the following year the circle of members was extended to the entire German Confederation and renamed 'Union of German Railway Administrations' (*Verein deutscher Eisenbahnverwaltungen—VDEV*). In 1864 the VDEV provided a clause that opened membership to non-German railway operators, and subsequently several foreign operators joined, mostly from Central Europe—for instance from the Netherlands, Luxembourg, Austria and Hungary. As the VDEV's scope of activities grew, the organisational structure became more sophisticated. A permanent office was established as early as 1852, but it soon became clear that the scheduled annual meetings of the general assembly were no longer sufficient as a single standardisation forum. Subsequently, the work was transferred to permanent commissions, each with a limited scope of responsibility such as the articles of association, general administrative matters, passenger transport, goods transport, technical issues, waggons and tariffs. The general assembly then only met every 2 years, but retained ultimate decision-making authority in all areas. At the same time the common interest was strengthened by introducing the majority rule for votes. The decisions were binding for the minority,

whereas previously they were only binding once each railway company had approved them. In 1851, at the insistence of the large railway companies the equal voting right of each member was converted into a weighted voting right depending on track mileage. The relationship between the VDEV and government authorities also underwent major changes, which could be interpreted as an emancipation process. Initially the VDEV sought to influence governmental practices of legislation and concessioning, but from the early 1850s the focus shifted towards a voluntary commitment, eliminating government institutions from the process. This was particularly evident in the union's arbitration processes: they were designed to help avoid legal disputes, without having to involve government bodies. The collaboration increasingly shifted to experts employed by the railway companies which started to form a fairly autonomous and well-networked group. To a certain extent, however, the separation from the state remained rather symbolic, because the government could decide to intervene directly or indirectly as an operator or shareholder in the railway companies. 1850 saw the creation of the non-governmental association 'Union of Railway Technicians' (Verein deutscher Eisenbahntechniker—VDET), which focused on technical research. The VDET was designed as a scientific advisory body, legally independent from the VDEV, but complementing it in terms of subject matter. The technicians purposefully set themselves apart from the VDEV which also had a technical commission. Due to considerable staff overlaps the separation between the two bodies was more formal than real. Nevertheless it should prove important for further cooperation. The technicians developed a group identity and a common interest reinforced by their intense contact. This led them to think and act in ways which favoured their common technical background over company interests (Henrich-Franke 2007).

The character of negotiations within the VDEV changed considerably over time. What began as conference diplomacy surrounding the general assembly evolved into a sophisticated structure of increasingly permanent, decentralised and complex decision-making processes which led to the creation of commissions within the organisation. Generally it was the VDEV's head office—managed between 1854 and 1882 by the 'Berlin-Anhalt Railway Company' (Berlin-Anhaltinische Eisenbahngesellschaft) and afterwards by the 'Royal Prussian Railway Administration' (Königlich-preußische Eisenbahndirektion) in Berlin—that initiated standardisations, after having collected emerging issues and shared them with members. These could then prepare for the negotiations and coordinate their efforts. Despite an increasingly steady stream of correspondence used to exchange information and explore mutual positions, commission meetings remained the key location for negotiations and decisions on standards.

In terms of contents, the VDEV's work breaks down into two phases, with the early 1870s marking a turning point in two respects: the VDEV lost its monopoly on multilateral cooperation, and with the foundation of the German Empire in 1871 a national regulator emerged that incorporated the VDEV in the structures created by the imperial constitution and national railway policies. In the early years of its existence the VDEV succeeded in laying the foundations for cross-border railway traffic by establishing operational and technical standards accepted first within

Germany and later also within Europe. The union notably initiated technical developments which were never abandoned due to the technical path dependencies of infrastructural systems: once chosen, technical characteristics of the rail network such as the incline of tracks in curves, track length or gauge were difficult to change. In 1850, the 'Grundzüge für die Gestaltung der Eisenbahnen Deutschlands' (Guidelines for the Design of German Railways) established standards for track support and superstructure, station facilities, locomotives and carriages. In a parallel process the 'Einheitliche Vorschriften für den durchgehenden Verkehr' (Standard Provisions for uninterrupted Railway Traffic) defined the minimum technical requirements for locomotives and carriages to be used on different railway companies' networks. In the same year the 'Reglement für den Güterverkehr' (Freight Transportation Regulation) established operational standards and allowed for uninterrupted freight transportation on the basis of a standardised common freight contract. The regulation included provisions on a consistent stance in dealing with shippers, on the interoperability of carriages or avoidance of reloading, and on a mutual adoption of the customs and fiscal treatment of transported goods by the associations' administrations. Published in 1855, the 'Normalbestimmungen für die wechselseitige Wagennutzung im Bereich der dem Übereinkommen über den durchgehenden Güterverkehr beigetretenen Eisenbahnverwaltungen' (Standard Provisions for the Mutual Use of Carriages on the Territories of Railway Administrations Adhering to the Convention on the Interoperability of Freight Transport by Rail) went one step further: they established the conditions and modes of carriage use, payment terms, periods of use and procedures in case of carriage damage. By 1855 the VDEV had defined the basic technical and operational standards which subsequently had to be continually adapted to the requirements of the expanding railway system. The VDEV showed increasing signs of developing rudimentary collective regulatory powers. In 1869, the 'Grundzüge für den Bau und Betrieb von Lokalbahnen' (Guidelines for the Construction and Operation of Local Railways) provided for a more comprehensive integration of branch lines into the standardisation efforts. The 1868 'Übereinkommen über gegenseitige Wagenbenutzung' (Agreement on the Mutual Use of Carriages) introduced a comprehensive legal commitment and established the principle to treat the administrations' freight carriages as one homogenous fleet. In 1873 the agreement was extended to passenger carriages and baggage cars.

Tariffs were more difficult to standardise. The VDEV had decided to tackle the issue of standardised tariffs as early as 1847, but efforts proved unsuccessful. The bilateral principle that had shaped international relations outside of the VDEV prevailed on the levels below the union. In the 1850s and 1860s a number of bilateral and to a lesser extent multilateral tariff associations and agreements emerged, the majority of which was short-lived. They were modelled on the 'North German Tariff Association' (Norddeutscher Tarifverband) of 1848, which established direct tariffs for traffic between Cologne, Harburg, Berlin and Leipzig. Soon after the 'Central German Tariff Association' (Mitteldeutscher Tarifverband) was founded and served in turn as a model for the 'South German Tariff Association' (Süddeutscher Tarifverband). These introduced cross-border tariffs for

specific freight transports. Some associations even aligned their timetables and established central billing offices. As some railway companies belonged to more than one tariff association, different tariffs were applied to the same track sections (Kaessbohrer 1933).

With the emergence of multilateral cooperation between European railway companies from the 1870s, the VDEV lost exclusivity on the international level. It subsequently represented a core group of stakeholders whose cooperation intensified, and was able to negotiate more comprehensive standards than the gradually emerging pan-European associations. It took for example several decades—up to the interwar period—before operational agreements comparable to the ones reached by the VDEV would be made on a European level.

As a consequence of the expansion of national rail networks in the second half of the nineteenth century international links multiplied to such an extent that regular passenger and freight traffic could develop across Europe. The most famous examples are the Orient Express between Paris and Istanbul and the trans-alpine Gotthard Railway. This led both public and private railway companies to press ahead to establish multilateral European railway cooperations instead of the previously common bilateral agreements. A complex mix of both governmental and non-governmental multilateral organisations emerged which complemented each other without being formally integrated. It is difficult to distinguish between governmental and non-governmental railway organisations as many railway companies were state-owned. Consequently, the government was inevitably involved in non-governmental agreements. Most structures were based on agreements negotiated during periodically convened conferences. It took some time until stable structures developed. The driving forces behind the first multilateral agreements were the private railway companies. Therefore the earliest European agreements were made without any involvement of national governments. The ‘European Passenger Train Timetable Conferences’ (Europäische Reisezugfahrplan-konferenz—ERK) led the way in 1871 which met annually and established timetables for international passenger trains. The Compagnie Internationale des Wagons-Lits (International Sleeping-Car Company) had a unique status among the non-governmental associations. Founded in 1872, the company offered its services to various European railway companies and enjoyed a monopoly in the European sleeping and dining car business. It was therefore able to establish standards unilaterally, as the railway companies abstained from developing their own sleeping and dining cars which they would have had to standardise for cross-border traffic. While the railway companies tended to organise administrative and operational aspects of their multilateral cooperation without government involvement, a variety of intergovernmental organisations emerged tasked with negotiating technical and legal aspects. However, even intergovernmental agreements on technical and legal standards were driven by the railway companies. After a decade of tough negotiations—the industrial protectionism had already a noticeable impact on international cooperation at the time—the first agreement establishing the so-called Technical Unit (TU) was signed in 1882. The agreement which would be revised during periodic conferences committed the governments to enforce

various minimum technical standards on railway companies, whether public or private. Initially only Switzerland, the Austro-Hungarian Empire, France, Italy and the German Empire joined the TU, but by 1914 all European railway companies operating on the standard gauge had followed suit.

