The Association of German Railway Administrations

(*Verein Deutscher Eisenbahn-Verwaltungen*)

1847-1914

- More than a Trade Association

By

Edmund Bernard Flood

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Abstract

This thesis is based on research of primary sources carried out in libraries and archives in England and Germany as well as the review of both English and German language secondary sources. It examines the contribution of the *Verein Deutscher Eisenbahn-Verwaltungen* (Association of German Railway Administrations) during the period 1847-1914 in the rise of Germany as a unified country; a country that was arguably, by century's end, the leading industrial nation in nineteenth century Europe.

That the *Verein* played a significant role in Germany's ascendance is not at all apparent from most of the historiography where little mention, if any, is made of it. Consequently, what published material is available is sparse, which itself raises many questions. At best the *Verein* tends to be viewed solely as a trade association, but this thesis will make an original contribution to knowledge by presenting evidence to test the proposition, and where hard evidence is absent to permit reasonable inference, that it was much more than that.

In particular it will examine the claim that the *Verein* should be considered as a political institution. It will also examine the role the *Verein* assumed as the non-statutory railway authority in Germany.This delivered what must be considered the basis of the country's strategic infrastructure, namely: a national, standardised, all-weather railway network which was the catalyst for realising the potential of industry, trade and commerce. It will consider the *Verein's* influence not only on commercial matters where it encouraged good business practice across Germany, but also on political and societal issues which had far reaching beneficial effect. Altogether, the evidence presented would indicate that the *Verein* was a major facilitator in the transformation and unification of a fragmented Germany of many independent states, not least by promoting the German language. This transformation was from a cultural nation primarily dependent on agriculture, craft work and cottage industries into an industrial nation-state in the vanguard of technology.

As a consequence, the *Verein* appears to have been an indispensable element in the process of nation building. Therefore, the *Verein*'s status deserves to be re-assessed to determine whether it should be accorded a place of prominence

in the history of Germany. The aim of this thesis is to put forward an original case to test this proposition.

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In so far as any errors or omissions may be discovered in the thesis, the responsibility for these is entirely mine.

Introduction

The historiography of nineteenth century Germany gives little indication of the important part played by the *Verein Deutscher Eisenbahn-Verwaltungen* (Association of German Railway Administrations) – hereafter the *Verein*[1]- in the rise of that country which was, until the political unification in 1871, a collection of 38 independent states.[2]

It is remarkable that although the *Verein* was responsible for establishing a standardised and functioning railway network across Germany, a network which constituted the most important strategic element of modern Germany's national infrastructure, this fact is rarely acknowledged in these terms. It is also extraordinary that the *Verein's* catalytic impact on Germany's industry and economy and its societal impacts, delivered mainly through its railway administrations members, have been largely overlooked.

Consequently, by examining and bringing together many disparate strands of information from primary and secondary sources, and by new interpretations, this thesis delivers the evidence that will require the *Verein's* position in nineteenth century Germany to be re-assessed. In this way, this new presentation makes an original contribution to knowledge.

It is universally recognised that the railways acted as the catalyst for industry, trade and commerce and had implications for politics and society, but in Germany the impact was more profound. The economic historian Rainer Fremdling emphasises the fundamental importance of the railways by quoting his peer Albert Fishlow as saying that "the innovation of the railroads was important in the United States, and this is even more true of Germany, where the industrial revolution cannot be explained without it."[3] In effect the railways facilitated the transition of Germany from what was still a craft based society largely dependent on agriculture to a world-leading industrial society. Childers saw another aspect referring to this period as the transformation of Germany

[1] Later, other vereins will be mentioned, but only die *Verein Deutscher Eisenbahn-Verwaltungen* will be referred to throughout this thesis as "the *Verein*".
[2] Some records quote 38, Henderson (1967b, p.13) cites 39. It is understood that 39 states is in the context of the Austro-Hungarian Empire being a member of the German Confederation.
[3] Fremdling (1977, p. 601).

from a cultural nation (*Kulturvolk*) into a nation state (*Staatsvolk*).[4] Yet there is little evidence in the historiography, apart from the official celebratory and jubilee publications, of the part played in this transition by the *Verein,* the *de facto* strategic management board of the railways, in Germany's rise as a world power.

This thesis will answer the question as to why this occurred and whether the *Verein's* omission from the historiography matters.

Even a cursory reading of the secondary source literature quickly reveals the reason for the omission: the academic history of the railways is dominated by a surfeit of economic history texts which cast the railways as "a leading sector" of the German economy. The texts review the many aspects and implications of this thus over-shadowing other considerations. However, this still leaves the issue of the *Verein* and whether it really mattered.

This thesis argues that, given the facts, it clearly does matter. Namely, that in a relatively short space of time during the period from 1835, when the first railway was built in Germany, until 1914, the eve of the First World War, the *Verein* was instrumental in Germany rapidly establishing an effective railway system with its supporting industry, a railway organisation which became a technology leader and the catalyst for Germany's two industrial revolutions; this is expounded later in the thesis.[5] Further, through improvements in transportation delivered by the railways under the leadership of the *Verein*, costs were lowered boosting trade, exports and the economy. Taken together, this was an outstanding achievement in a very short time compared to Great Britain, Belgium and France who at the outset were some ten years ahead, were more industrially advanced and had made good progress in creating their own railway systems.[6] This raises the question whether, compared to other industrial nations, the German performance was so demonstrably better that it must at least be partially attributable to management of the process. This in

[4] Childers (1990).

[5] The term "organisation" is not intended to denote a single nationalised company, but to describe a loose collaborative network of players in the new industry. (*Rückblick* 1871, p.7).

[6] The term "Great Britain" is used throughout this thesis as it was current during the period under review and is the usual style employed in the historiography.

turn raises questions of how this feat was achieved by Germany and, coming full circle, puts focus onto the *Verein*.

With a few exceptions, where the *Verein* is mentioned at all in the historiography, it is to report simply that it was a railway trade association which pooled and disseminated knowledge amongst its members and later, near the end of the nineteenth century, metamorphosed into a European railway organisation. As a result, it is likely that the *Verein* was regarded as more of a club rather than an organisation of national importance like the *Zollverein*.[7] The *Zollverein's* high profile image can be inferred as being attributable to the many well-known professionals amongst its members, that it fitted the typical definition of statecraft, and that it attracted a high level of press coverage at the time and subsequently.

This interpretation of the *Verein,* which manifested itself as an imbalance in the historiography, was in effect a lacuna that cried out for rectification if the case could be made for it. Consequently, the research aim of this thesis is to present the information gleaned from investigation which details the activities and achievements of the *Verein* and to test whether it played a role which went well beyond merely being a trade association.

From the outset the research uncovered a mosaic which showed that the *Verein,* not least through its constituent member companies, had been every bit as important to Germany's history as the *Zollverein*. This brought to mind the observation of the entrepreneur Friedrich List that the *Zollverein* and the *Verein* were as "Siamese twins" because their activities in many ways were intertwined.[8] Certainly, Germany's advance through the nineteenth century could not have proceeeded apace without the railways and the railways could not have operated as a national system without the co-ordinating management of the *Verein.*

The Original Hypothesis and it Component Parts

Initial findings supported the hypothesis that the *Verein* was more than a trade association. These indicated that the *Verein* from its foundation in 1847 until

[7] *Zollverein* – the German Customs Union. See chapter 7 below.
[8] Sheehan (1989, p.468).

the establishment in 1873 of the *Reichseisenbahnamt* (Imperial Railway Office) -hereafter REA- was: Independent of government; The centre of railway engineering excellence and a technology leader; The *de facto* non-statutory railway authority in Germany; The co-ordinating authority behind the most important strategic element of modern Germany's national infrastructure, namely a standardised railway network, and as such the lead in the transport revolution; The catalyst and indispensable support for Germany's two industrial revolutions; More akin to a commercial head office of a corporation with far reaching commercial effect; A *de facto* political institution as well as a trade association; An unanticipated counter-balance to the Zollverein; A major force in driving the use of the German language; An international body which raised the profile and awareness of Germany as a world power.

The research also looks beyond 1873 to consider the *Verein's* continuing activities as the pre-eminent railway technical authority in a unified Germany and beyond.

In addition, it appraises the *Verein's* international activities and geo-political influence delivered through a multi-national membership, although German railway companies predominated. This evidence indicates that this latter characteristic contributed to the united Germany's growing influence in central Europe as shown by the *Verein's* leading role in the Berne Convention on European trans-national railway freight traffic. Altogether, the prima facie evidence is that these diverse inputs by the *Verein* were crucial to Germany's rise as a world power.

This thesis brings together an original presentation to show that these conclusions, whether supported by empirical evidence or, in the absence of such, through logic and reasoned inference, require that the conventional historical understanding of nineteenth century German development, which was greatly state influenced, should be understood in a different way.

Sources

As regards source material, it was planned to consult primary sources in the German language in Germany, and to augment these, as necessary, with secondary sources predominantly in English as far as practicable.

In the search for primary sources, it was expected that there would be an archive in Germany which held the main body of the *Verein's* records; this proved not to be the case. On investigation it transpired that there is a multiplicity of archives. However, subsequent reference to the University of Oxford Bodleian Library's guidance on German archives gave rise to an expectation that a trail would open which would lead to the principal records of the *Verein*, namely the archives of the railway companies which had acted as the Executive Board and secretariat of the *Verein*, but are now held by their successor organisations or by their state archives.

Therefore, the research was focused in this direction and established that all the railway companies which had acted in the secretariat role for the *Verein* were Prussian.[9] Hence, it was expected that the said records would be held either by Deutsche Bahn, by the Geheimes Staatsarchiv Preußische Kulturbesitz (Prussian State Archive) Berlin, or by the German Federal State Archive, Berlin.[10]

Although this line of enquiry was pursued, none of the policy and administrative files and records of these companies, or any such files relevant to the *Verein*, were found; nor did they surface at any other location subsequently. This was a huge disappointment because they would have provided a rich source of data and cast light on the *Verein's* thinking, its motivations and indications of its stakeholder network. For example, "understandings" and any secret deals between the *Verein* and governments, which may have taken place given the political and economic importance of the railways, and governments' dependence on the *Verein*, would have been revealed by the contents of dossiers compiled at that time; unfortunately, these were not available. The supposition about such *Verein*-government interactions gained greater credibility when initial research showed the number of civil servants and former civil servants who were involved in the top echelons of the *Verein* and its technical arm, the *Verein der Techniker*. Since such information often allows

[9] *Festschrift* (1896). *Nachweisung.*

[10] Deutsche Bahn (German Railways), which had been nationalised in 1920, subsequently went through various re-organisations but at its core included the old Royal Prussian State Railway which constituted the greater part by far of the nationalised railway of 1920.

new interpretations of history, this was intended to be one of the main areas of research. Inevitably this situation changed the shape of the project.

The difficulties in getting hold of the desired material only partially answered the questions posed at the beginning of the thesis: why is there so little in the historiography about the *Verein* and even what there is has many gaps? These fundamental questions presented a number of possibilities. The railway companies which had acted as the secretariat for the *Verein* had not considered it necessary to keep such records. It is likely that the rules and norms for archiving material were different from today. The material had disintegrated prematurely through acidification of the paper.[11] The material was destroyed in World War II. The material was removed after the war by the Allied powers and not included in documents which were later returned.

Apart from this many researchers would be surprised to find how little of the material in the German archives is digitised, or even catalogued in any detail. One German academic advised that the total of digitised material is probably no more than 20 per cent of the holdings. Eminent historians such as Ziegler and Mitchell put little store by what is available concerning the *Verein* because of the apparent paucity of information from a historical viewpoint (Ziegler[12]) or the quality of the information (Mitchell[13]). Despite this, other eminent historians and domain experts such as Fremdling and Schot considered the *Verein* worthy of research on the information available.[14] It was these positive responses which further encouraged the author to forge ahead with this thesis. However, more reliance on German language secondary source material beyond that originally intended became necessary.

As the research progressed without finding the desired material, even as background to the minutes of the *Verein's* meetings, it was unavoidable that the absence of information placed limits on the research and set unexpected

[11] Deutsche National Bibliothek (German National Library). Note regarding deacidification. http://www.dnb.de. Accessed 8th May 2017.
[12] Correspondence Ziegler-Flood 16th February 2015.
[13] Mitchell (2000, p. 72) considered the minutes of the *Verein's* meetings as almost frivolous compared to those of the French Corps de Ponts et Chaussées. But he is not comparing like with like, because the Corps was a department of the French government while the *Verein* was a commercial organisation, not a bureaucracy.
[14] Correspondence Fremdling-Flood 16th March 2015; Correspondence Schot-Flood 17th March 2015.

boundaries. Hence it was necessary to exploit that which did exist, for example, primary source documents cited by academics such as Dunlavy and Henderson. At the same time the importance of comparing to other countries' experience, where appropriate, offered a potential solution for gap filling.

Primary and Secondary Sources

The list of primary sources consulted will be found in the Bibliography and those primary sources which were used are discussed below.

With regard to secondary source material:

the *general background* literature relating to Germany used in the project is mainly from English language secondary sources including texts by: Blackbourn (1998, 2003); Brophy (1998); Clark (2006); Dunlavy (1990, 1991, 1994); Fremdling (1977); Henderson (1939, 1967a, 1967b, 1975); MacGregor (2014); Pierenkemper & Tilly (2005); Sheehan (1989), Tipton (1976, 2003), and Watson (2010). The books consulted, augmented by academic journal articles, are listed in the Bibliography. Among these which deserve especial mention are German language texts by Tilly (1980) and Kopper (2015).

The *railway background* literature relating to Germany used in the project, apart from Dunlavy (1990, 1991, 1994), Henderson (1967a), Kaiser and Schot (2014) and Mitchell (2000), is mainly from German language secondary sources including: Gall and Pohl (1999); Kech (1911); Klee (1982); Kühne and Reiners (2010); Wagenblass (1973); and Ziegler (1996). Again, the books consulted, augmented by other academic material, are listed in the Bibliography.

The *railway background* literature relating to Great Britain, France, and the USA used in the project for the purposes of comparison are all English language publications, apart from Kocka (1987), and includes Bagwell (1968), Dunlavy (1990, 1991, 1994), Gourvish (1980), Hawke (1970), Mitchell (2000), Snell (1971), and Wolmar (2012). Again, the books consulted, augmented by academic journal articles, are listed in the Bibliography.

Primary Sources used

The most important primary source document used was the *Festschrift* published in 1896. This is a book of some four hundred pages, celebrating the achievements of the *Verein* in the first fifty years of its existence, 1846-1896.

Translated from the German, it bears the inscription:

> "Compiled and dedicated to the members of the Verein on the occasion of the celebration of its 50th anniversary by the Executive Administration (Royal Railway Directorate at Berlin). Berlin, June 1896."[15]

The *Festschrift* styles itself as "a commemorative volume devoted to the task of describing the development of the Union [*Verein*] and its activities in the first half-century of its existence on the basis of official sources."[16]

Its scope covers everything to do with the setting up and running of a railway: from its constitution (*Verfassung*) including the setting up of an office (*Vereinsbüro*) and a fund (*Vereinskasse*); the creation and work of a technical arm (*Vereins der Deutschen Eisenbahn-Techniker*); matters concerning railway construction, operation and equipment (*Bau, Betrieb und Betriebsmittel*); discussion of important technical questions and the publication of articles; and *Regulations for Passenger and Goods Traffic*.

Given its scope, the *Festschrift* constitutes a compendium of key information about the *Verein*, a compilation from which it was possible to understand how it came into existence and how, with a strong technical focus at its core, it evolved into the *de facto* management authority of the German railways in the days before unification. Inevitably, the *Festschrift* was the first point of reference and was used to help shape and inform the thesis; and at other times was used to calibrate inputs from other sources. In view of the scarcity of sources it is no surprise that it was cited by other authorities.

The next most important primary sources used were the two *Rückblicks*. These look back over the founding and effectiveness of the *Verein*. The 1871 publication covers the period 1846-1871, while the 1900 publication, *Rückblick*

[15] *Festschrift* (1896). Titel, Page III.
[16] *Festschrift* (1896). *Einleitung*, p. XVI.

Techniker, covers the period 1850-1900 and is dedicated to the activities of the technical arm of the *Verein* (*Vereins der Deutschen Eisenbahn-Techniker*).

The first *Rückblick, Rückblick* (1871), covers the foundation of the *Verein,* initially the Union of Prussian Railway Administrations in 1846. It explains how its original Prussian membership was extended across other German states and beyond. This eventually included railway administrations in other European countries that operated passenger and goods traffic connected to a Union (*Verein*) railway.

As regards scope, *Rückblick* (1871) explains the *Verein's* guiding principle in its early years, namely, co-operation between members not duress; this meant that any member could veto a decision. In addition, it emphasises the importance of the association having a newspaper and a technical magazine and reports how this was achieved over time. The *Rückblick's* scope also covers the *Verein's* success concerning the question of customs, weights, measures and currencies, and the guidance to members through regulations.

Given the scope of *Rückblick* (1871), it proved useful in assessing the credibility of, and plugging the gaps in, the *Festschrift.*

The second *Rückblick, Rückblick Techniker* (1900), recounts the creation and activities of the technical arm of the *Verein* (*Vereins der Deutschen Eisenbahn-Techniker –hereafter "Verein der Techniker"*), provides details of its composition and gives details of its meetings. In particular the minutes of the foundation meeting in February 1850 are included at Annex II. The *Verein der Techniker's* independent existence lasted only some forty two years, from its separation for professional reasons from the *Verein* in 1850 until its re-incorporation back into the *Verein* in 1892. Yet, for all of its existence, it served only the *Verein*.

The scope of this document embraces the history of the founding of the *Verein der Techniker.* It explains that a strong impetus for its creation was that there was little prospect of any government railway authority emerging at that time to promote standardisation given the political fragmentation of a Germany of 38 states. It further explores how the promulgation of principles and regulations by

the *Verein der Techniker* not only prevented the further fragmentation of the German railways but promoted and upheld uniform standards.

Rückblick Techniker (1900) makes the claim that "The first assembly [in 1850] was the starting point for the independent development of the railway industry in central Europe." [17] Kaiser and Schot [18] lend weight to this claim in acknowledging the *Verein* (at the heart of which lay the *Verein der Techniker*) as one of the early building blocks of Europe.

The detail in *Rückblick Techniker* (1900) provided the backbone for Chapter 6 of the thesis.

Other primary sources used in the thesis include material found at the Geheimes Staatsarchiv Preußische Kulturbesitz, Berlin, identified as the likely location for material relating to the *Verein*. But little of significance for the thesis was found there except for Germany's involvement and payments in support of the building of the St Gotthard Tunnel in Switzerland and, in another file, the names of members of the *Verein für Eisenbahn Kunde* (The Association for Railway Science). Both are referenced in the thesis.