Transport law illustrates how strongly governmental and non-governmental organisations were dependent on each other in the nineteenth century. In 1878, the Swiss railway industry instigated negotiations between governmental and non-governmental representatives on a standard freight transportation law. After lengthy debates the railway companies presented their governments with a draft for an international treaty concerning freight law in 1886. It covered liability, set out standardised regulations for indemnities and harmonised transport contracts. More negotiations involving government bodies followed until the 'International Convention concerning Freight Transportation by Rail' (Convention Internationale concernant le Transport des Marchandises par Chemins de Fer—CIM) was signed in 1890. Similar to the TU, initially only a small group of seven Western European countries signed the convention, gradually followed by the rest of European countries. To further develop these regulations, the governments established the 'Central Office for International Carriage by Rail' in Berne in 1893 and agreed fixed organisational structures for the development of international railway law. At the same time the railway companies issued national provisions which supplemented international transport law. In response to these, from 1894 the companies convened periodic standardisation conferences. These negotiations led to the creation of the non-governmental 'International Rail Transport Committee' in 1902, which transformed the periodic negotiations into a permanent organisational form. Founded in 1885, the 'International Railway Congress Association' (Association Internationale du Congrès des Chemins de Fer—AICCF) in Brussels was another mix of public and private structures which convened the leading representatives of national government bodies and railway companies every 4 years. The association was the first attempt to unite various international organisations under one roof. It was set up as an advisory body with a purely consultative function. However, the AICCF reinforced the exchange of experiences in the railway sector and therefore contributed to integration, albeit in an indirect way (Anastasiadou et al. 2011; Dienel 2009).

In the nineteenth century multilateral cooperation processes outside the VDEV both on a non-governmental and governmental level were conducted primarily at conferences. Similar to the processes in the VDEV, decision-making processes developed gradually without any obvious phases.

The contents of the multilateral agreements included copious amounts of legal, operational and technical standards, establishing a basic foundation which was successively refined. In the nineteenth century the standards required to ensure regular cross-border railway services were negotiated by both governmental and non-governmental representatives. Just how attractive multilateral standardisation was is evident from the fact that, once agreed in Western Europe, the standards were then adopted across the whole of Europe, with a growing number of countries and railway companies signing the agreements. It was not uncommon to extend and

elaborate multilateral agreements adding bilateral ones. Strictly speaking, the standards agreed only applied to the international railway lines, but as national and international standards became increasingly aligned, a comprehensive standardisation process began at the end of the nineteenth century. Only tariffs were largely excluded from this process (Dienel and Schiefelbusch 2010).

In summary: *Structure*: When considering the efforts made to integrate cross-border railway traffic in the nineteenth century, we identify a structural trend from bilateral to multilateral forms of cooperation—a trend, as we will see, mirrored in many other infrastructures. Bilateral standardisation continued within and outside of multilateral organisations. The emergence of complex structures and the coexistence of diverse agreements and organisations responsible for specific aspects of international relations is characteristic for the time. It is not always possible to distinguish clearly between governmental and non-governmental structures. *Process*: Due to the increasingly closer interadministrative contacts the initially periodical forms of international cooperation gradually evolved into more permanent ones. This development is visible to a greater or lesser extent in all agreements and organisations. It is important to emphasise that there was no consistent pattern in the standardisation processes. Distinct phases of initiative, negotiation and decision, which start to emerge in the bilateral cooperation and negotiations within the VDEV, were less pronounced elsewhere. Due to the fragmented nature of the institutional structures in terms of the contents they were dealing with, specific expertise was in great demand in the early multilateral phase. Although the railway companies acted more or less autonomously in the international arena, standardisation processes were never free from political influence, particularly with regard to legal or technical issues. The railways—and their construction—were far too important for the emerging industrial economies in Europe and the public finances to be ignored by politicians. *Content*: In the early railway era technical and operational issues were standardised within the market. The United Kingdom enjoyed a monopoly and set standards which were then adopted by other countries or railway companies. It was crucial to establish the technical and operational conditions for the transfer of trains from one national railway network to another. As the volume of cross-border transport grew, international legal standards rapidly began to play a vital role. Transnational rail services required uniform legal standards. By contrast, the standardisation of tariffs remained a difficult issue throughout the nineteenth century and was never satisfactorily resolved. Remarkably, in many European countries stakeholders were even unable to agree a standardisation of domestic tariffs. With the increase of railway traffic in the nineteenth century a shift from interconnectivity to interoperability can be observed. In general more standards were agreed by coordination than by regulation. Cooperative standardisation was preceded by market standardisation, and then almost completely replaced it to become the predominant approach for all types of standards.

2.2.2 *Inland Navigation*

Leaving aside the Rhine Octroi Convention between France and the Holy Roman Empire in 1804, the first cooperative efforts to integrate transport policy date back to the Congress of Vienna in 1815. The parties involved wanted to achieve a liberal regime for the navigation on the Rhine, and ultimately for all navigable rivers in Europe. A 'Central Commission for the Navigation on the Rhine' was created, made up of representatives from the riparian states, but took until 1831 for the first comprehensive agreement to be signed: the Mainz Convention, replaced in 1868 by the Mannheim Convention after steamboats in particular had caused major changes to navigation. These conventions governing the navigation on the Rhine eliminated restrictions for cross-border transport and "consequently constitute one of the earliest and most important instruments for the integration of the European transport market" (Schermer 1988, p. 85). The Mainz Convention was a geographically limited regime agreed between a small number of member states. After the events of the years 1870/1871—the Franco-Prussian War and the foundation of the German Empire—the number of member states decreased to three, even though the federal states of the German Empire initially remained in the Central Commission. The tributaries of the Rhine such as the river Main were subject to separate regulations.

The Rhine Octroi Convention was a bilateral international treaty. Until the Mainz Convention came into force, it remained one of the legal foundations for the navigation on the Rhine. The Octroi Convention established a central authority and a general administration tasked with enforcing and levying the 'octroi' for the navigation on the Rhine which was put into place in lieu of the taxes eliminated by the Final Recess of the Reichsdeputation in 1803. The administration also had to supervise the provisions governing navigation: the obligation to unload goods and offer them for sale ('Umschlagzwang'), the regular general cargo service between two locations ('Rangfahrt') and fixed freight prices. A liberalisation of the transportation on the Rhine, which was envisioned by some of the protagonists, more or less failed. In case of an infringement against the provisions of the convention fixed penalties had to be collected. At the top of the administration was a directorate-general, staffed with a director-general and four inspectors. They controlled 12 octroi offices. Decisions were made after consultation with the governments and by consensus. In principle the organisation's structure was intergovernmental, but it had its own jurisdiction which displayed some supranational elements. If for example a bargeman was convicted of an infringement, he could sue against the penalty imposed on him. In this case the octroi staff would act as judges. There were three instances, with the court of the third instance composed of representatives of the French and Hessian governments and both a French and a German expert in law. Judgments were passed with a simple majority without a right of veto. "The judges were no longer representatives of their national legal systems, but representatives of an international court appointed jointly by two states," (Thiemeyer and Tölle 2011, p. 182) and the international court was no longer subject to the judicial authority of

the member states. It was not possible to appeal against judgments at national law courts.

Effectively, the Octroi Convention ceased to be valid as early as 1813, at least as far as its organisational provisions were concerned. The Central Commission for the Navigation on the Rhine founded during the Congress of Vienna took 15 years to negotiate a shipping regulation (*‘Übereinkunft unter den Uferstaaten des Rheins und auf die Schifffahrt dieses Flusses sich beziehende Ordnung’*) which was ratified in 1831 and is known as the Mainz Convention. It was an international treaty and created an organisation composed of seven plenipotentiaries (*‘commissioners’*) from the seven riparian states (France, Baden, Bavaria, Hesse, Nassau, Prussia and the United Kingdom of the Netherlands). The Central Commission appointed a *‘superintendent’* for the navigation on the Rhine and four other district supervisors under its authority. These reported both to their governments, which had appointed them, and to the superintendent. The individual countries also appointed civil servants for their customs offices. The Central Commission generally decided by simple majority. However, these decisions were only binding for the countries which had approved them. The Mainz Convention explicitly provided that the seven plenipotentiaries appointed by the member states “were not authorised to legislate or issue decrees on behalf of their countries” (Thiemeyer and Tölle 2011, p. 180). This fundamentally intergovernmental approach was complemented to a degree by supranational elements. The Central Commission became increasingly proactive in initiating projects and later received more powers to interpret navigation regulations when the Mannheim Convention was ratified. The superintendent, whose role was abolished in the Mannheim Convention, was a civil servant accountable to the commission and to the navigation on the Rhine as a whole. His role evolved to consultant, mediator, resolver of conflicts, discussion leader and agenda setter “with considerable powers of definition” (Thiemeyer and Tölle 2011, p. 193). Not accountable to any government, independent external experts played an increasingly important role. The Central Commission’s decisions were binding, even though they did not constitute law in the strict sense of the word. The governments only had to ratify the amendments to the Convention. The supranational character of jurisdiction was also maintained to a limited extent. This multilateral approach was complemented by bilateral negotiations relating to minor problems among the members, and between these and third parties. Over time a considerable number of bilateral agreements were signed.

Negotiations were instigated by ministries (foreign offices, ministries of trade and/or finance), the commissioners or the Central Commission and the superintendent. It is interesting to note that over time the initiative shifted to the Central Commission—an international organisation—and its stakeholders. The negotiations themselves often lasted several years, but were accelerated in urgent cases. In general the work in the Central Commission’s committees was limited to a month per year. The negotiations were largely informal as the commissioners tended to discuss many issues outside of the official meetings during their stays in Mainz or Mannheim. If the issue in question was urgent, the frequency of meetings rose. As the commissioners exchanged opinions in writing, the flexibility

of negotiations increased. With negotiations gradually shifting from questions of principle to specific issues, an increasing number of external experts were consulted, and negotiations consequently became more open, but also more complex. At the same time representatives of chambers of commerce and shipping companies got more involved, reinforcing the transnational character of the standardisation processes. While majority decisions were possible in principle, the negotiations often carried on until the parties reached a consensus. The Central Commission's meetings were conducted in strict secrecy. After 1840 extraordinary meetings took place in addition to the scheduled meetings. It is important to note that cooperative forms of standardisation were complemented by 'competitive' ones. One or more countries would adopt standards, rules or regulations applicable in another country without prior consultation. The 'competitive' approach to standardisation was particularly prevalent in the shipbuilding industry, as the Central Commission had only issued a limited amount of specifications. It is easy to understand—particularly in the case of the transition to steam navigation—how these competitive standardisations evolved. Standards originated in the United Kingdom, were then reproduced or adapted, and spread from the Netherlands to Baden, taking into account the distinct geographic characteristics of each section of the Rhine.

The objectives and principles of the Mainz and Mannheim Conventions included freedom of shipping, equal treatment of bargemen and fleets, exemption from charges, simplified customs clearance, the riparian states' obligation of maintenance, and a standardisation of shipping safety and river traffic regulations. Technical standards referred to the suitability and safety of barges and river facilities such as navigation channels, signals, landings and moorings. Operational standards governed pilot services, boatmaster's certificates and general behaviour during navigation. The entire convention was translated into national law, while standards under private law covered for example freight contracts, the carrier's liability and liability for damages. Initially there was no need for further standardisation, as French civil and commercial law was largely applied across the entire Rhine region. Tariff standards primarily covered vessel fees, taxes and customs duties. The Police Regulations of 1851 included operational and legal standards governing damage prevention, behaviour during navigation and berthing, flying bridges, pontoons and other facilities as well as specific rapids. A real breakthrough in the tariff system was only achieved in the Mannheim Convention of 1868. For the first time a comprehensive freedom from charges and duties was negotiated. Flexible freight pricing mechanisms were established as a common principle. Administrative standards regulated customs clearance, the protection of free ports and the equal treatment of barges (Mainz Convention, art. 93). It was predominantly technical and legal standards that were aligned competitively through market forces.

In summary: *Structure*: with the creation of the Central Commission for the Navigation on the Rhine in 1816 and its administration, a multilateral 'organisation' emerged which still left room for bilateral agreements on the same standards. Its structure was predominantly intergovernmental, but also developed supranational characteristics, albeit less so than the Octroi Convention of 1804 with its strong

supranational elements in the area of jurisdiction. *Process*: The Central Commission started meeting regularly from the outset, with the period between 1816 and 1831 considered as one permanent session. It was a continuous cooperation with considerable stability both in terms of its organisational structure and processes. The agenda was set by the governments, the commission or specific commissioners and by the superintendent. Due to the growing complexity of standardisation processes and the long intervals between the Central Commission's regular meetings, the negotiations took a long time and were increasingly influenced by external experts. While majority decisions were possible, the parties mostly negotiated until they reached a consensus. *Content*: The content of standards was regulatory rather than coordinative. Standardisation also involved allocative aspects insofar as a comprehensive range of standards needed to be in place to enable the freedom of navigation on the Rhine—with the corresponding consequences regarding allocation. The standardisation of tariffs for both customs duties and transport charges turned out to be particularly difficult as tariffs had widespread repercussions concerning the distribution of income for countries and carriers. The Congress of Vienna intended to transfer the regulations agreed for the Rhine to all other inland navigation and to establish a common pan-European order, but failed. In fact most European waterways such as the Danube or the Main River were governed by individual regulations, although to a certain extent most of them followed the Rhine Conventions and the suggestions of the Central Commission. The first agreements for the Danube were bilateral, but the United Kingdom, the Austro-Hungarian Empire, Russia and Turkey entered into multilateral agreements in the wake of the Crimean War in 1857. While this convention for the navigation on the Danube followed the Rhine Convention, it added more content. Transit duties and other charges were abolished, and the Danube was altogether exempt from duties. The governments party to the convention committed themselves to maintenance according to the requirements established by the newly created Danube Commission. The commission abandoned the principle of precedence for riparian countries, offering members such as France and the United Kingdom free access to the Danube. However, the Danube Commission did not succeed in sealing an agreement for the entire Danube—all agreements only covered specific sections of the river.

2.2.3 *Postal Services*

The nineteenth century not only witnessed an industrial 'revolution', but also a communication 'revolution' (Benz 2013). The amount of information produced multiplied faster than the production of material goods, and internationalisation impacted the postal services even more than the cross-border transport of industrial goods. The provisions governing postal services across borders were extremely complex and confusing. Cross-border postal traffic was inefficient and costly due to a multitude of different currencies, units of measurement, weight and tariff systems

and transport conditions. There was no freedom of or compensation for transit, and rather than sending mail on the fastest route often the cheapest transport option was chosen. The British Postal Reform of 1840 had introduced both the stamp as evidence of a prepaid fee by the sender and a standard rate for domestic mail. At this time at the latest it was assumed that the bulk of the cost incurred by the postal services was caused by processing the mail and parcels at the collection point and at delivery rather than the transport. And yet the postal services had developed over a long period of time, with the first ‘transnational’ transport companies such as the one run by the Thurn und Taxis family in Germany emerging in the sixteenth century.

In the first decades of the nineteenth century, and ultimately up to the creation of the Universal Postal Union in 1874, international postal services generally operated bilateral, occasionally trilateral treaties and administrative agreements, altogether several hundred. Between 1844 and 1852 alone for instance ten bilateral agreements were made to regulate mail services between Prussia, Belgium and the United Kingdom (Benz 2013, p. 64). Some were international ‘conventions’, others interadministrative agreements or even private contracts if private transport companies were involved. The contractual structures between France, Spain and Portugal or Bavaria, Switzerland and the Kingdom of Sardinia were equally complex. These contracts usually included provisions on the distribution of income from fees, the treatment of mail and the routes to be used. On a domestic level all mail transport was organised by public monopolies. International treaties therefore relied strongly on intergovernmental, but also interadministrative relations. It is not possible to distinguish clearly between these two levels during this time as the number of negotiators was small, and one person would often act as both minister and head of administration. There was no permanent international cooperation at the time. The parcel services were additionally characterised by competition from private non-governmental carriers who cooperated with each other without establishing formal associations. Consequently, some treaties and agreements had to include private sector companies. Frequently private railway companies were involved in mail and parcel transport. The transport across the English Channel for instance was ensured by private companies such as the ‘Rhenish Railway Company’ (Rheinische Eisenbahngesellschaft), the Chatham-Dover Railway and the British and Continental Express Parcels Agency.

One of the few exceptions in this bilateral regime was the ‘German-Austrian Postal Association’ (Deutsch-Österreichischer Postverein—DÖPV) founded in 1850. Initially only Prussia, Austria and Bavaria signed the treaty, but the new association was open to all German postal administrations or federal states, which all 17 joined within the following year. The treaty created one postal territory with standardised tariffs and terms of transport that covered an area extending from Hamburg to Trieste with 72 million people. It was the largest structure governed by a common transport and communications policy at the time. There were still bilateral elements to the organisation as the treaty allowed a more in-depth cooperation between two or more members. When members signed an agreement with a third-party non-member, the agreement was applicable to all other members,

creating ultimately a multilateral agreement. The association was a formal, but loose alliance of a strictly intergovernmental nature. Not the countries themselves, but their postal administrations were members. The association periodically held conferences, each member having one vote in the decision-making process. While most decisions were made by majority vote, important matters required a unanimous decision. The association had no supranational elements, no permanent central body and no formal arbitration process. Agreements only applied to cross-border services, but not to domestic services within the individual German states. Hence the sovereignty of the member states remained untouched in this respect. As the states increasingly adapted their individual regulations to those of the association, the German-Austrian Postal Association had an indirect standardisation effect on the entire German postal system. In this respect, the association had 'competitive' structures. The German-Austrian Postal Union was dissolved in 1867 when the German Confederation was replaced by the North German Confederation in the aftermath of the Austro-Prussian War.