By contrast, much useful material was found in the Staatsbibliothek, Berlin, and has been used extensively in the thesis. The scope of this material included documents, and articles in the *Verein's* own newspaper concerning tariffs, the part played by the North German Confederation relating to railways after 1866, the *Verein's* proposals for a secondary railway system, and the drafting of the Commercial Code.

Similarly, the Deutsche Bahn Archiv-Museum in Nuremberg yielded many documents. However, in subject matter terms the scope was quite narrow and mostly about the contentious issue of tariffs. Although minutes of certain *Verein* meetings were available, often pages were missing. Nevertheless, useful information about the *Verein's* Clearing House was found and the *Enzyklopädie* helped with date pointing on occasion. These have been referenced in the thesis.

Secondary Sources used

[17] *Rückblick…in Technischer Beziehung* (1900, p.5).
[18] Kaiser and Schot (2014).

Among the secondary sources used, the most important were the works of Henderson, Dunlavy, and Brophy which set the scene for study of the railways in Germany but which because of their more general application are reviewed in Chapter 1.

Other publications upon which the thesis depended heavily were:

Die Entstehung der allgemeinen Vertragsschluß-Vorschriften im Allgemeinen Deutschen Handelsgesetzbuch (ADHGB) von 1861. (The Development of the German General Commercial Code from 1861). (1991)

This secondary source book by Bühler (1991) is one of eighty nine books and documents in a collection about the ADHGB listed in the book's annex. While at its core this book focuses on contracts, it delivers a general history of how the Code evolved. It provides a sound academic basis to give credence to assorted material and papers found elsewhere but with deficient, or uncertain, supporting evidence, e.g. *Allgemeines Deutsches Handelsgesetzbuch (1861) Würzburg.* This assorted material is further strengthened from the academic viewpoint by the index and recital of Articles in Köbler's *Allgemeines Deutsches Handelsgesetzbuch* (1861). Together Bühler and Köbler were the critical sources drawn upon to make reference to the ADHGB and its Articles in the thesis.

Unexpectedly, a clutch of secondary sources, some broadly contemporaneous with the *Festschrift*, delivered many valuable pieces to make up the jigsaw, namely: Cohn (1893), Taussig (1894), Meyer (1897), and Bradford (1907). Another important source, Helmholtz and Staby (1930), must be mentioned for this was started before 1914 by another author (see below) before it was picked up by Helmholtz and Staby.

In some ways it could be argued that these works produced during, or proximate to, the period covered by the thesis are on the cusp of being considered primary sources. And, in so far as Cohn, Meyer and Bradford are concerned, the indications are that they were Americans looking at the German railways from a distance; this suggests some objectivity and adds credibility to their writings. Certainly for this thesis all these secondary sources were of fundamental importance. Looking at each in turn explains its purpose:

Cohn's (1893) article considers the railway policy of Prussia. It describes the changing situation from the 1840s to the 1880s as it impacted the railways, from the difficulties of raising finance for construction before 1848, to the financial surpluses later plugging gaps in the Prussian state's finances. In between, the Prussian government's pre-occupation with constitutional conflicts, Bismarck's wars (1864, 1866, 1870/71), the joint tariff system (1877), and the railway "nationalisation" bill (1879) are examined. Also, it shows that in the early days the Prussian government sometimes got better performance out of railways than did private enterprise. Cohn is drawn upon extensively in the thesis to give perspective to the topics listed.

Taussig's (1894) article focuses on the criticism of the Prussian State Railways which was given voice in the *National Zeitung*, Berlin, in 1891. It was part of the national debate on education and status in the rising meritocracy which had developed. In particular the public takeover of the railways in Prussia had resulted in their technically trained management being replaced by civil servants trained in the law, "*Juristen*". Operational managers (engineers) were relegated to lower positions and this adversely affected the running of the railways and the services offered. This article was relied upon in the thesis to provide the background to this important aspect of railway management.

Meyer's (1897) article deals with the administration of Prussian railways. Its scope covers the evolving structure of government in Prussia from the 1840s to the reforms of 1895; how the Imperial constitution of 1871 gave the new federal government greater direct power over the railways; and how all the administrative, legal and advisory bodies were organically connected with one another and parliament. In particular, attention is given to the new advisory councils which became locked into the governance structure of the Prussian railways, gave all stakeholders a voice and became a unique and powerful means of determining realistic tariffs. The federal government strove with difficulty to expand this into other states. The negotiations from 1878 leading to the Berne Treaty (1890) agreeing standards for international rail freight traffic are also addressed. However, the most important find was reference to the *General Konferenz*. Meyer does not state that this body replaced the *Verein* in Germany but, from a close reading of the text (excepting the activities of the

Verein der Techniker) this is the only conclusion to be reached. This fact is given prominence in the thesis.

Bradford's (1907) article also considers Prussian railway administration. Inter alia, it looks at the classification of railways in Prussia; the Imperial Railway Office (*Reichseisenbahnamt*); how the federal government, while it was empowered under the constitution to exercise supervision of the railways throughout Germany, for political reasons did not apply this with any force; the government administrative structure after 1895 (including advisory councils) as it affected the railways; the fixing of rates; and financial results.

A key point (supporting Meyer) concerns the *General Konferenz*. Bradford refers to this by its English translation as the General Conference of German Railways.[19] But there is no commentary on its being the successor to the *Verein* (here referred to as the Society of German Railway Managements) either in the text or the chart attached (entitled *Outline of Prussian Railway Administration* and under Part III. *Imperial and International Advisory Bodies).* The chart is a significant piece of evidence which graphically demonstrates the reduced status and importance of the *Verein* in German affairs. Although the chart is undated, the text indicates the date point as circa 1895. This evidence is referenced in the thesis.

Helmholtz and Staby's (1930) book was published at the behest of the *Verein* and the Association of German Locomotive Manufacturers (for which no other reference was found in the research). Although its authors are given as W. Staby, a government councillor in Munich, and R. von Helmholtz, a senior locomotive engineer with Krauss in Munich, it owes its genesis to earlier work by Dr R. Sanzin, a senior engineer in the Austrian Railway Ministry in Vienna, who produced the preliminary work before the First World War but who died in 1922 before it was completed; volume I is attributed to him. The book is in three volumes and is a work of technical reference. Its scope includes the definitions relating to the *Verein's* classification of locomotives based on their design; Strahl's formulae for working out the maximum speed at maximum power for different locomotives; and the serious accidents caused by axle failures. Such

[19] Bradford (1907, p.318).

examples have been included in the thesis to illustrate technical issues and the work of the *Verein der Techniker.*

Other secondary sources which proved of especial value and drawn upon in the thesis were :

Tilly (1980) for his paper on the part played by banks in the industrialisation of Germany; Pierenkemper and Tilly (2005) for the economic history of Germany as it related to railways; Kech (1911) and Ziegler (1996) for explaining what went on outside of Prussia regarding the politics and motivations around the building and operation of the railways, tariff leagues and the fixing of tariffs; and Tipton (2003) for providing insights into cultural and political differences between the regions and their impact on industry. As such these historians delved into affairs beyond Prussia and balanced out the predominantly Prusso-centric historiography.

For comparison purposes, and to help provide an international perspective, particular reliance was placed on Bagwell (1968) who wrote about the railways in England; Kocka (1987) who compared railway administration in the industrial revolution in Germany and in the United States; and Mitchell (2000) who compared the development of the railways in France and in Germany.

Methodology

The material assembled enabled the structure of the thesis to be put together providing form and a firm foundation for the study. It also facilitated understanding the *Verein's* constitution (*Verfassung*); some of its key drivers addressing railway construction, operation and equipment (*Bau, Betrieb und Betriebsmittel*); the responsibilities of the *Verein's* committees; provided listings of its major assemblies held between 1846-1894 and gave information about the *Verein's* principal executives during this period. In addition, articles from the *Verein's* own newspaper, *Zeitung des Vereins Eisenbahn-Verwaltungen*, helped identify the *Verein's* business priorities.

This approach allowed analysis of issues against the historical background of the day promoting the production of the historical narrative. In order to achieve this, the methodology employed has utilised a hybrid study approach: a

synthesis of primary source material from archives fleshed out with secondary sources thus contextualising the *Verein's* relevance to the rise of Germany.

The Question of Inference in the Thesis

Nevertheless, given the limitations of the source material, a challenge might reasonably be made concerning many of the broader conclusions about the operation and impact of the *Verein* being derived by inference from the nature of the organisation. In response, it may be said that the key to understanding the nature of the *Verein* can be found via North [20] who wrote about institutionalism, and in Kaiser and Schot [21] who wrote about technocratic internationalism. Both principles are examined in the thesis and can be identified in the *Verein*. At this point it is necessary to put oneself into the shoes of railway executives at that time when the railways were just starting out in Germany. Like any business, the imperative was to make money. Yet every railway administration was hitting problems, whether technical relating to laying track, or operating locomotives, or concerning running on one another's track, making payments or progressing receipts etc. Each company independently grappled with these issues. The emergence of an association (the *Verein*) where experience could be pooled, challenges addressed and resolved, and agreements reached across the membership enabled the prime objective, namely profitable business, to be realised. The inference drawn from this is that a unified, standardised and inter-operable strategic railway network developed across Germany because of the co-ordination provided by the *Verein* when no other body existed and there was no German statutory rail authority.

Another important example of inference, cited in Chapter 6, can be found in the technical arena. In those days axle failure was a continuing problem and the thesis infers that the *Verein der Techniker* would have highlighted possible overloading issues to its members, or axle manufacturers would have introduced modified designs. This is entirely consistent with today's industry practice whereby equipment failures reported by major customers are monitored by manufacturers in conjunction with those customers and, if appropriate, either an amendment to the maintenance schedule is introduced

[20] North (1996, pp.1-13).
[21] Kaiser and Schot (2014, pp.6-7).

or a modification to the equipment design is instigated. Nowadays this is part of the doctrine of *availability, reliability and maintainability* and the attendant *defect reporting and modification* procedures. While today's methods may be more refined than hitherto, the same demands on business applied at that time: rolling stock had to be available for service if a railway company's business was to function effectively. Hence, the demands of trade, and the imperative for a business to be profitable, forced industry players and their suppliers to take note of the performance of their products and services and take the necessary corrective action when these failed.

A final example of inference concerns the influence of the *Verein* in terms of commercial matters across Germany and even beyond its borders, that is, where its non-German railway members operated. The unity of the German railways, as described in the thesis, extended beyond technical and operating procedures. The evidence found includes standardised Bills of Lading and Consignment Notes, *Regulations for Passenger and Goods Traffic*, compliance with the articles in the German General Commercial Code and customs regulations**.** Chapter 7 shows that the *Verein* made a major contribution to the commercial code and customs regulations. As such, the thesis infers that the German railway system, which was a *de facto* organisation, through the use of common procedures with its customers, and other parties, must inevitably have beneficially influenced commercial activity in the German economy not least by spillover into general business. An analogous situation is the way that, nowadays, public procurement policy and procedures, for example contract terms and conditions, influence contractors who, in turn, flow-down or reflect these conditions in orders on their sub-contractors and into the supply chain. In this way thousands of firms operate in a common rules environment, with broad commonality of commercial practice, where the rights and obligations of the parties are clearly understood and enforceable in law.

In summary, the existing historiography rarely goes beyond making peripheral references to the *Verein* or mentioning it briefly in relation to a specific theme. This thesis is different. By drawing upon documentation and literature which addresses discrete topics, it pulls together many different strands to produce a more comprehensive and balanced account of the activities and achievements

of the *Verein* than has hitherto been available. Consequently, it presents an entirely new picture, a whole picture which is greater than the sum of its parts. This will permit a new interpretation of the part played by the *Verein*, which the evidence indicates was central to the role of the railways, in Germany's development as an industrial power. In this way the thesis makes an original contribution to knowledge. At the same time it challenges the reader to stop and consider anew the *Verein's* indispensable role.

Structure of the Thesis

After the initial chapters this thesis adopts a thematic approach. This has strengths and weaknesses. Its strength is that it allows coverage of the diverse material examined in the research; its weakness is that it results in occasional re-iteration where material is cited in a different context.

Introduction

This explains the motivation for the thesis, what it sets out to achieve, the sources used and justification for inferences drawn, and what it claims as an original contribution to scholarship.

Chapter 1 The Literature Review

This chapter acknowledges the *Verein* jubilee and celebratory publications, but focuses primarily on the work of those historians whose material was relied upon in the writing of Chapters 2 and 3 for setting the environment. Although this addresses economic issues, much of what is reviewed was written from a political perspective.

In subsequent chapters, the relevant literature is reviewed as the text demands.

Chapter 2 Setting the Environment - the Disaggregrated German States

This chapter gives some historical background from 1648 until 1835. It then reviews the environment into which the railways were introduced in Germany in 1835 and examines these transformational years, which included a transport revolution, up to 1871. By this time the railways had catalysed and supported the industrial revolution and the railways themselves were well established. En route, the text considers the social unrest which led to the Revolution of 1848. Apart from giving the recently founded (1847) *Verein* time to become

established, this period was a political watershed, especially in Prussia, which saw the entry into political life of those who espoused liberal economics. This mattered because it re-inforced the efforts of the *Zollverein* to set a new economic environment and encourage enterprise. At the same time a new method of banking was taking root financing the expansion of the railways, the still fledgling heavy industry, and commerce. Together these developments presaged the death of the *ancien régime* and a meritocracy gained traction.

Prussia triumphed over Austria in 1866 and expelled it from German affairs thus establishing Prussian hegemony in Germany. As a result, both the German Confederation and the *Zollverein* (German customs union) crashed, only to be replaced by the North German Confederation (1866-1871) and the Second *Zollverein*. The North German Confederation displaced the *Verein* within the confederation; it was from this place and time that the seeds were sown of the *General Konferenz* which subsequently supplanted the *Verein*. The Second *Zollverein* acted as the bridge between the erstwhile warring north and south. Later, these institutions were stepping stones towards the unification of Germany in 1871.

During this era, 1835-1871, a transport revolution was underway and competitive pricing forced down costs to the benefit of the economy; but tariffs were a complex and continuing issue especially when the railways were attempting to displace water-borne carriage as the pre-eminent mode of transport. This did not happen as quickly as many imagined as the text will reveal.

Chapter 3 Setting the Environment - the German Nation State

This chapter examines the continuing transformation in agriculture, the advent of the new industries (chemicals, shipbuilding and electrical) and the cartels after 1871. It also notes the evolving societal situation, the decline of liberalism and the Imperial government's attempt to suppress the rise of socialism by the introduction of generous social security laws.

This was the period when the Imperial government moved determinedly to displace the *Verein*. A start had already been made in the time of the North German Confederation. This displacement was reinforced when the *Verein* was

excluded from the joint military-civilian railway line commissions. Finally, the government founded the REA as the statutory railway authority in Germany, thereby replacing the *Verein* which had hitherto fulfilled this role on an unofficial basis. Nevertheless, the *Verein*, maintained its standing as the pre-eminent railway technical authority in the land and continued to be acknowledged as the expert on European rail matters. On this issue it was heavily engaged in negotiations leading to, and concerning, the Berne International Convention relating to the *Carriage of Goods by Rail*.

During the same period, the governmental machine in Prussia (the proxy used by the Imperial government), which was often imitated by other states, began to be re-structured. This included the mandatory requirement for a consultative body of stakeholders on railway matters, especially tariffs, in each region; the requirement was eventually passed into federal law. This model was unique, proved economically beneficial, and finally resolved the vexed question of tariffs in Germany.

Chapter 4 The Emergence of the *Verein Deutscher Eisenbahn-Verwaltungen* (Association of German Railway Administrations) 1847.

This chapter studies the raison d'être and traces the genesis of the *Verein* from its Prussian beginnings. It examines the *Verein's* structure, membership and constitution. It is immediately apparent from the exalted membership of its consecutive executive committees down the decades that this was no ordinary trade association; rather it was an association connected with the highest echelons of government and one with a wide and influential network. Consequently, the evidence presented casts the *Verein* in an entirely new light and helps to explain its facility in achieving mutually acceptable solutions across unlikely boundaries.

Chapter 5 The *Verein* and the Political Dimension

This chapter explains how, in the Railway Law of 1838, Prussia laid down the basic rules for the construction and operation of railways and how this became a standard reference for other German states. It also expounds the implications of the Railway Fund Law of 1842 which provided a source of funds for railway related matters for the Prussian government. The tenure in office of the

Prussian Minister of Commerce responsible for the railways, August von der Heydt (1848-1862), was one of tension with railway companies and between von der Heydt and his liberal cabinet colleagues. Both of these interest groups resented his interverventions in the railways, but these often resulted in improved efficiencies in performance, whether in terms of quantities of coal hauled, or the running of night trains to bring the mail to businesses. The evidence shows that although the relationship between the railways and government was at times fractious, it developed into one of compromise for mutual benefit.

The founding and diverse purposes of the REA are reviewed in this chapter as well as Bismarck's efforts to nationalise the railways after German unification in 1871. (This was not achieved until 1920 during the time of the Weimar Republic.) However, with the complicity of his proxy, Prussia, Bismarck engineered the taking into public ownership of the private railways in Prussia. The new organisation was to serve as a model for the future nationalisation of all the railways in Germany.

The chapter also looks closely at the suggestion that the *Verein* was an institution. This is calibrated against the criteria proposed in Northian institutionalism and is found to comply. Further, the *Verein* is shown to satisfy the criteria for a political institution.

Chapter 6 The *Verein* as an Engineering Authority

This chapter addresses the genesis and relationship of the *Verein's* technical arm, *Verein der Deutschen Eisenbahn-Techniker* (*Verein der Techniker*) to the parent organisation the *Verein.* In a similar way as the *Verein,* it is immediely clear that this was an association of highly qualified professional engineers many of whom held, or had held, senior posts in government and the civil service.

This was a time when locomotive research and development was helping to push forward the boundaries of science and technology; the chapter brings out the fact that the *Verein der Techniker* was engaged in such activity in conjunction with industry stakeholders. It also emphasises that the core of the *Verein's* continuing power and influence was through the *Verein der*

Techniker's agency as the centre of railway engineering and railway operational technical excellence in Germany, and beyond.

Chapter 7 The *Verein* and the Commercial Dimension

This chapter considers the commercial difficulties encountered by the railways in the early years and how the railways, what Chandler called "the first big business," led by their association the *Verein*, met and solved these challenges.[22] It also looks at the spill-over of the *Verein's* commercial practices into German business.

In addition, the chapter considers how improvements in transportation from the arrival of the railways led to heightened competition first between the railways and traditional horse-drawn carriers, then between the railways and waterways but ultimately between the railways themselves. Competition resulted in lower transport costs, which in turn led to lower trade costs, which boosted the economy and Gross Domestic Product. Caught up in this was the complex subject of tariffs and the charge that the *Verein* failed to exert its influence; this charge is countered. Finally, the chapter enquires to what extent the *Verein* may be considered as the commercial successor of the Zollverein.

Chapter 8 The Changing Fortunes of the *Verein* after the Unification in 1871

This chapter traces the downgrading, and even exclusion, of the *Verein* by the Imperial government from German governmental bodies. It enquires how this contributed to the *Verein's* metamorphosis from a German into an essentially European institution. Yet, in the same period the *Verein* was the instigator of a secondary railway system which arguably helped the government during "the Great Depression" (1873-1895); to what extent this is true is examined. As regards the *Verein* in its international rôle, the narrative notes how it was used by the federal government in its geo-political power plays, and to what effect.

Conclusion –The *Verein's* contribution to nineteenth century Germany

The last section draws together the research and presents the conclusions. It compares the hypotheses presented at the beginning of the thesis with the

[22] Chandler (1965).

findings. On the basis of the evidence presented, it establishes that the *Verein* was much more than a trade association. Rather, it was a political institution which provided Germany with its first modern infrastructure, a national railway system. This underpinned and released the potential of industry and commerce and was the catalyst for important societal developments. The *Verein* also made a major input to the rules, regulations and processes used by German business. The evidence is clear: the impact of the *Verein Deutscher Eisenbahn-Verwaltungen's* achievements and influence, which went beyond Germany's borders, were essential ingredients in Germany being recognised as a world power.

The Direction of the Thesis and the Original Contribution to Knowledge

The direction the thesis will take, and the particular aspects of this study which constitute an original contribution to knowledge are as follows. (For the avoidance of doubt, each of the nine points listed is an original contribution to knowledge.)

First, it will provide a clear account based on evidence that the *Verein* was the *de facto* non-statutory railway authority in Germany until the establishment of the REA in 1873. This questions how the *Verein* emerged and developed into a railway authority. It will explain how the many state governments in Germany reacted to this and how the non-German governments became involved. Also how the *Verein* was empowered in this manner.

Second, it will provide a clearly presented case that the essence of the *Verein's* continuing power and influence was the agency of its technical arm, the *Verein der Techniker*. The *Verein der Techniker's* special relationship with, and value to, the *Verein* which allowed the *Verein* to present itself as a centre of railway technical excellence will be explained. This insulated the *Verein* to a great extent against the vagaries of political change, particularly after the unification of Germany.

Third, it will provide a clearly presented case that the *Verein* was a poltical institution as well as a trade association. The *Verein* will be shown to have met the criteria for an institution and a political institution at that. Yet it was the competence of its directors who were prepared to engage robustly in politically

difficult situations, such as the conflict over the German Commercial Code, which marked it out as a political institution. However, the *Verein's* power as a political institution was primarily "soft power". This power was delivered by means of the influence it wielded through the multi-national civil service network of its many directors who were civil servants, or former civil servants. Also, through access to the highest level of governments across Germany and other European countries via its directors who were aristocrats. This facilitated the efficient resolution of what might otherwise have been difficult and protracted issues.

Fourth, it will provide a new interpretation that it was the *Verein* in a co-ordinating role, working through the *Verein der Techniker* and the Verein's railway administration members, that was responsible, as the enabler, for the establishment of Germany's most important modern strategic infra-structure, namely a standardised, inter-operational railway network. It is extraordinary that this achievement receives barely a mention in these terms in the published historiography of nineteenth century. It will be shown that the Verein's rules and regulations provided the governance whereby the structure and operation of a national railway network was put in place.

Fifth, it will provide an explanation why the *Verein* was <u>the</u> indispensable support for Germany's second industrial revolution. This explains the different circumstances of the support provided to the chemical, dyestuffs and shipbuilding industries.

Sixth, it will provide reasons why the *Verein* should also be considered a pioneering commercial body which facilitated good business practice across Germany and beyond. Unlike the *Zollverein* which had the luxury of time to consider commercial issues, the *Verein* had to face commercial challenges head-on and come up with workable solutions. It will be shown that, whether by making inputs to government regarding commercial terms and conditions or customs duty regulations, or devising answers to currency issues, the *Verein* oiled the wheels of trade and commerce in Germany and beyond.

Seventh, it will provide reasons why the *Verein* should be considered the principal facilitator of adoption of the German language across "German lands".

In its border lands Germany had absorbed many communities which previously had belonged to other dominions. These were distinguished by a mother tongue other than German. However, the *Verein* made no concessions to this and conducted all its business in German. This fact and its implications will be examined.

Eighth, it will provide reasons for identifying 1866 as the year when the *Verein's* power and influence started to wane. Other historians indicate 1871 (the unification) or 1873 (when the REA was established) as the date(s) the *Verein* began to lose its power and status. This thesis challenges these interpretations and claims it occurred in 1866. It also reveals the implication of this development.

Ninth, it will the clearly identify the *General Konferenz* as the *de facto* successor to the *Verein* in Germany. In the historiography the *General Konferenz* is virtually an unknown entity. This thesis will explain how it supplanted the *Verein*. It will also answer the puzzle about how this occurred when the REA had been established (in 1873) as the railway statutory authority, ostensibly to replace the *Verein.*

What of the *Verein* after 1873 – did it disappear off the scene? Unfortunately for historians who had more than once predicted its demise, it did not. The record shows that it entered a new phase: while continuing to exert influence in its traditional domain, centred in Germany, it became more focused on European matters. This is addressed at Chapter 8.

Chapter 1

The Literature Review

Previous works specifically about the *Verein* for the period covered by this thesis, 1847-1914, consist primarily of the celebratory and jubilee publications listed in the Bibliography.

The scarcity of such material may be accounted for by the reasons previously stated. Nevertheless, these publications did provide a sound basis from which to begin writing the thesis by drawing particularly on material concerning the *Verein's* constitution, the responsibilities of its committees, and technical publications on railway construction, operation and equipment. In addition, the *Verein's* newspaper, *Zeitung des Vereins Eisenbahn-Verwaltungen*, was a valuable source for identifying issues of interest to, or involving, the *Verein* which were topical at the time.

The literature review which follows relates primarily to Chapters 2 and 3 of the thesis and describes in general terms the situation which prevailed in Germany from 1648 until 1914. Where appropriate, it refers to issues which touched upon the activities of the *Verein* or its constituent railway company members. Given the timescale covered, it was necessary to access many sources and consult the works of some forty or so historians. Particular reliance has been placed upon the writings of Blackbourn, Brophy, Dunlavy, Henderson, Kaiser and Schot, Klee, and Sheehan, who are considered below before citing them again as the thesis unfolds.

As regards subsequent chapters, the literature is reviewed as the text demands.

Three general histories are cited: those by Blackbourn and Sheehan which are avowedly not Prusso-centric, and by Henderson, which without publicising the fact evidently is. To explain the implication of this difference: historians in the 1960s considered that their predecessors had placed too much emphasis on the influence of the Prussian state in the development of Germany. It was economists such as Tilly cited by Tipton who first questioned the state's

influence.[1] Tilly was not convinced about the value of the Prussian state's involvement in such matters as transportation and finance and introduced the rigour of neo-classical economics into assessing its real contribution. This methodology itself was subsequently called into question by the focus on transaction costs and property rights, which in turn were superseded by yet another new focus, namely institutionalism. Reading between the lines it could be inferred that perhaps some of the criticism about the pre-1960s school of historians was later considered too harsh; it was certainly called into question (albeit unintentionally) by Wagenblass, of whom more later. But the new writing from the 1960s onwards certainly diminished the political dimension of the historiography. Collectively the work of Blackbourn, Brophy, Dunlavy and Sheehan sought to rectify this.

Blackbourn's book is a general history which covers Germany's transformation from an agrarian and craft based economy to arguably the leading industrial state in Europe during the period 1780-1918.[2] Blackbourn has a questioning style in that he muses over much of what he reports and is generally interpretive. In this way he conveys how the great transformation in Germany's situation came about by describing not just the flow of events but by revealing the many and diverse undercurrents. In addressing three themes (politics, economy and society, and culture), Blackbourn's book examines their historical development during the long nineteenth century but in an unorthodox manner. Hence under "politics", the legal, police, welfare and fiscal functions of the modern state are brought together in what seems an unusual linking. Then under "economy and society" he sees class as the transformational factor in society during this period. Lastly, under "culture", "the symbols and practices which inform everyday life" are prioritised over education.

The reader may be disappointed that Blackbourn's approach does not result in the clean "chunking-up" expected; rather the narrative weaves back and forth, time and again, and might be considered untidy. However, the range of topics covered and interaction between them makes this almost inevitable. What is not inevitable are the many apparent contradictions in the evolving story.

[1] Tipton (2000).
[2] Blackbourn (Edns 1998, 2003). Unless otherwise stated the references refer to the 1998 edition.

Blackbourn acknowledges this and attributes it to the era being a period of transition; nevertheless it raises the question as to whether Blackbourn's writing style deliberately contrives to leave an issue unresolved. For example, this occurs regarding the *Zollverein*, where his statements are ambiguous and the reader is left uncertain as to what value he puts upon it.[3]

While rejecting the *Sonderweg,* or special path, view of German history promoted by German historians such as Wehler et al, who traced a path back through time to make the case for the inevitability of the unification in 1871, Blackbourn maps the path of state-building from the events of 1848 (noting the draft constitution and rejecting the idea that the business class, the bourgeoisie, were at this point feudalised) through 1866 (which he identifies as the critical point in the unification process which potentially had more than one outcome) to 1871; all this occurs against the background of the industrialisation and modernisation of the country.[4]

Blackbourn maintains that his explanation of the emergence of a new class structure which accompanied modernisation was not adequately treated by other historians.[5] This is curious because it takes no account of the evidence found by Watson (2010) of earlier developments (see below). Blackbourn tells us that, at the same time, undemocratic liberalism waned as a political force after 1871 and new political parties representative of the working class gained traction, particularly the Socialist party. At this point, Blackbourn introduces the concept of Germany being "a carceral society": "if the barracks and the police station were two powerful symbols of German society, the law court was a third". This conjures up a harsh and regimented image of German society, a recurring theme in German historiography.[6]

As for the railways, Blackbourn identifies them as promoting industrialisation, driving demand into the economy via the supply chains, enabling logistic solutions and driving down costs of bulk transport by around 80 per cent, while

[3] Blackbourn (1998, pp. 117-120, p.185).
[4] Blackbourn (2003, pp. 184-185).
[5] Blackbourn (1998, p.217).
[6] Blackbourn (1998, pp.234-235, p.242, pp.266-267, p.384).

also bringing about the growth of towns and cities.[7] Yet, in a book of some five hundred pages with numerous references to associations, no mention is made of the *Verein,* which together with its constituent member railway companies, facilitated this revolution of modernisation. It is also noticeable that Blackbourn, save for a passing reference to the Army Railway Section, makes no mention of the part played by the railways in the build-up to the First World War.[8] Similarly, he makes no mention of the dependency on the railways of the new chemical and shipbuilding industries which burgeoned in the latter part of the nineteenth century. These omissions might indicate a lack of primary sources, otherwise it is a serious oversight.

Sheehan's book is a general history covering the period 1770-1866 which is structured to address politics, societal and economic issues, and culture.[9] It is a book in which he "enjoins his readers to put in abeyance the Prusso-centric eschatology that even today informs much of what is written about modern German history."[10] The corollary of this is that Sheehan rejects the idea promoted principally by German nationalist historians that the unification of Germany under Prussia in 1871 was a foregone conclusion pre-ordained by a series of steps which culminated in that event. Rather, he believes that a number of outcomes were possible. This is the key to understanding Sheehan's book which initially can be confusing because it is counter-intuitive: that is, it contradicts traditional interpretations of German history and what the reader expects to find on the basis of knowledge already acquired. As such it can be seen as a re-thinking and re-interpretation of German history.

This is an enlightening process because Sheehan favours writing about culture more than his peers, prioritising what happened in the regions and their concerns; similarly he prefers writing about trends rather than about the big headline events.[11] This approach is uncommon and in this way Sheehan puts Prussia into a different context alongside the other states in Germany so that their stories are not eclipsed by those of Prussia.

[7] Blackbourn (1998, p.180, p.184) and Blackbourn (2003, p.140).
[8] Blackbourn (1998, p.287).
[9] Sheehan (1989).
[10] van Horn Melton (1991).
[11] Mommsen (1994).

At this point, it is necessary to look more closely at how Sheehan addresses the matter of culture which goes beyond the usual definition by embracing science. The inclusion of science becomes clearer when he considers the rise of German science and quotes writers who in the 1850s identified "the future as belonging to 'investigation' by which they meant empiricism as opposed to idealism."[12]

This journey might be said to have started in the eighteenth century with the foundation of such universities as Göttingen in 1737 described by Watson.[13] Sheehan follows on by describing the journey of discovery in the sciences as being largely on an individual basis which "by mid-century… gave way to a self-perpetuating set of institutionalised connections through which knowledge was created, tested and communicated." He quotes the celebrated scientist Hermann von Helmholtz as describing scientists as resembling "an organized army, labouring on behalf of the whole nation, and generally under its direction and expense."[14]

This description deserves further consideration because it has profound implications. It can explain how such dedication to the pursuit of knowledge and its practical application, not least its harnessing by and for the state, became a distinctive characteristic of the German people and thereby a part of German culture, in today's vernacular "part of its DNA". In later decades this even extended to capturing from art and design the possibilities of productionisation, for example "the Bauhaus School of Design's basic principle of creating good design that could be used industrially…and cheaply produced."[15] Many people know about the Bauhaus movement and its driving spirit Walter Gropius, but only in terms of innovative architecture. However, the real innovation was commercially exploiting design by mass production. In terms of the railways in Germany, an early example was Krupp's invention and production of the all-steel weldless wheel, "the steel tyre". Later, with the standardisation of locomotive design promoted by the "nationalisation" of the railways in Prussia, this gave stimulus to mass production in heavy industry.

[12] Sheehan (1989, p. 803).
[13] Watson (2010, p.54).
[14] Sheehan (1989, pp. 805-806).
[15] MacGregor (2014, pp. 442).

Sheehan leads the reader from the Germany of the Holy Roman Empire into the Napoleonic age and its aftermath, all the time keeping hold of the thread of culture in its diversity in the many regions of the country. By doing so he is able to reveal a level of detail beyond that of other historians and open new perspectives which are illuminating, if not startling. Hence we are told that the smaller number of territories resulting from the Congress of Vienna (1815), the advent of industrialisation and the advent of the railways did not serve to bring the regions together but, if anything, amplified the differences between them. This is an amazing proposition completely at variance with the prevailing historiography. In this connection, Sheehan accesses Tipton's ground-breaking work on the regions but, by looking through a dissimilar lens at the Ruhr and Silesian coalfields, reveals greater differentiation than before.[16] This also allows Sheehan to comment on both the negative as well as the positive aspects of the railways in so far as they impacted regional economies; of particular interest is how some regions developed more industrially and others more agriculturally.[17]

Concerning the events of 1848 and 1849, the historian Mommsen observes that Sheehan discerned no co-ordinated revolution only many local uprisings and that Sheehan believed the middle class, the *Bürgertum*, emerged only after the failure of the "so called revolution".[18] This is clearly at variance with the writings of most other historians reporting on this period and Sheehan's belief that the *Bürgertum* were principally interested in economic matters rather than the new opportunities to become involved in political affairs is, except for Brophy, adrift from many of his peers.

Regarding the 1850s and 1860s, Sheehan paints the picture of the potential of the German economy being released through the states' governments' dismantling of restrictions.[19] Sheehan often quotes other authorities to illustrate his points and here he quotes the economist von Czoernig to illustrate the improvement when he compared economic "conditions in 1847 (seeming)

[16] Tipton (1976, p.39). Sheehan (1989, p.743).
[17] Sheehan (1989, p.744).
[18] Mommsen (1994).
[19] Sheehan (1989, p.733).

much closer to 1758 than to 1858".[20] On the industrial front Sheehan gives an insightful level of detail with regard to the new chemical industry where the importance of the discovery of "aniline dyes, first discovered by an English chemist in 1856…became a mainstay of Germany's achievements in the industrial application of organic chemistry."[21] This must be considered as another example of Germany being much quicker than other countries to move from research and development into pre-production testing, thence commercial production.

In terms of the railway history of Germany, Sheehan's book is of especial value because it puts into perspective, more than other historians' works, how it took the railways some time to overtake water-borne traffic as the predominant means of freight transportation. This raises the problematic issue of rates which Brophy studiously avoids but which Sheehan explains in a clear manner thus allowing calibration against von der Heydt's "one pfennig tariff" which is addressed in some detail in Chapter 5.[22]

The end date for Sheehan's book is 1866 when Austria was expelled from Germany's affairs after the battle of Königgrätz, the so-called small Germany (*Kleindeutschland*) solution. That is, the closing-in of Germany's borders. This was seen by nationalist historians, with the benefit of hindsight, as the penultimate step in the unification process. Yet it is clear from Sheehan that, even at this juncture, such an outcome would have been a surprise to most Germans, many of whom held out hope for "a third Germany" led by neither Prussia nor Austria, a theme also addressed by Blackbourn.[23] Hence, Sheehan's book is at pains to destroy what he sees as the retrospective re-writing of German history based on the success of Prussia. Despite this, closer analysis would show another interpretation is possible. Namely, that the energising and unifying effect on the country resulting from the activities of the *Verein,* which was greatly influenced and delivered by Prussia's railway administrations (but never acknowledged), and Prussia's gifting of a strong and shared German identity to the German people after Bismarck's wars (of 1864

[20] Mommsen (1994).
[21] Sheehan (1989, p.741).
[22] Sheehan (1989, pp.466-467).
[23] Blackbourn (2003, p.188).

against Denmark, 1866 against Austria-Hungary, 1870-71 against France), stand to challenge some of Sheehan's hypotheses.

Like Blackbourn, it is disappointing to find no reference to the *Verein* in Sheehan's nine hundred pages while other vereins relating to welfare, education and craft associations are given some prominence. This is a curious omission, but similar to Blackbourn, it might suggest the lack of primary sources.