It is important to note that the number of negotiators involved in the standardisation processes on an international level was initially small, but steadily growing. In fact the same individuals often represented governmental, ministerial and administrative bodies at the same time. Negotiations were mostly initiated by a government or the Postmaster General who took up suggestions and proposals originating from their administrations. In some cases private postal services proactively started negotiations. During the negotiations themselves governments and ministries continued to play a key role, but the administrations and 'informal' personal relationships gradually gained in importance. While the traditional diplomatic relations had never taken centre stage, they were increasingly sidelined. Politically important decisions were made on the government or ministerial level. Only the government could ratify international treaties, while administrative agreements could be signed by a head of department or minister, but not by the head of the postal administration although in many cases they were one and the same person.

At a time when a number of countries had not yet fully developed standards for their domestic postal system, stakeholders could only hope to lay the basic groundwork on an international level. The issues they had to resolve included the standard postage rate for mail irrespective of the distance it travelled and a simplified billing procedure between the sender and recipient countries, and also between these and transit countries. In addition to these tariff-related and administrative standards the countries had to negotiate legal standards such as the regulation of transit and operational standards such as the 'transport on the fastest route' possible. These standards were first harmonised in the DÖPV in 1850. Procedures were extremely complex. A parcel sent from Berlin to Liverpool in the mid-nineteenth century could either take the sea route via Hamburg, but would travel for quite a long time, or the land route via Ostend in Belgium. Although Belgium had a railway network at the time, the postal services had to use roads and were often not able to take the shortest route. Tariffs were inconsistent and relatively high. Parcels were opened and checked at the border. Free transit through Belgium was not possible. The

‘transit on the fastest route possible’ was therefore one of the basic questions and of utmost importance. A general freedom of transit affected state sovereignty. Choosing the fastest route possible resulted in substantial changes in the entire operations of the postal system. Standardised postage rates and billing procedures impacted the profit and loss statement of postal administrations and mail services. It is important to note that their income and expenditure was still seen primarily from a fiscal perspective at the time.

The German-Austrian Postal Union’s convention created a standardised postal law for cross-border services. The entire territory of the member states was treated as a single postal area with regard to mail and stagecoach services. Postage, billing procedures, currency, weight and measuring systems, accompanying paperwork and other items were standardised. The parties also agreed on administrative and operational standards such as the mutual consent to ensure the fastest possible delivery using the shortest possible route and the most efficient means of transportation. Technical standards were not yet significant, although it was not always possible to distinguish clearly between different types of standards at the time. However, the services mutually adopted each others’ techniques in the construction of mail coaches.

The first initiatives to establish a pan-European or international postal organisation were launched shortly after the German-Austrian Postal Union was founded. It took, however, until 1874 before the treaty which created the ‘General Postal Union’ was signed by 22 countries. In 1878 the name was changed to ‘Universal Postal Union’ (UPU). The treaty consolidated more than 1000 individual agreements and several hundred pages of regulations, reducing provisions to a minimum. The UPU also abandoned the overriding goal of maximising profit in the postal services in general and in cross-border connections in particular. The supreme body of the UPU was the congress, consisting of authorised representatives from all the member countries. Only the congress had the authority to modify the treaty. Several commissions—three after 1885—were established that answered to the congress and dealt with specific issues relating to the postal services on the basis of executive agreements (regulations). Each country had only one vote. The importance of the issue in question determined which type of majority was required for the acceptance of an application. Usually the negotiations lasted until a consensus was reached. The vote was only taken on the entire agreement. In a few exceptional cases a mention included in a protocol indicates that a country had not accepted a specific paragraph. The Universal Postal Union was a multilateral, but also an intergovernmental organisation. Given that the postal administrations negotiated the practical agreements, it had also a strong interadministrative element. The treaty allowed special alliances within the association that could negotiate additional rules. In 1865 for instance the Scandinavian countries formed such an alliance that was only absorbed into the UPU as a group in 1869. The member states were free to decide whether they wanted to join these arrangements. The association gradually grew beyond its original concept as a European organisation and by 1900 it had become global in scale. In 1906 it counted 71 member states and had become the largest international organisation both in terms of membership and geographic coverage.

The member countries remained autonomous with regard to their own domestic regulations. The UPU was a strictly intergovernmental organisation. Although a 'Bureau International' was created in Berne that was managed by the Swiss postal administration but funded by all members, it was just a permanent head office and had no supranational powers. A formal arbitration procedure was established, but in practice never played a major role.

The main decision-making processes took place at the congresses during which the authorised representatives negotiated the most important organisational, membership and standardisation issues. Until the outbreak of the First World War six congresses took place. In the majority of cases the larger members instigated amendments to the treaty. They endeavoured to find allies prior to the congresses in order to secure a majority. However, the purpose of the congresses was not limited to approving compromises which had been negotiated in advance. Before the final decision was made, intense debates took place within the commissions. The congresses had the final say in the decision-making process. Given that it was the usual practice between postal administrations to establish permanent bilateral or multilateral contacts and that the same people cooperated over long periods of time, important interadministrative or transadministrative voting processes took place well in advance.

The 1874 Treaty of Berne created the first uniform law for worldwide postal services. In the years to follow several related agreements extended the scope of the treaty to a growing number of services—from ordinary mail to registered mail, postal money orders, parcels, papers and other items. The treaty introduced a standard postage rate for mail as well as fixed transit fees. The most significant ancillary agreement was concluded in 1880 relating to parcel transport. A variety of operational and administrative standards were required to put the treaty into practice. The statistical reporting and evaluation methods on transit charges required standardisation as did the provisions for packaging, labelling and the mode of shipment. A number of postal administrations made agreements with rail and shipping companies independently of the UPU in order to accelerate mail transport. The most important example is the mail transport between the United Kingdom and the continent. The European countries' postal administrations entered agreements with French, Belgian and Dutch shipping and railway companies. No technical standards were established within the UPU before the First World War. Negotiations focused entirely on the international relationships between postal services. And yet, national and international standards continued to align: domestic organisations "voluntarily" adopted the UPU's standards without prior consultation, or the UPU adopted national standards for the international postal services.

In summary: *Structure*: if we consider the efforts to integrate cross-border postal services in the nineteenth century, we observe—in simplified terms—a trend from bilateral to multilateral forms. At the same time the bilateral tradition continued outside of the multilateral organisations. The intergovernmental nature of relations remained unchanged throughout the period. As the structure of national postal administrations grew and became more complex and the scope of standardisation expanded, the interadministrative cooperation increased. *Process*: During the

bilateral phase international cooperation took place on an ad hoc basis, but with closer interadministrative contacts permanent structures were put in place. Later the congresses of the Universal Postal Union set the pace for cooperation. In the bilateral phase initiative, negotiation and decision-making could be distinguished as separate process stages. Later they started to overlap and boundaries between them became blurred, making them less visible. As standardisation became more complex, the need for specific expertise grew, causing the process to be less political and more permanent. *Content:* Mail services were standardised first, and in the course of time more services and types of mail were added. The creation of a uniform postal law was accompanied by a standardisation of tariffs and operations. Directly linked to this was the alignment of tariffs and billing procedures, i.e. distributive standards. This was of major importance if the income from the postal services that contributed to the public finances was to remain stable. As the volume of cross-border mail and the demands for fast transport, affordable tariffs and security requirements increased, standardisation had to shift its focus from interconnectivity to interoperability. Standards were still set by coordination, but regulation became increasingly important.

The German-Austrian Postal Union and the Universal Postal Union are primarily examples for cooperative standardisation through political channels within formal organisations. There are, however, some small reservations: despite their monopolies, the national postal administrations competed to create modern and efficiently organised postal services. They offered national standards which showed promise to the associations to adopt on an international level, and took over other members' standards without consultation. A particularly important example is the British Post Office Savings Bank, founded in 1861. This 'standard' was subsequently adopted with small modifications by almost all other European postal administrations. Furthermore, standards originally intended for international postal services were applied to domestic structures, which caused standards to propagate in a non-cooperative way. In this respect we are witnessing a 'competitive' standardisation through market forces. Another reservation concerns the fact that, while the postal administrations were primarily public bodies, they were also economic enterprises exposed to fiscal pressures to generate income.