From the outset, Henderson's books, examined below, were relied upon to provide the background to the period under review.[24]

Henderson, while not ignoring general history, focuses on the industrial revolution in Prussia and in Germany, the rise of German industrial power, and the *Zollverein.* What shines through in Henderson's work is his obvious love of Germany and his pride in its achievements which suggest possible ties of kinship. It might also indicate that Henderson was perhaps not always as objective as he might have been in his appraisals of the Prussian state. Tipton says: "Until the 1960s the Prussian state-centred view of economic development, exemplified in English by the works of Henderson remained dominant."[25] But then Sheehan's quote comes to mind which recommended his readers to discount what he believed was the overstated influence of Prussia in German history. It is reasonable to infer that this was aimed at Henderson. Despite this criticism, Tipton indicates there were subsequent misgivings about the devaluing of the political perspective in the historiography after the 1960s.[26]

Henderson's style is both factual and descriptive; it relates what happened and when, supported by extensive archival research and a myriad of statistics. In the preparatory stage of this thesis, Henderson's texts were ideal for thinking in terms of a structure, a skeleton, on which to flesh out the bones with the offerings of other historians and thereby enable comparisons. This is not to say that Henderson can be dismissed simply as a writer of textbooks devoid of

[24] Henderson (1939, 1967a, 1967b, 1975).
[25] Tipton (2000).
[26] van Horn Melton (1991); Tipton (2000).

assessments; his profile of von der Heydt and his seminal work *The Zollverein* later demonstrate his scholarship.[27]

Another way of looking at this matter is that Henderson's work supplied a black and white building with solid foundations; subsequent historiographers were then able to fit-out the structure and furnish it in many hued colours. It might be argued that Henderson's style is more that of a chronicler rather than that of a cerebral historian, but he was recognised for the importance of his contribution. The German historian Wolfram Fischer paid tribute to Henderson's *The Zollverein* (1939): "Nicht energisch genug kann unterstrichen werden, was [sic] [28] W.O.Henderson, der beste Kenner des *Zollvereins*" ("It cannot be emphasised strongly enough that Henderson was the best expert on the *Zollverein*").

In so far as this thesis is concerned, Henderson's comment that "the *Zollverein* and the railways set Germany on the road to industrial success" summarises the focus of his work which is cited herein and, consequently, makes it of particular importance.[29]

Dunlavy's book, and that of Brophy, are very similar in that they examine the links between capitalism, politics and industrialisation which was catalysed by the railways, but the core of their research is political.[30] As was seen earlier, this was probably a reaction to the concentration on neo-classical economic history from the 1960's onwards which saw some excellent work published by such economic historians as Tilly and Fremdling but largely at the expense of political aspects. However, it is interesting to note that Dunlavy and Brophy emphasise the underlying primacy of politics but progress no further than 1870, indeed only Brophy's reaches this point. As far as the *Verein* is concerned, this can be viewed only as a serious limitation.

Dunlavy's book questions how national political institutions influence the process of industrial change. In so doing, it contrasts the political structure of the United States with that of Prussia, from the 1830s to the 1850s, in so far as

[27] Henderson (1939).
[28] Fischer (1961, p.108). The error 'was' appears in the German original; it should be 'war'.
[29] Henderson (1975, p.52).
[30] Dunlavy (1994); Brophy (1998).

they influenced the establishment of the railways. Dunlavy, amongst others, uses Prussia as a proxy for Germany, which needs to be treated with some caution, but the generality of the comparison is valid.[31]

Dunlavy's case study compares what occurred in Prussia, a unitary state with a centralised bureaucracy and an authoritarian tradition, with the United States, a federal state and liberal democracy with a laissez-faire approach to business. Calibrating these conventional stereotypes against the reality of what actually happened, Dunlavy demonstrates how these paradigms were stood on their heads. At the same time Dunlavy explores the relationship between the railways' insatiable need for capital and the political conflict between the Prussian king and the provincial assemblies in 1847, and the subsequent revolution of 1848 with its political consequences.

Dunlavy is one of the very few historians to acknowledge the debt the Prussian state and Germany owe to the *Verein, a* non-governmental association of railway administrations, for establishing a functioning railway network long before any governmental regulatory body existed. For that reason Dunlavy's work has unique significance for this thesis.

Brophy might be viewed as a historian who has come late to the party and has a mission to bring some measure of connectivity to the predominately stand-alone political, economic, and social assessments of this dynamic era of German history. In particular he is a revisionist of the post-1960s school of historians in his exploration of the extent to which the state actually managed the development of the economy. For his focus he takes the railways and studies the business, banking and political players who were involved with the railways during their formative period, from 1830-1870. In considering these groups and the conflicts about the railways which mark this narrow timeframe, he seeks to demonstrate that a more critical examination reveals a fragmentation and variation within and between the groups; a fact perhaps hitherto not fully recognised as a result of each group being treated as homogeneous.

[31] Dunlavy (1991, p.4).

Brophy attempts to clarify the position by exploring the complex relationships between railway businessmen and the Prussian government. He illustrates this by profiling two of the leading protagonists, the entrepreneur David Hansemann, a director of the Rhenish Railway Corporation, and the railways minister August von der Heydt.[32] Neither comes out of it with his hitherto sound reputation intact. Hansemann is portrayed as a vacillating entrepreneur, an exemplar of an inconsistent railway business community, shifting tack as the economic climate changes, by turns resisting government intrusion and conversely seeking government support as the occasion demands. Hence, at worst Hansemann can be seen as an opportunist but at best a pragmatist. As for government, the disagreements between government ministers are revealed and von der Heydt is portrayed as a very unprincipled character indeed with a cavalier attitude to legal niceties in his dealings with the railways. He is also accused of "illegal bookkeeping" in that he "misappropriated" Railway Fund receipts to acquire railways for the state at a time when his cabinet colleagues were more laissez-faire.[33] These portrayals are at the opposite end of the spectrum from those of Henderson. However, when it comes to considering the business classes, the *Bürgertum*, which emerged after the 1848 Revolution, Brophy steers a more moderate course. Here he does not support the view of Wehler et al that "they allowed themselves to be co-opted and feudalised", nor does he follow Eley in claiming that "they set the agenda and put their stamp on the new German Empire."[34] Rather he is clear that their focus was profit and to that end they were as pragmatic as the circumstances demanded.

Tilly, whose views are not dissimilar to Eley's, was not at all impressed by Brophy's assessment of 1848.[35] He was of the opinion that "the profound effects on state finances occasioned by the 1848 Revolution resulted in a step forward for bourgeoise and business participation in, and parliamentary control of, government." Tilly was also critical of Brophy's failure "to develop either a

[32] Tipton (1976, p.79). Hansemann was also President of the Cologne Chamber of Commerce and, subsequently, the founder of the Diskonto-gesellschaft von Berlin bank.
[33] Brophy (1998, p.168).
[34] Eley cited by Spencer (1998).
[35] Tilly (2000).

systematic account of either railroad building or its implications for long-run economic growth."

This author agrees with Tilly's and Eley's assessments. The year 1848 was a watershed and the country's finances were about to change out of recognition. Apart from the cash made available by government, the banking revolution in Germany was about to unlock vast amounts of money. At the same time, in Prussia, entrepreneurs and businessmen entered government and promoted capitalism via liberal economics. Von der Heydt, who was responsible for commerce and the railways, was seen as an exception to this because he fought a rear-guard action in favour of targeted statism. However, this depiction is too simplistic because von der Heydt was a complex character. He was a friend of the king, yet he opposed the king in 1847; a friend of the Eifel industrialist Poensgen, yet he would not help him with a request for a railway in the Eifel; an alleged anti-industrialist, yet as Minister of Commerce he used the the railways to support industry and commerce more effectively.

While Brophy's work appears to have been lacking from an economic history point of view, the main thread of his arguments is political. However, surprisingly, what may be considered his most important contribution is almost lost from sight, namely the connection with institutionalism which has implications for the *Verein*.[36] This is addressed later in the thesis.

As regards the *Verein,* Brophy explores the background of its directors whom he concludes were overwhelmingly bourgeois in social origin but who through earned honourary titles such as commercial councillor "allowed them to attend court, where connections and influence were found."[37] Yet this should be seen in context, others were (or had been) high ranking civil servants; and others were aristocrats and nobles. Brophy further reports that there was "little evidence…to correlate honorary titles and political docility…Access to court did not stop them from criticizing and resisting orders from the trade ministry and other government agencies." This independence was confirmed when the German Commercial Code was being drafted. The *Verein* considered the draft

[36] Brophy (1998).
[37] Brophy (1998, p.70).

as deficient in so far as the railway business was concerned and forced a re-drafting (albeit with the support of the Prussian government) before it became law.[38]

This bridge between business, as exemplified by the *Verein*, and government casts light on the railway-government relationship in the period 1830-1870. The *Verein* used its directors' access to influence government and to gain its support when circumstances demanded. Doubtless this was a reciprocal situation. Brophy saw this as each side recognising the realities of the time and seeking to establish a middle way, what he calls a "juste milieu".[39]

Kaiser and Schot's book is an especially important text in so far as this thesis is concerned because it examines the role of technology as an agent of change in European history. This provides an entirely different perspective from the work of other historians reviewed here. It explains how, from the mid-nineteenth century, new technologies enabled transnational connections, resulted in consequential regulation, and often occasioned a largely unnoticed integration across Europe. The *Verein* as a champion of the railways, what Klee called "the symbol of modern technology and economics", was an important player in this evolution and is identified by Kaiser and Schot as one of the early building blocks of Europe.[40]

Klee's book is at first deceptive.[41] It rails against the injustice and miseries suffered by the working class in the nineteenth century to the extent that Klee's criticism of government and the landed gentry, which seeps through his work, seems to overshadow other considerations and affect his ability to make impartial judgements. It also raises the question whether he is influenced by Marxist views given that Marx's observations about the desperate conditions of the working class were contemporaneous with the era about which Klee was writing.[42] However, in any event, it would be true to say that Klee has a keen

[38] Brophy (1998, pp.143-144).
[39] Brophy (1998, p.135 et seq.).
[40] Kaiser and Schot (2014); Klee (1982, p.10).
[41] Klee (1982).
[42] In 1848, "The Communist Manifesto" written by Karl Marx and Friedrich Engels, captured the spirit of the times in terms of class struggle. It was first published in German in London to avoid being suppressed or censored in Germany (MacGregor 2014, pp.272-273).

sense of social justice and is outraged by the failure of government to be pro-active on behalf of the working classes in the period under review.

Nevertheless, initial impressions are soon revised because closer reading reveals Klee as an insightful historian who is able to cast light on the paradoxes of the period.[43] Hence, while the situation in Prussia after the restoration of 1815 is presented in the historiography as that of a country struggling with huge debt and ruled by an autocratic monarch supported by a conservative government holding on tightly to the reins of power, a portrayal which has much validity, it is an unbalanced view. Rather, by contrast, Klee focuses on a liberal order pushed along by the leading Prussian politicians Karl Freiherr vom und zum Stein and Karl August von Hardenberg after the reforms of 1807. He explains how these reforms were not one-time to be forgotten events, but rather events heralding a liberal economic order. These reforms enabled and accelerated strong economic growth combined with the strong growth of tax revenues. These were indispensable in view of the debts following the Napoleonic Wars. This is the converse of the negative societal impacts resulting from the government's liberal economic policy about which he writes. Further, Klee recognises that it was the construction of the railways, encouraged by these very same liberal policies, which triggered an economic revival and provided work in numbers for the deprived working class; given the timeline this is not contradictory. Although Klee's book may not achieve the breadth and depth of other historians studied here, there is no doubt that he should be considered in the front rank of the post-1960s revisionist historians.

The next two chapters provide an overview of German history, with particular reference to the railways where appropriate, from the Peace of Westphalia (1648) until the eve of the First World War (1914).

[43] Klee (1982, p.10 et seq).

Chapter 2

Setting the Environment –The Disaggregated German States

This chapter gives a brief overview of modern Germany from 1648 until the eve of the unification of Germany in 1871. It gives particular attention to the factors which influenced the establishment of the railways in the nineteenth century or resulted from their introduction.

Germany before Napoleon Bonaparte

Starting from the Peace of Westphalia in 1648 which ended the devastating Thirty Year's War, Prussia came to the fore as the leading German state through the prowess of its army, the efficiency of its civil service and its enlightened social policies. In essence, through these attributes, the core of the future unified Germany already existed. Prussia, lying in the north-east of modern Germany, was flat, sandy and mainly devoid of natural resources. As a consequence, its annexation of Silesia and involvement in the partitioning of Poland by Frederick the Great (1740-1786) later proved of importance for coal, iron ore, lead and zinc, but more immediately for agricultural produce.

In eighteenth century Germany, a fragmented "country" of mostly independent territories, agriculture underpinned the viability of society and provided the main employment. With one or two isolated exceptions industry, such as it was, remained primitive and comprised blacksmiths and other craftsmen working iron, from iron ore deposits, with charcoal fires using traditional methods. [1] In rural areas, apart from agriculture, textile related cottage industries such as handloom weaving were to be found often as part of the putting-out system [2] while in the towns, glass makers, carpenters, stonemasons, millers and brewers abounded. Some cities specialised in particular skills: Nuremberg was

[1] Watson (2010, p.168): Efforts to reverse engineer Chinese porcelain were successful after 30,000 experiments and enabled the setting up of the porcelain industry at Meissen as early as 1710. A mining academy was later established in 1765 at Freiberg. These are two early examples of the pursuit of engineering knowledge in Germany.

[2] The putting-out system was a method of sub-contracting used by manufacturers across western Europe from the seventeenth until the nineteenth century. Decisions by industry today -transaction cost theory- probably have their origins in this practice.

renowned for its goldsmiths and cartographers while Dortmund was celebrated for its brewing and Meissen for its porcelain. Craftsmen and artisans involved in these employments were governed by guilds, but every citizen, except where Lutheranism had taken root as a result of the Reformation, owed obedience to some power, temporal or spiritual, under the auspices of the Holy Roman Empire. Notwithstanding isolated examples of sophisticated industrialisation, such as the production of porcelain, in essence Germany was still an agrarian and, arguably, in many ways a mediaeval society when Napoleon Bonaparte's armies invaded at the turn of the nineteenth century.

However, prior to the Napoleonic occupation, between 1804 and 1815, Germany had made significant progress intellectually in the arts and sciences through its version of the Enlightenment. The Enlightenment had begun in Great Britain with Isaac Newton's discoveries by which philosophers had sought to interpret society and ethics scientifically through a Newtonian prism of concepts based on a Natural Law.[3] However, the German Enlightenment, *"die Aufklärung"*, put greater emphasis on personal development through education and knowledge for oneself and for the benefit of the state.[4] In this connection, Göttingen University in the kingdom of Hanover, founded in 1737, had been the first to limit the power of the clergy to dictate what could be taught and published. This opened up new ways of enquiry, by means of a continual questioning of existing knowledge, that is, through research (*Forschung*). At Göttingen, Halle and similar universities, the ultimate attainment was considered to be the award of the new research-based degree, the PhD. Watson cites von Selle who believed this new approach "moved the centre of gravity …in German life…from religion to the state". Watson quotes the celebrated German historian Thomas Nipperdey as concluding that "music, the universities and science were the three great achievements that brought recognition to Germany in the eighteenth century."[5]

Nevertheless, with the exception of Prussia within the fragmented Germany, Germany was well behind other European countries, notably Great Britain and

[3] Craig (1983, p.26).
[4] Watson (2010, p.54).
[5] Watson (2010, pp.50-53, p.51, p.30).

France, in terms of structures of government, administration, democracy and industrial development. So, how did it occur that Germany forged ahead so quickly after 1815?

Germany in the Napoleonic Era 1804-1815

From the outset, the reader is taken by surprise by Blackbourn's description of Germany: around 1804 there was a plethora of territories in Germany mostly independent, yet despite being under the umbrella of the Holy Roman Empire there was no standard law.[6] Further, Napoleon found in Germany a situation which was very similar to that which existed in France prior to the Revolution of 1789. Blackbourn describes a society which was dominated by the aristocracy, landed gentry and the churches who levied various taxes on the largely peasant and artisan population.[7] However, unlike France, in Germany the remit of town corporations, often enshrined in ancient charters, and the power of the craft guilds re-enforced restrictive powers over the everyday lives of craftsmen and ordinary citizens. In this way a mediaeval culture still prevailed which was incompatible with the ideals of the French Revolution. Consequently, the civil administrators accompanying Napoleon's armies set to work to replace this with the French system.

Blackbourn writes that aristocrats and their ecclesiastical counterparts were removed from their posts and many taxes abolished; the secularism of the French Republic was reflected in changes to the law, especially as regards religious tolerance and divorce; the number of states was reduced and the French model of *départements* administered by trained civil servants introduced. Later, Napoleon's subsequent victory over Austria-Hungary resulted in the collapse of the Holy Roman Empire in 1806, following which the Emperor of Austria-Hungary relinquished the title of Holy Roman Emperor, thus strengthening France's influence and facilitating the consolidation of these changes.[8]

[6] Blackbourn (1998, pp.3-4, p.8, pp.70-71, p. 77).
[7] Blackbourn (1998, pp. 4-8).
[8] Blackbourn (1998, pp.70-71, p.77); Taylor (1993, p.263): The Kingdom of Bavaria was created by Napoleon. However, this was simply a change of status, for Bavaria had hitherto been an Electorate.

The conclusion to be drawn here is that Germany became a co-beneficiary of the French Revolution through the governmental, political and societal impacts brought about by France's revolutionary ideology, the Napoleonic Code and French bureaucracy; however in certain areas, particularly the Rhineland, its application was patchy.[9] Under the circumstances, it is not unreasonable to conclude that the Napoleonic occupation was the event which pulled Germany out of the Middle Ages and enabled it to become a modern state. However, it is remarkable that other historians do not appear to have clearly acknowledged this huge debt that Germany owes France; at best it is only implied.

Given the importance of Prussia in Germany's affairs, it is instructive to look at it more closely. In this period, Prussia was the one German state which already had an efficient and enlightened form of government. Its history from the time of Friedrich Wilhelm, The Great Elector (1640-1688), through the time of Friedrich II, the Great, (1740-1786), had been a time of thrift, effective administration, educational reform and tolerance.[10] On the latter point, Prussia had welcomed Jews fleeing the pogroms in Russia and this was to have beneficial consequences in the future when Jewish bankers arranged funds to finance government policies, especially the construction of the railways and support to industry. Yet its fearsome reputation as an autocratic and militaristic state, fuelled by its seizure of Silesia and its involvement in the partition of Poland, belied the reality of Prussia as a progressive society. Had it been possible to stay clear of confrontation with Napoleon it could have continued to build on this legacy. But its army had not been tested in recent memory and was soundly defeated in battle by the French at Jena in 1806.

The damage to its reputation and consequent loss of a good deal of its territory proved a salutary lesson for Prussia and resulted in many reforms. This included a great purge of ineffective army officers, a reform of the army with inputs from the military strategists Scharnhorst and Gneisenau, the abolition of serfdom (*Bauernbefreiung*) in 1807, the introduction of revised legislation

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After being elevated to a kingdom, it then became a natural counter-balance to Prussia. Pierenkemper and Tilly (2005, p.4): Holy Roman Empire.

[9] Blackbourn (1998, pp.74-79).

[10] Pinson (1954, p.6).

relating to the local government and commercial practice[11] and the abolition of guild powers which had profound effect by promoting private enterprise.[12] The apparent sweeping away of feudal practices through the *Bauernbefreiung* and the undoing of the guild system were to have far reaching societal consequences, but it would take further edicts over many years before these restraints could be fully removed.[13] Hence, the recurring implication in the historiography that this critical development occurred on a single date, 1807, is misleading. To make the point, Wagenblass records that as late as 1837 when the Leipzig-Dresden Railway Company decided to build its own rolling stock and recruited a coachbuilder, Thomas Wordsell from England, it was opposed by the Guild of Coachbuilders which claimed this was solely their domain. As a consequence, it took a special concession from the Saxon government in Dresden before the railway could build rolling stock, but this was limited to its own use, not for sale to other companies, and this was only on the basis of assembling parts; such parts they purchased from England. This restriction lasted until 1841.[14]

As regards the Prussian army, it had the opportunity to re-establish its military reputation when, in 1813, it successfully supported a Russian-led coalition army against the French at the Battle of Leipzig. The French armies had been weakened by the disastrous Russian campaign and the retreat from Moscow in 1812 and had not yet fully recovered; but the battle was indecisive. At the subsequent battle, in 1815 at Waterloo, the French armies under Napoleon were soon defeated by the British under Wellington ably supported by the Prussians led by von Blücher. The peace settlement which followed was ratified by the Congress of Vienna later in 1815.

Germany in the post Napoleonic Era 1815-1835

The number of German states in existence at the end of the Napoleonic Wars, 38, was confirmed at the Congress of Vienna and was collectively referred to

[11] Pierenkemper and Tilly (2005, pp.23-25).
[12] MacGregor (2014, pp.344-345).
[13] Kitchen (1978, p.14, p.18).
[14] Wagenblass (1973, p. 40).

as the German Confederation.[15] The Austro-Hungarian Empire which had abrogated its Holy Roman Empire role on 6th August 1806 was nominated a member of the confederation and this explains the total of 39 sometimes quoted.[16] Among those areas and states which were amalgamated or swallowed-up by larger states were the Rhineland and Westphalia; both were given by the victors to Prussia as a reward for its help defeating Napoleon.

In fact, Prussia did very well out of the settlement and finished up with territories which now stretched from Trier in the west to Königsberg in the east. With the war ended, Prussia more than other states set about repairing the roads and canals in accordance with the custom of the time which held that governments were responsible for maintaining the means of transportation, namely highways, rivers and canals. This point is of particular relevance to the unforeseen advent of railways and how Prussia responded to this development when it arrived, for the cost of this earlier repair and maintenance work had been a severe drain on its treasury. Nevertheless, at the same time, Prussia had tried to organise co-operation among the states for easing the passage of goods across their territories and a reduction in customs duties. The underlying motive was to give Prussia connectivity with its new territories which were geographically separated from Prussia by other states. By co-incidence these newly acquired territories, and Silesia which it already owned through conquest, were not only at the periphery of its kingdom but were also rich in coal, lignite, iron ore, lead and zinc which could only be exploited by serviceable means of transportation and by lowering existing tolls.

Unfortunately for Prussia, because of its crippling war debt reported to be 220 million thalers (£33.84 million),[17] and the cost of the work to maintain and upgrade its waterways and roads which proved more expensive than anticipated, it started to run out of money to pay its bills.[18] Consequently, the government was obliged to seek help from the banks and Rothschilds came to its assistance by raising loans in London in 1818 and 1822.[19] The concerns of

[15] Henderson (1967b, p.13) cites 39; some records quote 38.
[16] Clark (2006, p.296).
[17] For notes on conversions to sterling used in this thesis, see Appendix C.
[18] Klee (1982, p.10).
[19] Henderson (1967b, p.14).

the government's creditors were addressed in 1820 by passing the National Debt Law which thereafter limited government borrowing to 18 million thalers (£2.77 million) without the approval of parliament.[20]

Equally worrying was that Prussia made very little progress with other states in its attempts for co-operation on the reduction of customs duties and on easements. Even so, it continued its efforts and through diplomacy, rather than military action, it started laying the foundations of the *Zollverein* (Customs Union) in 1818 when it persuaded some of the smaller German states to adopt the Prussian simplified tariff, the "Maassen tariff".[21] Subsequently, in 1828, agreement was reached with one of the larger states, Hesse-Darmstadt, which was seen as a more important step towards the establishment of a German customs union based on this tariff. This was realised fully in 1833 when all members of the putative *Zollverein* agreed to adopt the Prussian tariff. The resulting workable, but limited, customs alliance came to fruition with the launch of the German *Zollverein* on 1st January 1834.[22] This is generally recognised as a major achievement in modern German history and was seen by some historians, not least Henderson, as a critical stepping stone on the path to unification because it was one of the chief drivers of the German economy in a country which was still fragmented and did not become a politically unified state until 1871. Tilly also viewed the *Zollverein* in a positive way, namely as the driver which expanded the German internal market.[23] Yet Blackbourn and Sheehan believed that German nationalist historians overstated the *Zollverein's* role.[24] In this connection, Sheehan named Roscher and Henderson as amongst these. But Henderson, an Englishman, considered that "the *Zollverein* and the railways set Germany on the road to industrial success" and, it will be remembered, published a well-received work, *The Zollverein* (1939). Later, Henderson added the introduction of technical improvements (to the *Zollverein*

[20] Dunlavy (1991, pp.20-21).
[21] Henderson (1975, pp.33-34, p.37): Karl Georg von Maassen, Finance Minister (1818), simplified Prussian customs duties and tariffs… "the Maassen Tariff was the most liberal in Europe in the 1820s."
[22] Henderson (1975, p.36).
[23] Tilly (1980, p.1).
[24] Blackbourn (2003, p.140); Sheehan (1989, p.503).

and the railways) as the three reasons why the German economy escaped from its financial predicaments after 1815.[25]

Although the *Zollverein* had immediate impact, the movement of goods and animals across state borders to towns and markets, indeed even to local markets, remained a slow affair at the vagary of the weather. During inclement weather, unpaved roads could quickly turn into quagmires bogging down both horses and heavily laden carts making timely deliveries impossible. To give some idea of the difficulties of travel: at that time, the journey from Frankfurt am Main to Berlin typically took nine days.[26] Today, motoring organisations quote a driving time of 5 hours 12 minutes for this 342 mile journey.

The Railway Age arrives in Germany 1835[27]

Thus, in the following year, 1835, the arrival of the railways, as primitive as they were, portended a quantum leap to more rapid and reliable transportation and the commercial opportunities that would be presented.

Four factors are of note regarding the first railway in Germany which was constructed in 1835 between Nuremberg and Fürth in Bavaria[28] a distance of some 6 kilometres:[29]

Firstly, the technology was imported from Great Britain: the rails, the locomotive, and even the crew who operated the locomotive. Other historians generally take this technology transfer for granted, but it should not be underestimated. This accounted to a large degree for Germany's rapid progress in catching up, and then passing, those countries that pioneered the original design and manufacture of locomotives and the laying down and operation of railway networks.

[25] Henderson (1975, p.52). Henderson (1967b, p.22).
[26] Blackbourn (1998, p.9).
[27] See Appendix B regarding the length of railway lines open between 1835-1914.
[28] Henderson (1967b, p.19): This was followed soon after in 1839 by what Henderson called Germany's first important railway line from Dresden to Leipzig, a distance of some 115 kilometres, again under the supervision of British engineers but with German miners building the tunnels.
[29] Gutberlet (2013a, p.4): cites the distance as 7.5 kms and identifies the first long distance railway in Germany as the Cologne-Minden Railway, 230 kms, completed in 1847.

To put this into perspective, with one or two notable exceptions as was observed earlier, Germany lagged behind other leading European countries in industrial terms. However, it had made good progress in the sciences, its coal mines trained engineers and Germany had a tradition of craftsmanship in metal working, all of which which presented a basis for closing the gap. Nevertheless, in general terms, there was an engineering deficit.[30] The Prussian Minister of Trade and Industry, Peter Beuth (1815-1845), addressed this problem in 1821 by first setting up the Association for the Promotion of Industrial Knowledge and then the Berlin Technical Institute. Subsequently he was instrumental in establishing *Gewerbeschule* (technical feeder schools) for the institute in major cities. This initiative ensured a steady stream of engineers for the industrial revolution which by then was taking place in Germany. It also opened a new way forward for industrial development but this did not altogether supplant the craft guild tradition but rather underpinned it in terms of its skills training regime. Kocka emphasised the contribution this had made to the industrial success of Germany; a system of craft training progression from apprentice to journeyman to craftsman having its origins in the Middle Ages.[31] This has continued until the present day and it helps explain how Germany was able to move so quickly after 1835 taking its place in the forefront of railway engineering matters. However, it is worth noting that Beuth was not averse to employing other methods to move things along; Klee reports that "Beuth's institute organised spying trips to England at a time when industrial espionage fell under the death penalty."[32]

Industrial knowledge, an essential key to progress, was thus enhanced by this transfer of technology and it was quickly exploited by means of the Dresden to Leipzig Railway acting as a school of learning for the neighbouring Leipzig-Magdeburg Railway.[33] In a similar vein, new railway workshops became centres of technical awareness and training which could quickly be converted to military workshops in the event of war. Further, the arrival of the railways stimulated and developed demand for some important industries such as the

[30] Gutberlet (2013a, p.5); Henderson (1975, pp.76-77).
[31] Kocka interview with Andrew Graham Dixon, historian, The Art of Germany (repeat) BBC TV 2018.
[32] Klee (1982, p.12).
[33] Dunlavy (1994, p.151).

processing of pig iron, iron working and mechanical engineering with the prospect of profits.[34]

Secondly, the historiography provided by Henderson and Sheehan reports that the Nuremberg-Fürth railway was built with the support of those businessmen who could not stay overnight in Nuremberg and whose prime purpose it was to transport them to and from that city. This was because "Many passengers were Jews who worked but who could not live in Nuremberg."[35] This would be the first of many occasions when Jewish businessmen and bankers supported the construction and operation of railways in the development of Germany. This is not to say that there was not a self-serving dimension to this.

Thirdly, the nature of the business arrangement which governed the building and operation of the railway merits attention. To provide the context, during the period of this study, from 1835 to 1914, when the railways arrived and became established in Germany, Germany underwent not just two industrial revolutions and a banking revolution but also a political one with complex social implications.[36] Tipton cautioned against downgrading social and institutional factors in favour of solely economic interpretations of business because customs and societal issues were powerful influences in Germany at that time.[37] This was evidenced from the outset in relation to this railway, the first in Germany. King identified the ideology behind the business case for the railway as being strongly predisposed to the principle of serving the public good.[38] This may be an early example of corporate social responsibility. Later in the thesis it

[34] Klee (1982, pp.11-12).
[35] Henderson (1975, p.47); Sheehan (1989, p.466).
[36] The first industrial revolution commencing 1835 relates to the railways and their catalytic effect on the coal, iron, steel and textile industries. (Some historians split out transport from industry as a separate revolution because of its economic impact on costs, trade, exports and GDP. In this connection, "the transport revolution" is a term attributed to the economic historian R.W. Fogel by Aldcroft (1991)).The second industrial revolution, commencing in the mid-1850s but continuing over the next 40 years relates to when chemicals and dyestuffs came onto the market, the modern shipbuilding industry and mercantile marine were established and latterly the electrical industry developed. Chandler, quoted by Dunlavy (1994, p.41), saw the railways as the bridge between two phases of Germany's industrial revolution. By contrast, Blackbourn (2003, p.135) questioned the very idea of an industrial revolution.
[37] Tipton (1976). As indeed they were in England where industrial and commercial progress was retarded in the middle of the nineteenth century. This was owing to the sustained propaganda of the intelligentsia and elites, led by Oxford University, who saw ancient Greece and Rome as the cultural model and yearned for the idyll of the pre-industrial age (Wiener, 1985).
[38] King (1991).

will be noted that the *Verein's* business practices and decision making reflected such considerations. Surprisingly, save for the *Festschrift,* none of the texts examined which reference the *Verein* appear to have highlighted this characteristic.[39]

Fourthly, the indications are that the construction of the line was constrained by the property rights of land owners. Not even the Bavarian state could compulsorily purchase land or grant a charter to build a railway over such land.[40] This may explain why the line was so short and why, later, when the state became involved in railways, it did not extend this original line as would have been logical but instead used another route. Thus, such constraints had both route and cost implications, but it can reasonably be assumed this also applied, to some degree, elsewhere in Germany. Hence progress was hindered by property rights.

As to the effect of the railways on the general populace, this varied from amazement to shock and apprehension. Sheehan quotes the poem "The Railway" (*Die Eisenbahn)* by Karl Beck about an observer's reaction and emotions on seeing a steam railway locomotive hurtling along for the first time:[41]

Rasend rauschen rings die Räder,
Rollend, grollend, stürmisch sausend,
Tief im innersten Geäder
Kämpft der Zeitgeist freiheitsbrausend,
Stämmen Steine sich entgegen,
Reibt er sie zu Sand zusammen,
Seinen Fluch und seinen Segen
Speit er aus in Rauch und Flammen.

Racing the wheels rush round,
Rolling, rumbling, stormily roaring.
Deep in its innermost veins
The Spirit of the Time struggles freedom-thundering,
If rocks oppose it
It grinds them together to sand,

[39] *Festschrift* (1896) pp. XII-XIII.
[40] Henderson (1975, p.46).
[41] Sheehan (1989, p.467).

Its curse and its blessing
It spits out in smoke and flames.

This poem may be said to complement elements in Ralf Roth's book about the railways bringing the power over space and time.[42] It may even be considered to conjure up the background for better understanding a theme in Wolfgang Schivelbusch's book, namely the pathology of the railway journey, a question which the new technology raised and which Schivelbusch illustrates with numerous quotations from the British medical publication *The Lancet,* particularly from the 1860s through to the 1880s.[43]

In conclusion, Tilly saw "the spread of the railways …as representing the decisive turning point in Germany's industrial development. About 10 million thalers (£1.53 million) was being spent a year in the 1840s to build railways - between one and two per cent of national income."[44]

Building the Railways: topography as a discriminator

By 1850 Germany already had an impressive railway network: (1) lines running north to south connected Hamburg-Kassel-Munich; Stettin-Berlin-Prague; and Cologne-Basle; (2) lines running west to east connected Aachen-Cologne-Minden-Anhalt-Berlin-Breslau-Crakow; Essen-Dresden-Beuthen; Mannheim-Munich-Vienna.[45]

What is noteworthy here is that these lines provided international connectivity with Prague (then in Bohemia and part of the Austro-Hungarian Empire), with Basle (Switzerland) and with Crakow (Poland). But these came after Germany's first international connection between Cologne and Antwerp (Belgium). That the *Verein* played a significant role in facilitating this international connectivity is examined at Chapter 8.

[42] Roth (2005).
[43] Schivelbusch (1986, pp.113-123).
[44] Tilly (1980, p.2).
[45] Henderson (1967b, p.20).

But to address the question of topography and whether it was a discriminator, first it is necessary to clarify that geography is inclusive of topography. Here we recognise that Germany is a country of many great rivers including the Rhine, the Main, the Donau (Danube), the Weser, the Elbe, the Oder, the Niese, the Nogat and the Vistula (the latter two are no longer in Germany since the re-drawing of boundaries in 1945). Most of them flow from south to north, are very wide with fast-flowing currents, and are therefore difficult to bridge.

In the early stages of this thesis it was believed that the apparent delay in constructing railway bridges was due solely to German civil engineers going through a learning curve. This would be a reasonable inference to draw from the report by the British civil engineer Crawford which is considered later.[46] However, more recent information indicates that "in Prussia before the 1860s, all railway bridges across the River Rhine had to be built so that they could also fulfil bridgehead and defensive functions on the other river bank".[47] Thus the obligation to satisfy this military requirement, especially in proximity to borders, appears to have been a contributory factor for the delay. In the same vein it would not be unreasonable to assume that this rule applied equally to bridging other large rivers such as Lentze's bridges over the Vistula at Dirschau and over the Nogat at Marienburg, both of which opened in 1857.[48] The iconic multi-span bridge at Cologne followed in 1859 connecting the furthest ends of Prussia: Aachen in the west and Königsberg in the east.[49]

Further research has revealed that this was not solely a Prussian pre-occupation, for example, the building of a bridge across the River Meuse requested by the Dutch-German North Brabant Railway Company was delayed by The Netherlands government for five years before the Dutch military approved it.[50] It is worthy of note that the Eastern Railway to Königsberg was substantially completed as early as 1853 apart from the bridges over the

[46] Crawford (1862).
[47] Grünbacher email 3rd May 2018 to the author citing the former head of the Düsseldorf city archive.
[48] Henderson (1967a, p.184).
[49] Henderson (1967a, p.185).
[50] Schot et al (2011, p.271).

Vistula and the Nogat which were finally completed in 1857. [51] This gives some idea of the complexity of construction which had to be achieved, although "overcome" might be a more accurate description.

Other features of the topography are that north of the River Main lies the relatively flat North German Plain, while to the south the land rises and becomes more mountainous, the terrain presenting challenges to railway construction more akin to those in Switzerland and Austria. Hornung superimposed data from official sources onto historical Prussian nineteenth century railway maps which allowed new analyses to be done. [52] These showed that, "until the 1860s, railroads were built exclusively to connect important cities. Since construction costs were high, lines were mostly built in a linear way."[53] However, exceptions were permitted of which the best example probably was Dortmund.[54] Dortmund, a town celebrated for its breweries, built its own railway station and paid 3,000 Thalers (£461) towards a 10 kilometres diversion so that it could be connected to the originally planned straight line route connecting Cologne-Duisburg-Minden.

The general rule to lay track in straight lines indicates a focus on simplicity, minimum cost and speed to ensure a quick return on capital employed; all these factors were dependent on taking advantage of Prussia's flat topography. This is a good example of topography being a discriminator by reducing the complexity of construction and therefore cost. Nevertheless, despite this objective, Dunlavy tells us that Prussian railways cost in the order of 50 per cent more per kilometre to build than those in the United States (although Henderson reports that they were much cheaper per mile than England). [55] This could be attributed to the fact that, apart from the skeleton standards of construction contained in the Prussian Railway Law (1838), the *Verein* from an early date had published detailed guidance for its members, for example as

[51] Henderson (1967a, p.174).
[52] Hornung (2012).
[53] Hornung (2012, p.2).
[54] Ziegler (1996, p.310) cited by Hornung (2012, p.15).
[55] Dunlavy (1994, p.43); Henderson (1975, p. 50).

reported in *Festschrift.*[56] This drove the price, whereas at the outset in the United States an insufficient availability of capital led to a variety of primitive approaches including the use of metal capped wooden rails to lay down as much track as possible. This was because of the great distances to be covered between cities.