2.2.4 Telegraphy

Telegraphy is the second sector of major importance for cross-border communication in the nineteenth century, particularly from an economic point of view (Reindl 1993; Wobring 2007). The development of the electromagnetic telegraph began in the early 1830s and accelerated in connection with railway construction to such an extent that the lack of cross-border connections was perceived as an issue by the late 1840s. In establishing their networks different countries used different technical standards—concerning capacities, transmitters and codes in particular. This contributed to the challenges of cross-border transmissions. The staff at the last

telegraph station before the border had to write the message down and hand it over to their colleagues on the other side, who then had to feed back the text into the other network. This process was costly both in terms of time and staff requirements and was more likely to produce transmission errors. In most European countries telegraph companies were public monopolies, similar to the postal services. The few private telegraph lines required a state concession.

The competitive market played a major role in the early stages of telegraph line and network construction, as the British industry enjoyed a production monopoly in technical equipment that impacted the entire European market. Most of the early technology was of British origin. However, as the technical specifications were not consistent in the United Kingdom either, the standardisation in the market were limited. It was only when the national telegraph lines were standardised and both national and international network connections were established from the late 1840s that standardisation effects increased noticeably. Competitive market forces continued to drive technological standardisation throughout the nineteenth century. With the exception of Sweden, the smaller countries in particular did not establish their own production facilities, and consequently technical equipment—such as cables or stabilizers—had to be imported from the leading manufacturers abroad, for example Felten & Guilleaume, Siemens, R.S. Newall & Co., W.T. Henley, Glass Elliot & Co.

The integration of the telegraph services within Germany took a similar route to the postal services, and we will therefore only examine specific developments unique to telegraphy. In 1850 telegraph operators founded the ‘German-Austrian Telegraph Union’ (Deutsch-Österreichischer Telegraphenverein—DÖTV) which was very similar to the postal association in terms of structure and organisation. It is remarkable, though, that the association had a more competitive character. Although technology was of greater importance in telegraphy than in the postal services, the standardisation efforts were rudimentary. The members made a more or less conscious decision to keep cooperative standardisation to a minimum to maximise the impact of competitive developments. In view of the rapid technical progress they wanted to allay the risk of a lock-in situation caused by cooperative standardisation. The union wanted to create competition between different technical solutions, hoping the best ones would prevail in the market. In addition, the majority of representatives active in the German-Austrian Telegraph Union had no technical background and were therefore not able to negotiate and make informed technical decisions.

Obviously there were differences between the postal services and telegraphy regarding the standards that were negotiated cooperatively. The German-Austrian Telegraphy Union dealt primarily with transactional, tariff and operational standards such as a common Morse code, consistent rules for telegram transfers, and the use of telegraphs in general. These were based on the Telegraph Regulations which in turn were legal standards, ratified by all member states. Charges and billing procedures also had to be standardised. In 1850 the members agreed on tariff zones and maximum charges for cross-border telegraphy, which were also adopted outside the association, but they never established a standardised tariff system.

The alignment of operational procedures at the telegraph stations was even more important than it was at the postal stations. Most countries prepared comprehensive manuals with detailed instructions on operations which had to be aligned with each other. While technical standardisation was purposely left to market forces, some elements of line telegraphy such as cable strength and transmitters were aligned cooperatively. It is important to note that different types of standards were strongly interrelated. The distinction between tariff, technical and operational standards is helpful for analytical purposes, but in fact in the nineteenth century the boundaries between them were blurred.

Compared to the development in Germany, the international integration of telegraphy lagged behind, similar to the postal services. Since the early 1850s a dense and highly complex network of bilateral agreements evolved. The significance of the German-Austrian Telegraph Union was strong enough for many of its provisions to be adopted in these agreements, resulting in a certain degree of standardisation (Beispiele). They were also adopted and even refined by the 'Western European Telegraph Union' which was founded in 1855 by France, Spain, Belgium, Switzerland and Sardinia—Portugal joined 1858—, particularly in the areas of tariffs and zoning. Just how much the bilateral and multilateral agreements dovetailed became clear in 1859 when Prussia and France concluded a bilateral treaty concerning tariff zones, tariff rates and word counts which automatically came into force for both associations. In 1865 the 'International Telegraph Union' was founded by 20 European countries, in the 1930s renamed as 'International Telecommunication Union' (ITU).

The International Telegraph Union was based on an international treaty. The central body of the organisation was the 'plenipotentiary conference'. Each country or administration had one vote. After the members signed a convention with fundamental regulatory standards and a separate regulation containing executive provisions in 1875, the conference did not convene for nearly 60 years. The treaty created a formally subordinate body, the 'administrative conference', attended by delegates of the national administrations. Again, each member had one vote. Private telegraph companies were not admitted as full members, and their representatives were only granted an observer status. The organisational structure was strictly intergovernmental. While a simple majority would have sufficed, negotiations usually carried on until a consensus was achieved. In order to avoid potential conflicts between a majority decision and national sovereignty in the first place, mandatory rules were complemented by optional ones which were not necessarily binding for the member states, if at all. In accordance with the territoriality principle, the provisions of the treaty only applied to international telegraphy while the members remained autonomous on a domestic level. Supranational elements were virtually non-existent. In 1868 a permanent office opened in Berne which was funded by all members. The office mainly focused on data collection and had no powers, but an advisory role which contributed significantly to standardisation. In 1891 for example it was tasked with compiling an international dictionary for code telegrams which subsequently became compulsory for cross-border telegram services. There was no arbitration body or formal arbitration

process. Controversial issues were either resolved on an ad hoc basis by way of circulars and mediation of the international office, or submitted to all member countries during the administrative conferences. Decisions were taken by a majority vote. The sole remedy of dissenting members was to resign from the organisation. There was no judicial procedure in case of disputes regarding the interpretation or application of the treaty. The administrative conference was attended by employees of the national administrations. This points to the strongly interadministrative nature of the cooperation, which became more pronounced in the course of the nineteenth century. Interadministrative or transadministrative forms of cooperation prevailed in the telegraph union, whereas intergovernmental cooperation and diplomacy only played a minor role. While the importance of this multilateral organisation steadily increased during the integration of the European telegraph network, it is important to acknowledge that bilateral forms of cooperation continued to exist. The specifics of technical standards and the use of telegraph technology for cross-border connections in general were often laid down in bilateral agreements. In the case of sea cable connections for example, operators invited bids from relevant companies from various countries and chose the most attractive one. The specifications of the successful bid, with regard to cable thickness in particular, were then applied to the cross-border connection.

Telegraphy standardisation processes were similar to those observed for the postal services. The decision-making processes within the International Telegraph Union had a distinctly diplomatic character as key questions were negotiated and decided during conferences. These were complemented by an increasing number of preparatory meetings and votes. Standardisation processes were often initiated in response to an urgent need and were not planned in the long-term. Most therefore happened ad hoc or in some cases were interrupted and postponed to the next congress. Similar to the German-Austrian Telegraph Union, the International Telegraph Union made a conscious decision to maximise competition for technical standards in order to minimise the risk of cooperatively choosing the wrong technology. So despite the cooperative framework, competitive processes were very significant.

In terms of their content, the spectrum of standards laid down in the regulation largely corresponded to the standards of the German-Austrian Telegraph Union. These included legal standards which were ratified as regulations or laws, as well as tariff, administrative, operational and technical standards. When legal standards regarding the 'free access to the network for everyone' were established for instance, national sovereignty was recognised by granting governments the right to withhold telegrams or stop them from being forwarded when they considered them a threat to public security or as containing immoral content. While the International Telegraph Union initially only pooled the standards laid down in the two multilateral agreements of the German-Austrian and Western European Telegraph Society, it gradually introduced innovations and advancements. Standards agreed in the initial convention and the executive regulations included technical specifications covering devices and cables, provisions on the Morse code, telegraph office opening times and the obligation to create a functioning network with

suitable capacity. In 1865 a radical change in tariffs was implemented: the zone-based tariff system was replaced by homogenous rates by state, with rates staggered according to geographical size. The union also consistently refined operational and administrative standards and adjusted them to the expanding telegraph services. This included the introduction of obligatory isolation measurements or a maximum number of telegrams in order to prevent network overloads. Technical standards—such as the recommendation issued in 1869 to use 5 mm cables for network expansion—were the exception rather than the rule.