Elsewhere in Germany, particularly in the more undulating southern states, the topography demanded other routing solutions; in some cases no railway at all in certain regions in the first decades. The report by Crawford to his professional body, previously mentioned, about the standard of railway construction in Germany suggests its civil engineering ability was limited because Germany's engineers would have been going through a steep learning curve: track and tunnels often had to be re-layed and/or re-worked subsequently.[57] In practice this probably would have been necessary anyway as the size and weight of locomotives and rolling stock increased and safety considerations demanded more robust and double-tracked railway lines. It was these types of problems which were addressed by the *Verein*. As regards bridging the great rivers, it has been noted already how military considerations had to be taken into account in the early stages of railway construction in Prussia, if not Germany as a whole.

Related socio-economic data produced by Hornung indicates an east-west gradient showing how the railways contributed significantly to the increase in prosperity of the eastern lands within Germany.[58] Here again topography was a discriminator because the land was mainly flat and facilitated the rapid laying down of railway track once the bridging challenges were overcome. These areas were mainly agricultural, if Silesia is excluded, and now regardless of the weather their produce, often perishable, for the first time could be sent daily to Berlin and the expanding cities further west.

[56] *Festschrift* (1896). *Bau, Betrieb und Betriebsmittel*.
[57] Crawford (1862).
[58] Hornung (2012).

Historians other than Hornung explore the negative side where areas declined between 1835 and 1878 owing to their being by-passed by the railways. Yet it would be a mistake to assume that all such cases constituted discrimination by virtue of topography. An alternative fundamental reason might be that a region was unable to satisfy the requirement (of the Railway Law 1838[59] in Prussia and copied by other states) that it could support a railway passing through its territory. On a general point, Banzawa quotes Yamada who observed that had Bismarck's plans for nationalisation been successful, it would likely have been detrimental to Germany's regional industrialisation.[60] However, the timeline is important here, and in certain cases such areas might be deemed to have recovered when the lines of secondary importance with lower operating standards, suggested and promoted by the *Verein,* were introduced. However, this is a complex issue and is examined more fully at Chapter 8.

Taking a broader view of topography, the north-south divide, as delineated by the River Main, presented legal differences: unlike the north, in the south there appear to have been more legal restrictions governing the ownership and inheritance of land. Henderson reports that this was exacerbated because there was no law allowing the state in Bavaria, one of the largest states in Germany, to compulsorily purchase land for public works.[61] Doubtless these factors combined to make land expensive, or even unavailable, and precluded the purchase of land which would have provided optimal railway routing.

Government and the Railways

Dunlavy expounds on the benefit of comparative study in that it lessens the difficulties of interpretation. [62] In this connection, Dunlavy observes that historians of *Vormärz* Prussia and *antebellum* United States tended to write in a

[59] The Prussian Railway Law of 1838 is examined in more detail in Chapter 5. The criteria for a proposed railway included proof as to its usefulness**;** evidence that the railway would be technically practicable; and that above all it served the public interest. This law was the principal means by which the Prussian government controlled the railways.
[60] Banzawa (2012, p.1) cites Yamada (2001).
[61] Henderson (1975, p.46).
[62] Dunlavy (1994, pp.12-13).

manner which aligned with pre-conceptions of these two states.[63] They took no account of the developing situation which was dictated by the governmental structures of those states and the laws, processes and manner of economy which flowed from them. Hence, the old view of Prussia as a hands-on, authoritarian state persisted in the face of the facts, as did the view of the United States as a hands-off liberal democracy. In each country, the circumstances relating to the advent of this new capital intensive industry, the railways, caused these paradigms to be overturned. Within Germany itself, this was reflected in the expectation that Prussia would nationalise its railways. Mitchell, however, disagreed: "And of all the large German states Prussia was least inclined to espouse state ownership."[64] But this remark cannot be explained against the actions of the Prussian railways minister, von der Heydt or, later, Bismarck. By contrast, it was expected that other states, especially in the south of Germany, would permit private enterprise to flourish but a reading of Kech describes the same up-ending of the expected paradigm as explained below.[65]

It was the solvency problems of the Prussian state in the aftermath of the Napoleonic era and the restrictions on borrowing imposed by the National Debt Law (1820) which caused the Prussian government to rely on private entrepreneurs to fund railway development in the early days. As a *quid pro quo*, the state had to step back from its inclination to manage this new sector of the economy, although later von der Heydt became increasingly interventionist. Two cases illustrate this: the case of the Lower Silesian-Märkisch Railway and the case of the Upper Silesian Railway; these are examined in Chapter 5. It is of note that intervening in the economy in this way was a new concept at the time.

While the southern German states are often presented as welcoming entrepreneurs and wanting them to fund and operate private railways, this was

[63] *Vormärz*: the period from the Congress of Vienna (1815) until the revolution in March 1848. *Vormärz* literally means: 'before March'. Antebellum: Latin for 'before war' and commonly meaning the period preceding the American Civil War which started in 1861.
[64] Mitchell (2000, p.42).
[65] Kech (1911, pp.64-67, p.70).

not entirely accurate. This was a complex situation as shown by other accounts. From the outset, in 1845 the president of Bavaria, Karl von Abel, declared that "the government would under no circumstances allow railways – 'whose owners can, up to a point, dominate the country's entire commercial and passenger traffic'- to be run by private companies." [66] Nevertheless, Bavaria did change its stance and issue charters but, against expectations, it had to cancel many of these when the companies involved under-estimated costs and could not deliver on their projects. One such example was the Nuremberg-Bamberg-Hof Company. [67] This frightened away other potential investors and Bavaria was then forced to move towards a state run railway. This turned out to be beyond the funds available, so in 1855 it issued an ordinance expressly permitting the construction of railways by private parties. From then onwards a mixed system, state owned and privately owned, operated.[68] Württemberg, at first was not sure it wanted a railway at all, then decided on a state owned system. For its part, Baden appears to have attracted potential investors at the outset but its government commission failed to take advantage of applications for charters to build lines by entrepreneurs such as List in 1835 and Neuhaus in 1837.[69] This may be explained by its re-assessing the situation as a result of a report by Rabenius, a leading government minister and a founder member of the *Zollverein*, who recommended that "the state should build a railway from Mannheim to Basle because it would be the most important route in the country."[70] Mannheim was Baden's port on the River Rhine and, hence, it is probable the government came to the conclusion that it did not want to share with private railway operators the profitable business of Mannheim which would be enhanced once it was served by a railway. While Baden was good on ideas, it was poor on implementation. Baden's hopes for its state owned railways were set back by two bad decisions. Firstly, it was the state whose "incomprehensible decision" to opt for a track gauge (1.6m) different from its neighbouring states (1.435m)

[66] Henderson (1975, p.48).
[67] Kech (1911, p.82).
[68] Kech (1911, pp.85-86).
[69] Kech (1911, p.67).
[70] Kech (1911, p.68). Date not stated in the text.

cost it dearly to replace subsequently.[71] Kech[72] reports this re-construction as happening in 1854-1855 at a cost of 1,580,000 florins (£131,666). Secondly, as regards the Mannheim railway, it opted to fund each phase (after the first) from the operating receipts of the preceding one. As a result, it took seventeen years to complete the project.[73]

In every case the granting of charters gave state governments leverage over the new railway industry. This was amplified where states provided support in the form of subsidies and guarantees. Cohn reported that when the Prussian state had taken over railways for which it had provided guarantees (usually because revenues were inadequate owing to poor management) invariably productivity had improved: the Lower Silesian-Märkisch Railway and the Upper Silesian Railway provide cases in point.[74] A similar regulation applied to mines and other enterprises where the government was an investor. Faulenbach gives an insight into this in his book which is primarily about the mentality of employers in a state-owned or state-managed mine as compared to one privately owned and managed. [75] However, it also has a sub-text which could be read across to railway companies and describes how the state could adopt the roles of auditor, mentor or managing director as circumstances demanded. Such state intervention certainly seems strange when compared to British industry-government relations which at that time did not countenance this manner of state involvement. Similarly, in the United States such governmental involvement would not have been approved by state or federal legislatures. Both Great Britain and the USA pursued a policy of liberal economics which translated into largely unfettered capitalism.

It is instructive to look at how Prussia put in place the legal framework against which the charters were granted and were subsequently used as a model by other states. This is dealt with at Chapter 5. At this stage, suffice it to say that

[71] Mitchell (2000, p.277, Footnote 31) citing Mester in *Partikularismus der Schiene in Zug der Zeit*. However, "the incomprehensible decision" really refers to why Baden accepted the recommendation of the English Robert Stephenson Company to go for the wider gauge when other German railway companies were opting for the 1.435 metre track (Mitchell 2000, p.48).
[72] Kech (1911, pp.67-70).
[73] Kech (1911, p.69).
[74] Cohn (1893, p.182).
[75] Faulenbach (1982).

what at the beginning appeared to be a well-constructed management arrangement became caught up in the complicated issue of railway tariffs and government intervention.

In order to complete this brief overview of the government and the railways, it is necessary to mention the emergence of the *Verein Deutscher Eisenbahn-Verwaltungen* (Association of German Railway Administrations) in 1847, although this is covered fully at Chapter 4. Here it is simply noted that the emergence of the *Verein* was an evolutionary process resulting from the dissatisfaction of Prussian railway administrations with the Prussian government's Railway Law of 1838. This led to the founding of the *Verband der preußischer Eisenbahn-Direktionen* (Union of Prussian Railway Administrations) in 1846 and its further development in 1847 into the all-German *Verein*.

From this time the *Verein* and its technical arm *(Verein der Deutschen Eisenbahn-Techniker*), addressed at Chapter 6, established itself with the tacit agreement of the disaggregated German states as the sole railway authority in Germany. It discharged this role at a critical time in the fledgling German railway industry's evolution by publishing technical information and administrative procedures, and by facilitating the standardisation of a nation-wide operational network.

In summary, Brophy captures the essence of the railway-government relationship in this period by explaining that, despite the tensions, it was the compromises made by each side which by 1860 were responsible for the shape of the railways in terms of ownership and control. He calls this a "juste milieu" (a middle way) where "entrepreneurial elites saw their interests nurtured by the state". But of equal importance was that "the business class by achieving discrete economic reforms…ultimately lent support to the Prussian state, enabling it to survive in the era of industrial capitalism." Further, Brophy saw that "their own political success helped to forge the structural continuities that marked post revolutionary German history." The only conclusion to be

drawn here is that both parties had come to recognise their inter-dependence and had accommodated one another for mutual advantage.[76]

1848 -The Year of Revolutions: When history failed to turn

In 1848 civil unrest swept across continental Europe leading to that year being referred to as "the year of revolutions". But it lasted much longer in Germany than elsewhere: it stretched from March 1848 until the summer of 1849.[77] The problem in Germany was that social unrest had become rife caused by several factors: the migration of landless labourers to the new industrial towns, which Kitchen attributed to the the abolition of serfdom process (*Bauernbefreiung*) which began in 1807 but took many decades to fully realise; the crop failures across Europe in 1845-1847; and the economic depression during the same period which resulted in widespread unemployment.[78] It is evident that in 1848 the railways became an important communication medium and enabled "the fast transport of persons, letters and newspapers…[thereby playing]…a significant role during the revolution."[79] In a Germany of thirty five million people Prussia constituted the most populous state and included the largest towns. It was, therefore, most acutely affected by the disorder.[80.]

While the causes of the civil unrest are seen as primarily societal, there was an undercurrent of discontent and friction between politicians and the king which had ramifications of the utmost significance. Hence, 1848 was a revolution of two parts, social but more importantly political. The politicians in question were mainly Rhinelanders many of whom were entrepreneurs and businessmen like David Hansemann and August von der Heydt. The king, Friedrich Wilhelm IV, was supported by the more conservative political class in Berlin and the land-owning elites of the eastern provinces. This was a clash of cultures. Those in the western provinces had enjoyed a good degree of self government during the Napoleonic occupation and did not take kindly to falling under the control of Prussia, a bureaucratic state, as a result of the Congress of Vienna settlement in 1815. As a consequence, relations were fraught and the western region saw

[76] Brophy (1998, p.135 et seq., p.168); Dunlavy (2000) citing Brophy.
[77] *Die deutsche Märzrevolution. Tatsachen über Deutschland* (2010, p.23).
[78] Kitchen (1978, p.14).
[79] Kopper (2015, p.225).
[80] Klee (1982, p.14).

Berlin as prioritising the agricultural east and hampering its efforts to exploit and expand industrialisation.

What brought this to a head was the Prussian government's need of capital to finance the construction of railways in 1842 and 1847, and the ensuing struggle between the king and politicians.[81] On the one hand, under the terms of the Debt Law (1820), the king needed the approval of the United Diet (comprised of the Prussian provincial assemblies) to raise further loans for railways (such as the Eastern Railway, the *Ostbahn*, from Berlin to Königsberg) and for other public works.[82] On the other hand, the Prussian provincial assemblies were only willing to give this approval if the king would grant parliament more powers and a real say in running the country.[83]

This impasse persisted and work stopped on the Eastern Railway. Klee describes the position as one "where the government had effectively lost its ability to govern… [and]…this was the endpoint of absolutist Prussian railway policy". In another telling expression Klee saw "the development of the railways as helping to accelerate the end of the ancien régime."[84] In the context of the failure of the king and United Diet to agree, Dunlavy believed that "in that sense, the capital intensive nature of the new transportation technology, in the Prussian political context, finally helped to precipitate the Revolution of 1848."[85]

Remarkably, given his future influential role as the Prussian Minister for Commerce, few historians bring out the part played by von der Heydt at this time; an exception is Tipton. Tipton writes that, in 1847, von der Heydt led the Rhineland liberals in the Prussian United *Landtag* in urging the rejection of the king's request for funds to build the Eastern railway.[86] Von der Heydt believed that this would set a precedent unless the Diet was given the right to approve the state budget on a regular basis. That this rejection by the United *Landtag*

[81] Dunlavy (1991, p.21 and p.24).
[82] It seems Dunlavy is using a form of shorthand here because Clark (2006, p.428) reports that "whereas each province had its own diet, the kingdom as such had none." Thus the United Diet must have been a de facto gathering which came together on an ad hoc basis rather than a permanent de jure assembly.
[83] Klee (1982, pp.106-108 and pp.112-113).
[84] Klee (1982, p.10).
[85] Dunlavy (1991, p.24).
[86] *Landtag* means a regional parliament. The United *Landtag* is synonymous with United Diet and, in this context, was the assembly of such regional parliaments in Prussia.

subsequently resulted in the constitution of 1850 which enshrined this right of budgetary approval by the United *Landtag* is similarly largely neglected.[87]

The conclusion to be drawn is that this marked a watershed in Prussian politics; the liberals entered government, and government was empowered for the first time to review the state budget on a regular basis. At this point it is important to note that the liberalism referred to here is economic liberalism. Klee wrote that "the economy was the only area of public life in which liberal principles more or less predominated."[88] Blackbourn painted a starker picture: "the liberals were not democrats… Hansemann (a leading liberal) even denounced popular sovereignty as a 'pernicious theory'."[89] The historiography further notes that while David Hansemann was an avowed liberal in economic terms, he was nonetheless of the opinion that the state should have the right to buy-back railways but not before thirty years of their charter had expired.[90] Such ambiguity was not to be found in Ludolf Camphausen, the former President of the *Handelscammer* (Chamber of Commerce) of Cologne, who had been an advocate of the Cologne-Antwerp Railway and who "insisted on a clear priority of private enterprise."

In this connection, Klee recounts that after the civil unrest died down in 1848 the new liberal government, under Camphausen, re-started work on the Eastern Railway but promptly took one thousand democratic agitators off the streets of Berlin to work on the construction site.[91] Also, Henderson reported that "in the period of reaction after…1848 von der Heydt put pressure on the railways to dismiss officials who were 'politically unreliable'."[92] This resonated with the earlier actions of Camphausen's government. Given Klee's sensitivity to social injustice, it may also explain the antagonism expressed in his writings towards von der Heydt.

Not counting those liberally inclined Prussian ministers already engaged with the affairs of the *Zollverein*, 1848 was, arguably, the start of an era of liberal

[87] Tipton (1976, pp.73-74).
[88] Klee (1982, p.13).
[89] Blackbourn (2003, p.98).
[90] Mitchell (2000, p.39).
[91] Klee (1982, p.115 and p.119).
[92] Henderson (1967a, p.172).

political power in Prussia. However, paradoxically, it was held in check by the conservative instincts of von der Heydt the erstwhile liberal. From this time a power struggle ensued between the liberals, who were ardent capitalists, and von der Heydt an advocate of targeted statism. By the time of von der Heydt's retirement in 1862, he had brought almost half of the railways in Prussia under state control. Yet, at the same time, his cabinet colleagues had promoted liberal economics and industrialisation had flourished transforming both Prussia and much of Germany.

What is striking about the historiography regarding 1848 is the spectrum of opinions offered. Klee, whose view veers towards Wehler et al, saw that the Prussian government "had used a half-way liberal economic order to console its capitalists about the way they were denied real participation in the exercise of political power."[93] Wehler et al, for their part, saw that the middle class despite their importance to the state allowed themselves at this critical juncture to be "co-opted and feudalised". Taylor held a similar opinion and assessed 1848 as "the year when history failed to turn".[94] By this he meant that the middle class in Germany failed to seize the opportunities of the moment for the democratisation of the political system. By contrast, as already noted, both Eley and Tilly held the view that 1848 allowed the bourgeoisie to step into the parliamentary process and set the agenda. In the middle ground stand Blackbourn, Brophy and Sheehan. Blackbourn rises above the distress of the masses and sees it as "marking the end of feudalism, setting Germany on the road to constitutional government and giving Germans a sense of national identity". In this he is referring to the Frankfurt parliament to which representatives had come from across Germany. Brophy focuses on the business classes whom he saw as only interested in achieving profitable outcomes and were as pragmatic as situations demanded. Sheehan holds a more nuanced but similar opinion, identifying the business class's preference for matters economic rather than political but conceding that the events of 1848 led to the emergence, out of the business class, of the middle class. Hence, he did not accept that a middle class already existed.

[93] Klee (1982, p.97).
[94] Taylor (1993).

Blackbourn describes the evolution of the new class structure in Germany at this time which he believes was neglected by other historians despite its being transformational.[95] While Blackbourn's explanation of this social structural evolution has value, Watson in his description of the Enlightenment (*die Aufklärung*) expounds how the Enlightenment in the mid-eighteenth century, and the emergence of pietism, became the engine and motivation for renewal and the pursuit of excellence, "the fufillment of (man's) potentialities."[96] Consequently, the evidence suggests that it was from that time, some one hundred years before, that the process of building a meritocracy in Germany, and hence a new class structure, began rather than around 1850 as implied by Blackbourn.

Blackbourn summons the zeitgeist of 1848 by quoting the businessman Friedrich Harkort and the philosopher Georg Hegel.[97] First Harkort: "The locomotive is the hearse which will carry absolutism and feudalism to the grave". Next, Hegel: "contract was replacing custom, property becoming more important than privilege… birth and traditional status were on the defensive against merit and achievement."