In summary: *Structure*: the integration of the European telegraph network started in the second half of the 1840s. It was initially based on bilateral cooperation which evolved into multilateral cooperation after a relatively short time, while bilateral agreements continued to be made alongside it. Both the German-Austrian Telegraph Union and the International Telegraph Union were strictly intergovernmental organisations, with interadministrative elements gaining in importance. *Process*: While competitive standardisation processes played a significant role in relation to technical issues throughout the nineteenth century, cooperative standards were predominantly negotiated within diplomatic decision-making processes at the conferences. In most cases specific administrations initiated the process, with the issue in question negotiated and decided at a conference. This pattern was increasingly complemented by informal preparatory meetings or correspondence. In general processes were cooperative, but competitive standardisation also had a place. Both the German-Austrian Telegraph Union and the International Telegraph Union relied as much as possible on market forces to achieve technical standardisation, and many German standards were incorporated into agreements between other European countries. *Content*: Standardisation extended to tariff, administrative, operational, legal and technical issues and was characterised by interconnectivity rather than interoperability, as the countries involved in developing telegraph technology took a strong protectionist stance. Both allocative and distributive aspects played a role. Most standards were set through coordination rather than regulation.

2.2.5 Telephony

The telephone was the second telecommunications device introduced after the telegraph (Ahr 2013). It was invented in the 1870s, and national telephone networks started to develop in the next decade, although to a very limited degree. In Europe the telephone was first used in 1879 when the first urban networks were set up in Belgium, France, Norway and the United Kingdom. Germany, Austria, Sweden and other countries followed suit in the 1880s. By the end of the 1880s most European countries had established telephone installations. In most European countries the telephone came under the telegraph monopoly. Initially private operators were granted concessions, but by the First World War the public postal and telegraph administrations had taken over most of the services. At first they saw the telephone

as no more than a complementary communications device to the telegraph. This attitude along with limited technical possibilities and language barriers impeded the expansion of cross-border connections. Nevertheless the first international connections emerged in the late 1880s and early 1890s. By the outbreak of the First World War many individual cross-border connections had been established, mostly between geographically close cities, but these could hardly be described as a European network. A network in the strict sense would only emerge between the two World Wars.

Cross-border telephony was largely based on bilateral cooperation for two reasons: (1) a multilateral system of standards was already in place, agreed in the International Telegraph Union's convention and regulation—although they did not refer explicitly to the telephone. In some cases, the telephone services could be operated simultaneously on the existing telegraph lines. Over longer distances separate cables were required. (2) The telephone was a brand new technology, so the stakeholders made a conscious multilateral decision to refer further standardisation to the bilateral level. They believed that rigorous multilateral standards would stifle further development. The telephone was not widely established at the time, and still unfamiliar to potential users. The telegraph convention only included one paragraph stating that standards for the international telephone services were to be negotiated bilaterally by interested administrations. It was only during the International Telegraph Union's London Conference in 1903 that a more differentiated set of provisions on international telephony was incorporated in the regulations. These provisions governed the operational framework, but not technology or tariffs. The first separate comprehensive framework for the telephone services was established in 1932. It was not possible to separate the multilateral from the bilateral levels, because the limited number of people involved cooperated on both levels and established personal relationships. From the outset it was the interadministrative or transadministrative rather than the intergovernmental contacts that moulded the cooperation. Governments or ministries were only involved in particularly important matters of policy. In all other cases it was the secretaries of senior civil servants or heads of department with a specific expertise that dealt with the fine detail of the cooperation. Similar to other infrastructures, expertise was vitally important in setting up telephone connections. Private stakeholders—such as operators, the telecommunications industry or other interested parties—only played a minor role in the decision-making processes. The negotiated standards were laid down in international treaties and/or conventions agreed by the administrations, and supplementary executive regulations and instructions.

It is difficult to establish who initiated negotiations about specific international connections. Private and economic interests as well as senior civil servants in the administrations all had an interest in promoting international agreements. The negotiations involved a mix of official, semi-official and unofficial contacts. The technical feasibility and financial viability of each project were analysed on a political and administrative level. In some cases the parties involved considered wider issues such as tariff standards which they wanted to agree at an early stage.

Information gathering and processing often occurred simultaneously with the negotiations between administrations, or the administrations and third parties. The negotiations themselves took place in writing, with face-to-face meetings being the exception rather than the rule. There was a final vote on the contents of the entire treaty when it was ratified, but it was in fact a formal act to legitimise what had already been agreed concerning specific standards and funding. Delays often occurred when external stakeholders or institutions had to be involved in the negotiations. Similar to other infrastructures, international telephony standardisation processes included competitive market processes in addition to cooperative negotiations. Some agreements or standards established for a specific connection were not negotiated from scratch, but just adopted—though only after prior negotiations. The agreements were only in force for a short period, which allowed for market forces to influence technical progress. In addition, only a small number of countries developed an industry that produced telephone equipment, and consequently telephone technology spread through competition of different international suppliers.

The International Telegraph Union's convention and its regulations constituted the framework for individual treaties and agreements relating to the telephone services. The bilateral agreements included technical, operational, administrative, tariff and legal standards, each adapted to specific telephone connections. The technical standards covered issues such as cable and line specifications rather than transmission and reception technology. Detailed technical standards were rarely negotiated. Protectionist policies ensured that national markets were inaccessible to foreign providers and the national telecommunication industries were protected from foreign competition. An example of operational standards was the negotiation of telephone exchange opening times. Telephone charges, their allocation and settlement also had to be standardised. It was important to ensure that administrations were exempt from liability, and to put in place a protection of telephone confidentiality. Tariff standards were the key focus, while "operational, administrative and legal standards [seemed] necessary, but far less significant additional agreements" (Ahr et al. 2010, p. 21).

In summary: *Structure*: the standardisation of telephone services was predominantly based on bilateral relations as the International Telegraph Union's convention offered a pre-existing multilateral framework. What is also remarkable is the pronounced interadministrative or transadministrative dimension which left little room for intergovernmental 'intervention'. *Process*: After cross-border projects were initiated, administrations were permanently in contact with each other—mostly in writing—and made preliminary decisions on standards. It is therefore difficult to distinguish different phases in the process. A treaty or administrative agreement only constituted a formal conclusion of the process. *Content*: As international telephone connections were operated through central exchanges, technical and other decisions were limited to the compatibility of networks, but did not provide for interoperability. The standardisation of tariffs was of major importance, because they determined the direct income earned from telephone services, and provided an indirect income for the public finances. This distributive effect played a

significant role, probably more than in other infrastructures. By contrast the regulative aspect was comparatively insignificant. Issues such as the question of liability had to be resolved, but others which did not directly affect the safety of the infrastructure did not require immediate attention as it was the case for inland navigation and the railway system.

2.2.6 *Radio Communication*

Radio communication—or wireless telegraphy as it was known in the early days—describes the use of electromagnetic radio waves for the transmission of information. It was only invented in the 1890s, but developed rapidly in the period up to the First World War. Until then the distribution was limited, because the technology was in direct competition with wire telegraphy which had established itself since the 1830s. Initially radio was therefore only used at sea.

Standardisation was not on top of the agenda in the early development stages of radio communication. It was private developers such as Marconi or Telefunken who spread the technology. The capital-intensive research was driven by private stakeholders keen to market their products. The individual technological variations that evolved in the early stages of radio development were generally compatible. It is not possible to determine whether this resulted from market standardisation or whether the characteristics of radio inevitably generated compatibility. In any case the progress of radio integration was driven by the competitive strategy of the Marconi Society which enjoyed undisputed leadership in both the technological and operational development of radio communication in the 1890s. The countries or their public telegraph associations initially responded to the new technology with considerable reservations, so the path was clear for Marconi to seek a global monopoly in sea radio services. To achieve this, Marconi endeavoured to establish substantial barriers for potential market followers in order to prevent them from entering the market or to force them out of it. For Marconi, it was crucial to set up a broad and dense network of radio stations as quickly as possible. His aggressive strategy was based on three elements: generating operational incompatibilities by barring communications with other systems; binding the governments of the major European seafaring nations, and the United Kingdom in particular, to the company and retaining their custom on a long-term basis; and ensnaring potential competitors into litigations by using an aggressive patent policy (Scholl 1998).

The question of non-cooperative technical standardisation cannot be answered clearly, but some non-cooperative processes can be identified for legal issues. All European countries needed to establish the legal status they wanted radio communication to have in their national legislation. The integration of radio communication in the existing legislation on electrical telegraphy was a key question that needed addressing. Without an answer it would be difficult, if not impossible to make international agreements. The United Kingdom was the first country which succeeded in integrating radio communication into telegraphy regulations which set

the trend for further standardisation. A number of countries followed the United Kingdom and adopted these regulations, the details of which also reflect a trend towards convergence (Fuchs 1998).