As will be seen later at Chapter 4, the Prussian government's pre-occupation with the civil unrest and the political tension with the United Diet presented the opportunity for the *Verein* to become established after its founding in 1847. As a consequence, 1848 thereby provided the impetus for associations like the *Verein* to forge ahead with their own agenda.

The Banking Revolution

A close reading of the historiography reveals a difference of emphasis, if not understanding, between Henderson and Tilly as regards the timing and extent of what is sometimes referred to as the Banking Revolution in Germany. Henderson's writings place this around 1848-1853 principally with the help and direction of the French *Crédit Mobilier* bank. By contrast, Tilly's later research shows that Prussian agricultural credit institutions, *Landschaften*, had been

[95] Blackbourn (1998, pp.209-217).
[96] Watson (2010, p.261).
[97] Blackbourn (1998, pp.118-119).

founded under Frederick the Great (1740-1786) while private banking houses were already getting involved in credit banking as early as 1815 ostensibly without any foreign involvement.[98]

This text will not pursue the case of *Landschaften* except to explain that they were primarily concerned with mortgage bonds for land and only later in the mid-nineteenth century did they refine their service to become rural co-operative credit banks for farmers. On the other hand, "private banking houses were the most important financial institutions in Germany between 1815-1870…[because they] linked savers and investors and stimulated entrepreneurial initiative… [by]…offering overdraft facilities…Their role in creating credit was important because it reduced the effectiveness of state control of the money supply."[99]

Here it must be explained what is meant by "reducing state control of the money supply" and taking Prussia as an example. What happened hitherto was that the state, influenced by landowners (especially *Junkers* in East Prussia), "resisted the transfer of capital from agriculture and the state sector to industry."[100] In addition, the Prussian state would not allow banks (apart from the Schaaffhausen Bank (*Schaaffhausen'scher Bankverein*)) to establish themselves as public limited companies.[101] For those banks that still wanted to expand, this meant they were forced to form partnerships limited by shares. This restricted the amount of business they could undertake and, therefore, their plans for offering more flexible banking. One such bank created on a partnership basis was the Discount Company of Berlin (*Diskonto-gesellschaft von Berlin)* founded by the businessman David Hansemann in 1851.[102] Finally, to exacerbate the problem, old established banking houses in the commercial centres of Frankfurt, Hamburg and Berlin, such as Rothschilds, Bethmanns, Schicklers, and Parish & Heine who served governments' needs relating to sovereign debt had no incentive to become involved with emergent industry often located at some distance from themselves; this was because the

[98] Henderson (1967b, p.30; 1975 p.123 et seq); Tilly (1980); Tilly (1980. p.3).
[99] Tilly (1980, p.3, p.21); Henderson (1975, p.129); Tilly (1980, p.7).
[100] Tilly (1980, p.4).
[101] The historical record does not provide any evidence as to why this bank got special treatment.
[102] Tilly (1980, pp.1-4, 9-10).

connection with government financing was not only profitable but bestowed status.[103]

It was into this negative, hostile environment that private banking houses began to offer flexible banking. Tilly explains how the banks' lending activities linked with the setting up of companies led to a cascade of (mutually) lucrative business; for example, a company's short-term debts could be turned into long-term liabilities in the form of shareholdings.[104] Banks often bought up such shares and debenture notes of the businesses they were helping and waited for the best time to sell these, even helping purchasers to buy them. This meant that each transaction attracted new business and a potential, if not actual, profit. Tilly noted that "unlike the English banks, they [German banks] saw funding clients as one of their main areas of business."

In terms of the railways, the founding and financing of firms was exemplified by the "Rhenish banking houses' connection from the outset with the Rhenish Railway Company (*Rheinische Eisenbahngesellschaft*) which, when launched in 1837, was Prussia's biggest business." At times this railway company's debts were running in the order of 400,000 thalers (£61,538) but Tilly notes that "around 1845 the issue of debentures transformed this debt into a considerable credit balance."[105] This was in stark contrast to British banks which were risk averse as far as industry was concerned. Henderson noted that British banks even considered any long term arrangement with industry as ill-advised.[106]

Whereas Tilly saw banking in Germany as evolving over an extended period, Henderson viewed the developments in banking following the civil unrest of 1848-1849 as more of a 'big bang', or a banking revolution.

To contain and reduce the growing unrest of 1848-1849, Tilly (quoted by Blackbourn) reported that in the period 1847 to 1850 the Prussian government was forced to increase the amount of paper money in circulation from 30 to 53 million thalers[107] (£4.61 million to £8.15 million). This was a huge amount of

[103] Tilly 1980, p.7).
[104] Tilly (1980, p.22).
[105] Tilly (1980, pp.22-23).
[106] Henderson (1975, p.123).
[107] Blackbourn (2003, p.114).

money but gave support to banks and businesses thus promoting employment and stabilising the situation. Given the shortage of government money prior to then, this raises the question of whether this was an early example of quantitative easing, analogous to the action Western governments were forced to take to support banks after the sub-prime crisis and bank failures of 2007-2008 and which has become a continuing device for central banks wanting to stimulate their economies; but this is outside of the scope of this thesis.

The change in circumstances resulting from the Revolution of 1848 was a nuanced and an evolving situation. It had allowed some movement towards democracy as the price for opening the doors to a source of additional funding from the wider middle class. Nevertheless, it soon became apparent to both the state governments and middle class entrepreneurs that the amount of finance required for railway building and operation was beyond anything previously experienced. This was a capital intensive technology, a "game changer", a business on an entirely different scale requiring significant inputs of cash on a recurring basis.[108] But where was the money to be found?

Henderson believed that a bank along the lines of the Schaaffhausen Bank would provide the answer.[109] This had been an ailing bank taken over by the banker Gustav Mevissen in 1848 and converted to a joint-stock company. However, because its activities were constrained by efforts to repay its creditors, its business was essentially local but included providing funds for new businesses by purchasing their shares for sale to private investors. So what was needed was the same idea but offered by a bank of greater standing. Henderson saw this as coming about when the Darmstadt Bank, sponsored by Mevissen and another banker, Abraham Oppenheim, launched in 1853 supported by the powerful French *Crédit Mobilier* bank.[110]

Here, the historiography again appears to clash. Henderson cites the case of the the *Crédit Mobilier* bank, founded by two leading Parisian entrepreneurial families, the Pereires and the Foulds in 1852, because of difficulty they had

[108] Kocka (1987, p.262) quotes a figure of 34 million thalers [£5.23 million] invested in the Upper Silesian Railway alone by 1855.
[109] Henderson (1975, pp.123-126).
[110] Henderson (1975, p.125): The Cologne banker, Abraham Oppenheim, was an investor in the *Crédit Mobilier* bank from the outset.

borrowing on commercially manageable terms from French banks to fund private capital projects. He also explains the business model they developed for a new type of banking: one with a good deal of flexibility in meeting the long term requirements of business customers at affordable rates. This would be funded by their non-business customers following their lead by purchasing shares in companies in which they invested, and by the bank using the interest bearing savings of investors big and small to finance its activities. This had the benefit of maintaining a steady stream of funds into the bank while reducing the risk they themselves previously carried as sole financiers.[111]

It is immediately seen that this is not unlike the model employed by the private banking houses which had been evolving over time as described by Tilly. The conclusion to be drawn here is that Henderson must have focused exclusively on the numerous banks that emerged in the 1850s and their diverse product offerings which helped finance the railway boom of the 1850s.[112] Commenting on this period he wrote: “A French consul, writing from Leipzig in 1856, declared that ‘as much energy is being put into covering Germany with a network of credit banks as has been put into creating a railway network.’ ”

By common understanding, these institutions provided the funding for capital intensive industries to flourish; yet Blackbourn casts doubt on this when (using his definition explained below) he says “the contribution of joint-stock banks to German industrialisation may have been exaggerated…especially for the period before the 1870s”.[113] This is puzzling in so far as the railways, the catalyst for industrialisation, are concerned, because he also tells us that “in the years 1850-1875 around 25% of all investment went into the railways” and the greater part of this is normally recognised as being due to the involvement of these banks.[114] This was a marked increase from the 1840s when “about 10 million thalers (£1.53 million) was being spent a year to build railways –

[111] Henderson (1975, pp.124-126).
[112] Henderson (1967b, p.30).
[113] Blackbourn (2003, p.142).
[114] Blackbourn (2003, p.140).

between one and two per cent of national income."[115] This was before the credit banking model became fully established.

The credit banking model established in Germany became known as industrial banking and proved transformational for industry and commerce. These banks comprised joint-stock banks and joint-stock companies. Blackbourn defines the joint-stock company as one which raised public capital and the joint-stock bank as one geared to industrial investment.[116] The "D" banks (Darmstädter, Deutsche, Diskonto-gesellschaft and Dresdner) were examples of the latter and Blackbourn saw them as "a powerful new engine of industrial investment."

It is confusing that Blackbourn's definitions of the banks are diametrically opposed to those of the economic historians Pierenkemper and Tilly. Under the circumstances the latters' definitions are preferred. For the avoidance of doubt, Pierenkemper and Tilly report that the principal types of credit banks were: (a) joint-stock banks, with limited liability in order to contain risk, which raised capital from the public and lent to industrial and commercial concerns; (b) joint-stock companies, geared almost exclusively to investment in large industrial concerns and where the banks became closely involved in the running of the companies which they financed.[117] This brings to mind the Japanese keiretsu in more recent times and it appears that these concerns operated in a similar fashion; but ultimately this created risk by restricting banks' scope for action. In both cases directors sat on one another's boards.

To complete the picture, in addition to the credit banks described, lesser credit banks came into existence in the 1850s and 1860s namely: (c) co-operative credit banks for craftsmen and small businesses; (d) rural co-operative credit banks for farmers.[118]

What has been considered is the advent of industrial banking with characteristics unique at that time to Germany, namely a mutual exchange of directors between the credit banks and the businesses they supported. While the joint-stock banks with limited liability were able to diffuse the financial risks

[115] Tilly (1980, p.2).
[116] Blackbourn (2003, p.142).
[117] Pierenkemper and Tilly (2005, pp.117-118).
[118] Henderson (1975, p.129).

incurred with firms to whom they lent money over their banking customer base, by comparison the joint-stock companies (banks) were not able to do this because they became involved in sinking far greater sums in capital expenditure outlays almost exclusively with industry. This latter case should be seen as a locking together which constituted nothing less than a shared destiny, but a destiny with huge financial risks for the joint-stock company banks. Inevitably this caused bankers to look for a way of managing that risk, in today's terminology "a risk management strategy". This led to the widely adopted risk reduction mechanism of cartels, via acquisitions and mergers, often influenced by the banks in order to control markets by reducing competition and ensuring stability, thus protecting the banks' investments.

Pinson reported on the rise in the number of cartels from four in 1865, increasing to ninety in 1885, then three hundred and sixty six in 1905.[119] German historians named this *die Riesenbetriebe*, that is, the move towards focused banking and industry and their evolution into large enterprises. Pinson believed that this development was a reflection of the rapid evolution of technology which drove industry and the economy generally. He also remarked on how non-German historians had believed that the phenomenon of *Riesenbetriebe* was "the economic expression of Prussianism". However, Pinson's understanding of the situation may not have been sufficiently focused. *Die Riesenbetriebe* translates as "giant companies" the number of which could not have reached the cartel figures quoted by Pinson. This means that the bulk of the cartels must have been formed by smaller companies. Blackbourn drew attention to the activities of cartels and co-operatives and how they strayed into the political arena, lobbying in order to gain economic advantage.[120] This served to sour the public's view of the evolving parliamentary process at a time when the Imperial government was attempting to contain the rise of socialism. Nonetheless, at the same time both the government and the public recognised that "cartels had made possible German "*Weltmacht"* (world power status) and, hence, they were socially beneficial."[121]

[119] Pinson (1954, pp.234-236).
[120] Blackbourn (1998, p.337).
[121] Pinson (1954, p.238).

It is indisputable that the banking revolution in Germany provided businesses of all kinds with access to substantial yet affordable long term loans which encouraged long term planning and delivered great business success.

What we have not yet fully considered is the other aspect of doing business differently, namely in accordance with *Genossenschaft.*[122] This refers to the spirit of co-operation and looking at something in terms of joint ownership; it was a guiding principle in German public affairs and influenced the decisions of not just government and business but society as a whole. In practice, it meant actively identifying stakeholders and taking their interests into account, then putting these into the balance with the needs of the community and the state (or Imperial government after 1871). Pinson noted this characteristic when he refered to the "…co-operative spirit of the German people as opposed to Anglo-Saxon individualism…" In the same vein, Mitchell cited Mierzejewski who wrote about "a German sense of "commonweal" which attributed moral superiority to technical excellence and social benefit…over the crass commercialism and avaricious individual enterprise of Anglo-American "westernization"." [123] An example of the latter in Great Britain was the way in which the repeated efforts of the Railway Clearing House and the Association of Railway Companies to standardise locomotives, rolling stock and charges were frustrated by vested interest groups throughout the nineteenth century. As a result, instead of remaining at the forefront of global railway industry development, British railways fell behind their international competitors and their contribution to the domestic economy was stunted.[124]

In conclusion, Dunlavy cast doubt on the role of national culture as compared with national political institutions which had the power to effect, and to be the essence of, industrial change. As such, Dunlavy appears to have followed Meyer. He wrote that the state-owned Prussian Railways administration impressed on its employees that *"die vornehmste Aufgabe"* (the foremost duty)

[122] *Genossenschaft*, that is, the co-operative spirit of the German people. Kay (1995) talks about the critical importance of relationships and distinctive capabilities leading to success. This thesis suggests that this unique strand in Germany's cultural DNA was an essential ingredient in the rise of Germany in the nineteenth century just as much as it accounts for its economic success today.
[123] Pinson (1954, p.234); Mitchell (2001b).
[124] Bagwell (1968, pp.71-72 charges; pp.212-216 standardisation).

of the local traffic office is to maintain "a living union between the railway administration and the public." This thesis puts forward the view that although these might be mutually exclusive factors, culture versus national political institutions, the *Verein* embraced both these attributes: it was a national political institution but was imbued with the national culture of *Genossenschaft.* As such, operating through its members, it had consequential beneficial economic impacts.[125]

Industry and the Railways before 1871

A massive programme of railway construction was undertaken in Germany in the years 1840-1850 in accordance with the charters granted by state governments and the precepts of the Prussian Railway Law of 1838. However, as far as construction was concerned, the guidelines in the Railway Law had been superseded by *The Principles for the Design of Germany's Railways* published by the *Verein* (after drafting by *Verein der Techniker*) in 1850.[126]

Without doubt this contributed to the rapid laying down of track and it is more than likely that the principles captured in this publication had been the topic of discussion from the earliest days of the *Verein*. Henderson recounts that by 1850 Germany had surpassed France in track distance: 5,856 kilometres compared to 2,996 kilometres.[127] In addition, six major cross country routes had been built, three north to south and three east to west. Of these five linked through into adjoining countries with destinations of Antwerp, Prague, Basle, Cracow and Vienna.

According to many historians the industrial revolution in Germany commenced around 1835, the time the railways were introduced. However, Blackbourn[128] questions the very idea of an industrial revolution. He says that given "the long gestation of proto-industrialization, the continuing importance of agriculture, [and] the persistence of pre-industrial forms of production, historians no longer think in terms of an industrial "revolution" as such, but a railway-led industrial breakthrough is seen as happening in Germany in the 1840s".

[125] Dunlavy (1994, p.4); Meyer (1897, p.400).
[126] *Rückblick* (1871, pp.23-25) and *Festschrift* (1896) *Einleitung*, pp.XVII-XVIII.
[127] Appendix B and Henderson (1967b, pp.19-20).
[128] Blackbourn (2003, p.135).

The historiography regarding the part played by the state in German industrialisation is problematic and was touched upon previously in describing the contention between pre- and post-1960s historians. It will be remembered that like Sheehan and other historians, Blackbourn[129] is dubious about the various states' roles. He believes that "nationalist historians typically exaggerated this just as they ascribed too great a role to the *Zollverein*" and observes that modern historians have noted how little German states put into fostering economic growth. Notwithstanding calling into question the validity of the neo-classical economics model (and each of its successors in turn) which replaced the Prusso-centric focus of German history championed by the pre-1960s school, this is a very strange assessment. Apart from the cost of funding infra-structure improvements and re-equiping the army with modern rifles, Blackbourn acknowledges that between 1848-1865 Prussia's debt more than doubled due to both direct and indirect state investment in the railways. His comments are also at variance with other historians including Henderson, Wagenblass, and Andersson-Skog and Krantz.[130]

Andersson-Skog and Krantz highlight the important role of the state in "promoting the building canals, roads and railways and was [thereby] actively engaged in the industrialization process."[131] In terms of Germany prior to the unification, "state" can reasonably be interpreted to mean "states".