The negative effects produced by the Marconi Society's intention to enforce a global monopoly, and in particular its refusal to allow intercommunication, prompted the first cooperative political attempts of multilateral standardisation. The foundations of cooperative standardisation were laid during three conferences—1903 and 1906 in Berlin and 1912 in London. The ensuing cooperative standardisation within political structures was a path which, once chosen, proved to be permanent. Both the organisational and legal frameworks were based on the ones previously established for telegraphy. The legal centrepiece was an intergovernmental convention, supplemented by subordinate executive regulations and a final protocol. The latter could include provisos, reservations or specific provisions beyond those contained the convention. In the radio conventions of 1906 and 1912 the governments reserved a right to introduce bilateral special agreements on billing procedures, including agreements with private companies. Meetings to negotiate the standardisation of radio communication took place at radio conferences, but no intergovernmental organisation was established before the First World War. Decisions were taken by majority vote, but each of the governments retained the right to ratify the convention. The negotiations were geared towards achieving a consensus accepted by all participants of the conference. As the number and scope of issues increased, a growing number of commissions with distinct remits was set up, and a noticeable differentiation can be observed even in the short time before the First World War. The executive regulations were also extended. In general the structures were intergovernmental and the major players acted as authorised representatives of their governments, but there were some exceptions: for example private stakeholders such as research institutions sent electrical engineers who were included in the decision-making process. Supranational elements such as an international office emerged, which was in charge of collecting and publishing information. The office was funded by the countries party to the treaty. The radio communication agreements also provided for an arbitration tribunal (Coddington 1952).

Radio communication was in its infancy and structures were still flexible, so the decision-making processes underwent constant changes. In general all conferences had similar procedural stages. As standards were not necessarily finalised during a single conference, processes would often span several of them, with significant recourses and shifts between different stages. Either the administrations initiated standardisation or one conference set the agenda for the next. The administration which organised the conference compiled the information on the relevant aspects and distributed it to the participants. The negotiations themselves and the final decisions were reserved for the conferences. By 1912 the negotiations had become so complex that the participants explored their mutual positions informally and—if possible—tried to find a common ground and to establish agreements in advance. Informally agreed solutions significantly accelerated the decision-making processes and shifted the bargaining power in favour of those party to the agreement.

The standardisation of marine radio, including operational, technical, legal and tariff agreements, took place before the outbreak of the First World War (Headrick 1991). The key operational standard was the obligation of intercommunication. Further operational provisions were added on avoiding disruptions, composing, transmitting and delivering radiograms, the service times and qualifications of radio operators. On the technical side, standardisation was restricted to a minimum: on the one hand the administrations did not want to hamper the development of radio technology, on the other hand they believed that the market would generate efficient standards. The standards' content was intentionally limited to allocating medium wave frequency band ranges to prohibit the deliberate creation of technological incompatibility and to define maximum transmission power of marine radio stations. In simple terms this meant that the cooperative standardisation of radio technology was used to prevent negative external effects, while market standardisation was expected to achieve positive effects. The primary focus of technical standardisation was therefore to prevent incompatibilities. Furthermore, the first frequency bands and specific frequencies in the medium wave range were allocated. Tariff standards referred to the calculation, collection and reimbursement of charges as well as billing. The total charge included coast and vessel fees. The agreements allowed a minimum charge per telegram, but with an upper limit. As for legal standards, the signatory countries committed to creating national legislation to ensure the treaty was implemented on a national level. It is important to note that, in addition to the structures, the contents of standardisation were also based on telegraphy. Thus, the ten articles of the St Petersburg Telegraph Convention of 1875 were adopted into the radio convention.

In summary: *Structure*: after an initial phase of market standardisation and the Marconi Society's attempt to impose a private monopoly, the radio sector moved on to cooperative standardisation processes through political channels similar to the path chosen in other areas of telecommunication. Within a very short period of time a complex framework of conventions and agreements emerged. However, the period of time that elapsed before the outbreak of the First World War was not long enough for the stakeholders involved in radio communication to feel the need to create a formal organisation. Convened in advance, but still on an ad hoc basis, the conferences therefore remained the key channel for cooperation. Standardisation was achieved cooperatively in committees, but also competitively through market forces. *Process*: Before long a set decision-making process with distinct stages developed during and around the conferences. These were supposed to be the arena in which negotiations and decision-making took place. However, the stakeholders increasingly started meeting either in advance or on separate informal occasions on the fringes of the conferences. *Content*: The standardisation processes included all types of contents—technical, operational, legal, tariff or administrative standards. They were either agreed by coordination or regulation, the latter being of major importance due to the properties of radio frequencies which overlap country borders.

2.3 Sectoral Comparison

In the nineteenth century infrastructural integration developed in two ways: competitively and cooperatively. The infrastructures examined for the purpose of this study were run by often public administrations or companies which enjoyed a monopoly and/or were strongly regulated. Therefore the entire spectrum of integration occurred either through the competition of public stakeholders representing their countries in the political market or through negotiations in international political committees. While market standardisation was important in some infrastructures such as inland navigation, telephony or radio communication, it was in general only relevant for technical standards, not for the entire spectrum of standardisation. A further distinction needs to be made between cooperative and competitive market standardisation. It is difficult to find a valid answer to the question which one was more important, both in the economic and political arenas. In many respects both ways complemented each other: while standards were agreed cooperatively, some would then be refined by market forces. Cooperative standardisation often also had a regulative character, imposing policy frameworks on the market. Competitive standardisation extended beyond technical issues and included operational procedures and legal questions. Spain for example based transport law on the French model, while the Central European countries adapted German transport law. Non-cooperative standardisation therefore not only applied to freight organisation in the strict sense, including regulations on waybills, packaging or controls which were often simply adopted, but also extended to legal issues relevant to transportation such as freight law. At the end of the nineteenth century international freight law, which had developed cooperatively, competed with the national freight legislations. In most countries this led to an adjustment of national to international law. As noted previously, it is difficult to find empirical evidence for the adoption of technical, operational, administrative or legal standards without prior consultation.

2.3.1 *Structures*

In studying cooperative integration, we will focus on the similarities rather than the differences between infrastructural sectors, which we have analysed in detail above. Our aim is to characterise the development of cooperative integration within a specific period.

In general terms, international cooperation in the nineteenth century can be described as ‘bilateral intergovernmentalism’. In the case of infrastructures, however, this applies only to a limited extent. With the exception of inland navigation, international relations—if there were any in connection with infrastructures in these early stages—were bilateral, but since the mid-1850s multilateral agreements began to complement or even superimpose them. Major regional, European or even global

organisations emerged whose influence on standardisation grew continually. Their structure was comparatively flexible, allowing their members to enter more detailed internal agreements and bilateral extensions with third parties. The structures could almost be characterised as ‘multilateral-interadministrative bilateralism’ due to the strong interdependence of both elements. Often the key standards were agreed within the multilateral organisations, while further details were established in bilateral agreements or—in the case of technical standards—through market forces. In negotiating standards for innovations such as the telephone, a return to bilateralism was possible. Telephony relied heavily on the old telegraph technology, and therefore adopted telegraphy standards which had been coordinated multilaterally decades before.

In the nineteenth century international relations between countries were limited to the intergovernmental level. Supranational elements were virtually non-existent. Exceptions were the jurisdiction enacted in the Octroi and Rhine Convention for the navigation on the Rhine and the different arbitration processes established by individual organisations. While almost all organisations could decide by majority vote, most continued to negotiate until a consensus was found. In the course of time some ‘supranational’ elements began to emerge which developed informally: (1) Infrastructures by their nature rely on physical networks. Consequently standardisation decisions had to be adopted even by those who had originally voted against them if they wanted to participate. (2) The offices established by international organisations distanced themselves to a certain extent from national loyalties. Better informed, tasked with information selection and processing, equipped with definition and arbitration competences, they increasingly transformed into bodies committed to their organisation and their common objective rather than to individual member countries. (3) In view of the growing importance of specific expertise, in many cases it was no longer the political representatives of national interests who were competent to decide, but the experts representing the joint standardisation project. (4) In some cases minorities had to accept majority decisions. The same ‘supranational elements’ visible on the government level also emerged in the context of non-governmental international cooperation. While ‘supranational’ in this case does not involve a transfer of national sovereignty, the key purpose was the creation of a ‘communal project’ which limited the freedom of action of non-governmental representatives.

The relationship between the intergovernmental and interadministrative structures also underwent significant changes over the period. The beginnings of international cooperation in the middle of the nineteenth century were still characterised by traditional diplomacy, even in a specialised field such as infrastructures. This was about to change. The more complex the issues, the more expertise was required, and the people with the relevant expertise were generally members of the public infrastructures or ‘business administrations’. Cross-border cooperation shifted gradually to the interadministrative level: the growing infrastructural interdependence soon required permanent structures, because the large conferences convened regularly but with long intervals proved insufficient. In this process, specific regional clusters of cooperation emerged in Europe, for example in the

German or Nordic countries. Permanent coordination structures were required. This was ultimately a natural consequence of the growth of companies or administrations operating in the infrastructures on a national level and of the increasing exchange of information, goods and people across the infrastructural links.

Transnational contacts sometimes preceded intergovernmental cooperation efforts. It is almost characteristic for this era that intergovernmental or interadministrative and transnational cooperation were closely linked. This was the consequence of ownership structures as some infrastructure companies were initially privately-owned and later nationalised. They either approached their foreign counterparts directly or were members of the relevant international organisation. Not all of them had voting rights, but at least an observer status. Some of these organisations were established on the basis of international treaties, but others were founded as associations under private law. Due to their nature infrastructures were possibly impacted first by socioeconomic influences on politics. The major economic players in particular wanted their interests included in the political decision-making processes. It was the trade associations and their demands to establish transnational networks that initiated many cross-border cooperations. Saying this, it was also economic stakeholders (and their transnational associations) who initiated a decentralisation of relations, by detaching large infrastructure markets from each other. What they aimed for was an interconnectivity on the lowest possible level.

It remains to be seen whether a temporary form of cooperation, limited to an individual international connection and one individual case on the one hand and a permanent form that applied to an entire sector on the other hand can be defined as structural elements. In any case it was characteristic for this period that spontaneous bilateral cooperations pursued specific integration projects. Multilateral cooperations were embedded in fixed organisational structures once agreements had been made, but their high-level general assemblies also remained sporadic. While the organisational structures were rigid, the workflows were fairly fluid. The most important bodies who possessed the ultimate decision-making authority met rarely—the Central Commission for the Navigation on the Rhine for example met once a year, while the general assembly of the ITU did not meet at all between 1875 and 1932. A permanent cooperation gradually emerged on the lower level of the public companies or administrations and in the offices of the international organisations, although these remained fairly insignificant for many years.

2.3.2 Processes

Each sector had its own characteristic negotiation processes which changed over time. There were also differences between bilateral and multilateral contacts. It is therefore advisable to exercise caution in trying to identify similarities. The developments described below are merely general trends which could look completely different in individual cases. It is evident, however, that the first integration projects or standardisation processes in different infrastructural sectors were instigated by

governments or ministries and their diplomatic representatives both on the bilateral and multilateral level. This changed as cooperation was institutionalised in creating permanent organisations and infrastructural administrations were established and extended on a national level. Specific standardisation projects were increasingly initiated by the relevant international organisations, their offices or national administrations. Sometimes private stakeholders approached their government and expressed their interest in specific standardisation projects. The instigation of projects also depended on their importance. If the primary treaties governing the cooperation had to be changed, it was mostly politicians who took the initiative.

The course of negotiations also depended on the subject matter. For important amendments to treaties or agreements the conferences—held periodically, but with large intervals—set the pace. As the volume of issues that required standardisation on an international level increased and the national administrations grew, permanent interadministrative contacts intensified. The experts in the relevant administrations could get in touch with each other at any time. In general, information was exchanged in writing, only complex subject matters were negotiated in face-to-face meetings. The experts convened special meetings, and even during major conference negotiations continued in the run-up to final decisions. Some conferences lasted for weeks and consequently offered enough room for informal negotiations outside of the official committees. As standardisation became more complex, increasing numbers of external experts were consulted and invited to participate. Given this routine day-to-day cooperation it is difficult to discern different stages of decision-making. Many new initiatives emerged in the course of negotiations relating to other aspects.

Multilateral cooperation left decisions about amendments to the basic treaties and crucial details in standardisation to the plenipotentiaries during major conferences. There is, however, some evidence that for many, if not most integration projects experts not only negotiated the relevant standards, but also made decisions prior to the conferences or at informal functions at the fringes. The official vote then merely constituted a formal, legalising act. This process would have been exactly the same for bilateral integration projects.

It is important to keep in mind that even when cooperative standardisation included an increasing number of issues, competitive or non-cooperative projects continued to play an important role.

2.3.3 *Contents*

In essence, infrastructures are technical systems. The standardisation of technical issues therefore played a major role in all infrastructures, in particular those which relied on new sophisticated technologies—for example the railways, telegraphy and radio communication. Inland navigation experienced technical innovation with the introduction of steamboats which also required a certain amount of technical standardisation. The postal services required the least amount of technical

standardisation, but depended to a large extent on those of other infrastructures (such as railways) for their cross-border services. One crucial issue was the compatibility of technical systems. This was achieved by aligning the couplings on rail carriages, electrical pulses in telegraphy or receiver technology in radio communication. The safety of the systems was equally important. For inland navigation, lighting was standardised, as were railway signals and cable strength in telegraphy. The negotiation of technical standards often triggered further standardisation.

Simultaneously with technical standards, operational or administrative procedures had to be aligned. This applied in particular if transport speed was important or if interconnectivity between networks at the national borders was no longer sufficient. Working hours had to be coordinated as well as timetables. Billing procedures or cost allocation needed to be aligned, as did the periods of use for railway carriages, handling of sensitive freight and other operating regulations. Some standards were not directly operational ones, but impacted on the operation of the infrastructures. A standard format for telegrams, waybills and packaging was established. The stakeholders agreed on a common Morse code and the way railway carriages should be sealed in transit. During the period in question hundreds of aspects were standardised with a view to coordinate workflows and accelerate the transport of passengers, goods and information.

Most standards were enacted as administrative regulations and were not incorporated into national law. This was not sufficient for safety-related standards which constrained the production of infrastructural services, or standards which limited the general freedom of trade and contracts. In these cases international agreements had to be transposed into national law, resulting in the creation of legal standards. This applied primarily to freight law, but also to insurance and liability law. Data protection in telegrams or letters was standardised and enshrined in law, as was the free access to postal and communication services and the non-discrimination in their use. The standardisation of railway freight law was taken furthest in comparison to all other infrastructures. In 1890, the 'Internationales Übereinkommen über den Eisenbahnfrachtverkehr' (International Convention concerning Railway Freight Transport) created international law that applied exclusively to cross-border transports. However, most signatory countries adopted the provisions of the agreement almost literally for their domestic transport. Hence at the end of the nineteenth century international and national law were almost identical.

Tariff standardisation was both the cause for and the consequence of technical, operational and legal standardisation. It was probably the politically most sensitive topic of standardisation because it impacted company profits, the incomes of infrastructure administrations and for most services also the public finances which relied heavily on this income in the nineteenth century. Standardisation efforts had varying levels of priority for different infrastructures. The postal services took tariff standardisation further than the other infrastructures, the most important achievement being the standard postage rate irrespective of distance. More mandatory tariffs and margins were established for other types of mail. Infrastructures such as telegraphy, telephony and railways also agreed tariff

standards. Inland navigation was an exception as the desired ‘standard’ was not a uniform tariff structure, but a flexible pricing system.

The purpose of standardisation in all infrastructures was initially interconnectivity, including the postal services, telegraphy and inland navigation if we count rivers and canals as networks. As soon as domestic networks had expanded to a point where political borders stopped them from developing further, the issue of cross-border connections arose for all infrastructures with the exception of inland navigation. When the technical and economic systems became more complex and the users’ demands increased, interconnectivity was no longer sufficient. In the course of time integration and standardisation increasingly endeavoured to achieve interoperability. A growing need to standardise technical modules and components arose to be able to implement them simultaneously in different systems, to align workflows and legal issues. The characteristics of infrastructures were crucial for the question of interoperability. In the railway systems for example it would not have been sufficient to limit the interoperability to the networks as locomotives and carriages were moving between them. Interoperability was therefore imperative from the outset. In other infrastructures such as telephony or telegraphy network interoperability was sufficient as the end devices were not moved from one network to the other. In these cases cooperative standardisation increasingly meant that national infrastructure markets were systematically sealed off from each other while their interconnectivity was guaranteed.

The question of interconnectivity and interoperability leads us to the issues of coordination and regulation. In the first years of international cooperation the aim of standardisation was to achieve or improve the coordination of infrastructural systems in order to increase their economic benefit. This soon proved to be insufficient, because modernising economies and societies were increasingly dependent on infrastructures, which in some cases even fulfilled the role of an essential public service. Consequently, governments had to intervene and establish regulations to mitigate or prevent adverse or external effects. The need to establish regulative standards on an international level increased. The postal services were required to put in place data protection provisions, the railway operators needed to ensure the safety of trains, inland navigation the competence of bargemen, and all transport systems had to establish insurance and liability standards. It was vital to manage the risks emerging with the expansion and growing complexity of infrastructural systems, resulting in a need for regulative standardisation. It was only in radio communication that standardisation began with regulative guidance.

The issue of coordination and regulation then leads to allocation and distribution. For all infrastructures, standards were of paramount importance for allocation efficiency. Standardisation led to faster and safer transportation of passengers, goods or information across borders. The distributive perspective played almost an equally important role. It is important to keep in mind that the operation of infrastructures turned into a profitable business within a short time—for both public and private operators. Governments promoted many international links exclusively for fiscal reasons. The greater the share of income from international infrastructure

connections in the public finances, the more important the distributive dimension of tariff standards.

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