Henderson recites a list of activities in which the Prussian government became involved from the 1820s including the *Seehandlung* (the Overseas Trading Corporation) which despite its name was also a state bank and a government body active on the domestic front in the running of government factories, the founding of the Association for the Promotion of Industrial Knowledge, and the Berlin Technical Institute. Further, Henderson describes how other German states were active operating railways, coal mines, and iron works, and he

[129] Blackbourn (2003, p.140).
[130] Mitchell (2000, p.51): The cost of the army is not stated, but out of a population of 30 million in Prussia in 1866, the army counted 800,000. /Blackbourn (2003, p.141): Prussian debt.
[131] Andersson-Skog and Krantz (1999, Preface, p.xvi).

compares this to the apathetic approach of the British government in fostering its economy in the 1860s.[132]

Similarly, a close reading of Wagenblass[133] reveals the extent of assistance from state governments across Germany who recognised the potential of the railways. These included: (a) Württemberg, where the city of Esslingen made available to the government a site alongside the River Neckar for the building of a locomotive factory. The government then invited bids for this project and received responses from the firms Maffei in Munich and Kessler in Karlsruhe. Kessler's submission was successful whereupon it put together a consortium (*Maschinenfabrik Esslingen*)[134] which agreed with the Württemberg government to raise 300,000 guilders (£25,000) and build the factory while the government undertook to provide a loan of 200,000 guilders (£16,666) and guaranteed to purchase railway material from it for fifteen years. In addition, the government required railway companies operating in Württemberg to purchase their requirements from the new factory. The first locomotive from this factory was delivered to the state railway in 1848, but the works also produced a large inventory of tools for craftsmen; (b) Saxony, where the businessman Richard Hartmann, who had operated a mechanical engineering enterprise in Chemnitz since 1837, wanted to expand into locomotive manufacture but lacked the capital. In 1845 he petitioned the government of Saxony in Dresden for a loan of 40,000 thalers (£6,153) at a favourable rate of interest (having mentioned the low rates available to English firms in England) in order to extend his facility and purchase the necessary capital equipment. In response the government granted him an interest free loan for five years. After visiting England to learn more about locomotive engineering, Hartmann delivered his first locomotive to the Saxon-Bavarian State Railway Company in 1848 and his company went on to take its place in the top eight locomotive builders in Germany; (c) Prussia, where Wagenblass reports that Friedrich Wöhlert obtained a loan from the *Seehandlung* in 1842 to set up a mechanical engineering company in Berlin. He started off doing repair and modification work on English locomotives before building to his own design in 1848. Progress was interrupted because of the

[132] Henderson (1975, pp.72-77); Henderson (1967b, p.31).
[133] Wagenblass (1973, pp.97-103, pp.204-205).
[134] Klee (1982, p.87).

civil unrest in 1848-1849 and Wöhlert did not get back into manufacture until 1851 when the construction of the new Prussian Eastern Railway, the *Ostbahn* from Berlin to Königsberg, got underway with its concomitant demand for rolling stock; (d) Again Prussia, where the Eastern Railway's requirements highlighted by Wagenblass gave the firm Union-Giesserei (U-G) of Königsberg the chance to enter into the new rolling stock market. U-G had been founded in 1828 and produced steam engines, boilers, pumps, agricultural machines, etc. At the beginning of the 1850s, U-G petitioned the Prussian Minister of Commerce von der Heydt, to be considered for the building of locomotives for the *Ostbahn*. In response the minister replied that he was prepared to purchase one locomotive on condition it would run without problem for 2,000 Prussian miles (1,500 kilometres). This was subsequently ordered on this condition and delivered in 1855. As it met the guarantee requirements two more were ordered but only after the quoted price was reduced to compete with Borsig. Thereafter a further six were ordered and delivered by U-G to the *Ostbahn* by 1860. After this, production was increased such that by 1874 U-G had delivered one hundred locomotives.

Each state of the *Zollverein* which had a railway ensured that it had its own locomotive building factory and that its railways were supplied by businesses within its borders. For example, Borsig and Wöhlert supplied almost exclusively to the Prussian railways, Egestorff to the Hanoverian railways, Hartmann to the Saxon railways, Henschel to the Hessian railways.[135] However, while each state had its own arrangements, which generated employment and boosted the local economy, it was at the expense of economies of scale in a developing industry. It is unlikely that, in macro-economic terms, a cost benefit analysis would have shown this as the optimum way of proceding.

Helmholtz and Staby provide a list showing the location of all the *Lokomotivfabriken* (locomotive building works) in Germany between 1841 and 1875 with the date the first locomotive was delivered from each factory and the

[135] Wagenblass (1973, p.204).

total number of locomotives delivered from each of those factories by 1880, as follows: [136]

Manufacturer	Location	Date first locomotive delivered	Total delivered by 1880
Borsig	Berlin	1841	3,800
Maffei	Munich	1841	1,232
Maschinenbauges Karlsruhe	Karlsruhe	1842	1,015
Egestorff	Hannover	1846	1,442
Eßlinger Maschinenfabrik	Eßlingen	1847	1,596
Hartmann	Chemnitz	1848	1,087
Henschel	Kassel	1848	1,147
Wöhlert	Berlin	1848	1,442
Union	Königsberg	1855	169
Grafenstaden[137]	Grafenstaden-Elsaß	1856	2,867
Vulkan	Stettin	1859	800
Schichau	Elbing	1860	291
Schwartzkopff	Berlin	1867	1,094
Krauß	Munich	1867	925
Hohenzollern	Düsseldorf	1875	148
		Total	19,055

Given the examples of state assistance quoted, it is reasonable to infer that similar support was forthcoming from other states to their potential locomotive manufacturers. As can be seen, these factories were geographically dispersed across Germany and present a convincing repudiation of the assessments of

[136] Helmholtz and Staby (1930, p.441).

[137] This manufacturer was in Alsace-Lorraine, France, before 1871. The figures for the period 1856-1871 have not been ascertained. (Alsace-Lorraine appears as Elsaß-Lotheringen in the German records).

Blackbourn, Sheehan and others as regards the failure of state governments in Germany to encourage industry in nineteenth century Germany.

Carr wrote that it was not until 1850 that industrial activity picked up speed. [138] Thereafter, in the 1850s and 1860s, owing to an increase in population which provided the necessary labour force and the availability of capital for investment from foreign investors and the joint-stock banks, the handicraft system which still was in use across much of the country "was superseded by large-scale concerns in the basic sectors of the economy…[and that]…Krupp of Essen and Borsig of Berlin had become world-renowned by 1860." As for the part played by the railways, Carr summarises the position: "The growth of the basic industries, coal, iron, metal and textiles, was engendered by the expansion of the Germany's railway network."

Blackbourn believes that the period 1850-1873 was especially important not least because of the impact of the railways' contribution to the economy resulting from the massive programme of railway construction that had been undertaken between 1840 and 1850. He reports that this grew faster than the twenty five years before or after, at circa 2.5 per cent per annum which at base was attributable to the underpinning railway growth of 14 per cent per annum. He also reports the production figures for this period which show factoral increases from 1850 to 1857 as follows: coal (Prussia had the major German coalfields) x8; iron ore x14; steel x54. [139] Kopper provides details for substantially the same period: "Railroads induced a tremendous growth of traffic and transport. From 1850-1870, passenger traffic on the railroads - measured in person kilometres - increased by factor 16, goods transports - measured in ton kilometres - even grew by the factor 25 [sic]."[140]

Because of the concentration on such data, the textile industry is sometimes overlooked, but Tilly notes that in the preceding period, 1815-1850, "thanks to foreign demand and the expansion of the German internal market driven by the *Zollverein*" this also grew.[141] Henderson then surprises with his observation that

[138] Carr (1991, p.66).
[139] Blackbourn (1998, p.178).
[140] Kopper (2015, p.225).
[141] Tilly (1980, p.1).

"between 1848 and 1870 the production of textiles was the most important industry in Germany…with over three quarters of a million full-time workers" and that "the net value of exports of the textile industries was estimated at nearly seventy million thalers (£10.76 million) in 1860". Unfortunately, Henderson provides no information as to what extent the textile industry was dependent on the railways at this time.[142] However, it is reasonable to speculate that it became more so when the dyestuffs industry, of which the textile industry was probably its most important customer, got underway in the second half of the century, and when larger bulking of finished products could be carried on the bigger more powerful freight trains.

Henderson's comments about the textile industries contrast with the much quoted statement that coal, iron and steel (together) were the backbone of the German economy. While he gives much detail about the coal, iron and steel industries between 1850 and 1870, his observation that "iron smelting was moving from the iron fields to the coalfields" is of especial interest as it affected regional communities.[143] It also gives rise to the suspicion that the reason for the move was the absence of adequate railways in those areas. Another point of note is that shortly afterwards, in 1871, the annexation of France's Alsace and Lorraine provinces resulted in the largest iron ore deposits in western Europe falling into German hands. Even later, in 1904, important deposits of potash were found in Alsace.[144] Once again, the railways proved indispensable in the exploitation of these mineral resources.

It is informative to look at the great ironmaster companies which emerged during this era including Krupp of Essen and Stumm of Neunkirchen. It was reported that "at the Paris Exhibition of 1867 Krupp showed a cast steel ingot weighing 80,000lbs (approximately 36 tons) as well as "a monster such as the world has never seen" –a steel cannon with a barrel weighing 50 tons".[145] But the question to be asked here is: "How were they transported to Paris?" And some years later when Germany started building its *Kriegsmarine* (war navy) how did the steel armoured plate for its warships and such huge guns reach the

[142] Henderson (1967b, p.31, pp.69-71). Textiles included cotton, woollens, silk and linen.
[143] Henderson (1967b, p.36).
[144] Henderson (1967b, p.45).
[145] Henderson (1967b, pp.36-37).

shipyards of Blohm and Voss and others on the north German coast? The answer in the former case is probably by railway, and it is certainly so in the latter case. This has immense implications for the importance of the railways and their co-ordinating administration, the *Verein*, for by this time the original track, locomotives and rolling stock would have necessitated upgrading and replacement to cope with the far heavier industrial and military traffic; only the *Verein* could have brought this specialist engineering knowledge together and disseminated it in a co-ordinated fashion.[146] Again, the significance of the *Verein's* contribution, transmitted through the railways, has been given little attention and is undervalued by historians.

While the railways were principally a service provider and the predominant freight haulier for raw materials regardless of the weather, they were also a main consumer of the coal, iron, steel, wood, ballast and building materials produced in the country. In addition, by back linkage, their demand for locomotives and rolling stock triggered a new railway engineering industry which itself was dependent on suppliers. It was seen how firms like Borsig and Maffei were early producers of home produced locomotives.

Klee provides an interesting profile of the rise of the Borsig from a manufacturer of nails and rail clamps to the delivery in 1841 of its first locomotive to the Berlin-Anhalt Railway Company; this was built under licence from Norris, a United States company.[147] Carr describes what happened next: "in 1848 Borsig supplied sixty-seven of sixty-nine locomotives ordered by Prussian railways in that year, and by 1854 was known in international markets."[148]

A journal article of statistics can be found for the accounting year 1853 based on facts and figures collected and presented by the *Verein* from inputs received from its members, namely statistics covering the number of locomotives purchased by them in 1853 (1,444) and their sources. These include: Borsig

[146] Sheehan (1989, p.741) records the increase in average locomotive horsepower from 157 h.p. in 1850 to 256 h.p. in 1869. Inevitably locomotives increased in size and weight to accommodate bigger and more powerful traction units.
[147] Klee (1982, pp.82-84).
[148] Carr (1991, p.33).

(Berlin) 470; Kessler (Karlsruhe) 124; and Maffei (Munich) 110.[149] These 704 locomotives accounted for just under half the total purchased.

Interestingly, at this point, Henschel of Kassel is not listed; it is not clear why, given that its first locomotive was delivered in 1848. More to the point, foreign firms accounted for only 740 locomotives of the 1,444 purchased. That 48.8 per cent of German railways' requirements were met from home production total less than 20 years after the introduction of the first railway in German territories demonstrates astonishing growth. This was an early indication of the growing strength of German industry in its home market and the impending take-off of rolling stock exports.

Just as importantly in the following decades the benefits of satisfying the demands of the home market produced economic benefit from import substitution.[150] This soon rotated into a flourishing export industry for railway rolling stock. Figures reported by the *Verein* support this*:* "As of 1865: sixteen German firms had exported over one thousand engines and there were 4,768 locomotives in service on its (German) lines of which only 574 were imported."[151]

In the inevitable concentration on locomotives, a similar story about import substitution regarding rails is often overlooked. If anything this was more important than locomotives because of the business it gave to nascent German heavy industry particularly in the Ruhr. During this formative period, 1843-1863, the purchase of rails from British companies fell from 88 per cent to under 15 per cent. Given the thousands of miles of track under construction the railways' requirements were the mainstay of the German economy in this sector and saved considerable sums in foreign expenditure.[152]

From the outset the railway industry developed steadily and "drove demand into the economy via supply chains."[153] But it ramped up significantly during the

[149] Staatsbibliothek, Berlin. 2Nz 33425-1853. *Statischen Nachricten von den Eisenbahn des Verein Deutscher Eisenbahn-Verwaltungen für den Rechnungsjahr* 1853. (Statistical News from the VDEV Railway Area for Accounting Year 1853).
[150] Pierenkemper & Tilly (2005, pp.61-63).
[151] Cited by Mitchell (2000, p.57).
[152] Mitchell (2000, p.56).
[153] Blackbourn (1998, p.180).

period from 1852 to 1873 when "the German railway network expanded…[from 6,605 kms to 23,890 kms] driving demand through the industrialising economy…[and contributing to]…the construction boom in the third quarter of the nineteenth century."[154] That this was facilitated by the greater availability of finance from more flexible "industrial banking" following the upheavals of 1848 is indisputable.

From the historiography, the conclusion can be drawn that the government intervened in the setting of certain railway freight charges to facilitate German manufacturers being able to export competitively. Sterne[155] writes that "a special rate made by the German government for transportation to England, enabled German engine builders successfully to compete with English workshops." This might suggest a strategic partnership between the railways and the government, but no evidence was found for this. Rather, it is more likely this was an early manifestation of a general policy pursued by the government. This is because Sterne adds that, later in the century, success may have been delivered with government assistance for it believed "that the railway should be used as an instrument for the promotion of protective tariff legislation to aid the development of home industries." Nevertheless, this should not detract from the success of the German railway industry because it is known from Bagwell that by 1900 British wagon manufacturers and some railway companies were purchasing components such as axles and steel tyres in quantity from the Continent.[156]

It is possible that England's dependence on foreign imports could be traced back to what Wiener called "the decline of the English industrial spirit." In his controversial book which is not the subject of review here, he marked two events as the end of Great Britain's leadership in world industry matters.[157] The first was the Great Exhibition of 1851, the world's first such exhibition, at the Crystal Palace, London, for which Queen Victoria's consort Prince Albert of Saxe-Coburg and Gotha, a German, deserved full credit for proposing and

[154] Blackbourn (2003, p.137). See Appendix B for distances.
[155] Sterne (1887, pp.453-468).
[156] Bagwell (1968, pp.209-210).
[157] Wiener (1985, p.29).

arranging. These events have been likened by Kaiser and Schot [158] to "transnational [cross-border] and partly global communicative spaces…[which] greatly facilitated the circulation of…ideas and practices, along with their influence on technocratic internationalism."[159] Unfortunately, this was to be the last time that Great Britain hosted such a world class engineering exhibition. The second event was the deaths in 1859 of Brunel, Stephenson and Locke, the leading British railway engineers of that era. To lose in the same year three acclaimed pioneers who had greatly influenced the British railway industry can only be viewed as a massive blow.

It will be remembered that Blackbourn put the railways at the centre of things as an enabler by "reducing the cost of bulk transport by 80 per cent" (but road tolls in Prussia were not abolished until 1875) and through "improved distribution reducing the amounts of capital tied up in stock"; this may be seen as the first example of modern logistics in Germany. Blackbourn also cites the railway as "increasing the volume of consumers, being instrumental in forming a new labour force for the building of the railways and for making the work force more mobile."[160] Kitchen has another take on this: "the initial driver was the *Bauernbefreiung* (1807) which resulted in the liberation of the peasants from the bonds of feudalism and was an important pre-condition for the industrialisation of Germany by creating the mobility of labour."[161]

Despite his earlier statement about their importance, Blackbourn downplays the railways saying they "should be viewed alongside waterways and roads as part of a larger transportation revolution, with its origins in the decades before 1850, that was a decisive element in permitting economic growth." Although this is surprising, it is borne out by Sheehan who writes that "in 1850 inland shipping still carried three times more freight traffic than railroads, but by 1870 the railroad had a lead of almost four to one."[162]

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[158] Kaiser & Schot (2014, p.26).
[159] Kaiser & Schot (2014, p.6): Technocratic internationalism: the approach whereby technological issues should be addressed in a non-political manner and the best technical and scientific solutions determined by domain experts.
[160] Blackbourn (2003, p.140); Kopper (2015, p.225): road tolls.
[161] Kitchen (1978, p.14).
[162] Sheehan (1989, pp 466-467).

Gutberlet offers similar data (if not altogether consistent with Sheehan's) reporting that "railroads were, on average, significantly more expensive than boats in 1846 but the rates converged over the next 38 years. One important factor in driving down rates was the 1-Pfennig tariff for coal shipments."[163] This was a reference to the charge of one silver pfennig per ton per German mile,[164] the so-called "ein pfennig tariff" introduced circa 1850 by von der Heydt. (This is explained at Chapter 5 in the case of the Upper Silesian Railways). Another factor which allowed railway rates to be reduced was that, around 1857, the major railway bridges came into operation joining the disconnected networks. This tipped the advantage more decisively to the railways.

Yet, there is another way of looking at this. In many instances boats were complementary to the railways and their tariffs were competitive for the carriage of bulk freight, certainly in the early years up to 1857. The conclusion that can be drawn from Gutberlet's account is that, thereafter, rates between the railways and boats appear to have converged reaching an equilibrium around 1884. Henderson picks up the story: "between 1885 and 1912 inland waterways were extended and improved…and a quarter of the goods traffic of the Reich was carried by inland waterways in 1910."[165] However, it would be incorrect to attribute this investment alone to waterborne freight becoming a viable competitor to the railways. O'Brien reveals the real reason: it was due in no small measure to the adoption of steam power for their boats by the waterborne freight carriers.[166]

Nonetheless, the railways still had a key role to play in areas devoid of navigable waterways and especially where the topography of upland regions with fast flowing rivers and rock-strewn river beds precluded the use of waterborne transport. That evolving technology and the availability of railway transport began to impact the economics of the regions, bringing (more)

[163] Gutberlet (2013a, p.4 and Table 1).
[164] German mile: The academic references are found in Henderson (The Zollverein, 1939, (Reprint 2013), Appendices, Length) which cites "Meile –About 4 3/5 miles" and Dumke, R.H. in Lee (1991, p.88) cites 1 Prussian mile = approximately 7.5 kilometres. Converting 7.5 kilometres at 1.6093 kilometres = 1 mile brings to 4.6 miles. Hence the meile (4.6 miles) and the Prussian mile have the same values.
[165] Henderson (1967b, p.66).
[166] O'Brien (1983, p.7).

industry to some but de-industrialising others, is a theme explored more fully at Chapter 8.[167]

Agriculture and the Railways before 1871

In the period 1850-1870 erstwhile peasant families had been able to acquire land with the help of new savings and loan banks while agricultural colleges provided training for farmers. But it was only the railways that, regardless of the weather, could rapidly transport their produce to the ever-growing towns and cities and deliver the financial benefits.[168] As an indicator, between the 1830s and 1870s before refrigeration, the increased availability of fresh produce in the distant city markets doubled the average consumption of fresh meat in Germany solely as a consequence of rail transport.[169]

Pierenkemper and Tilly describe the impact that agriculture had, paradoxically, by helping transform Germany into an industrial society. This might reasonably be deemed an unexpected development. Yet, "agriculture had itself been developing into a capitalist system characterised by property rights, free market labour and capitalist minded farmers and entrepreneurs."[170] At the same time better methods of farming proposed by agricultural institutes, better seed-corn, new crops and healthier livestock all underpinned this development.

Among the cash crops was sugar beet. Kitchen reports that as early as 1747 thought was being given to growing sugar beet as an alternative to sugar cane.[171] This moved from being something of theoretical interest to one of practical necessity when cane sugar became unavailable as a result of the British blockade of Europe during the Napoleonic wars. The blockade's effect on trade between England and Germany and the contingencies it generated, is referred to as the Continental System.[172] This system incentivised the sugar beet industry in its early years.

[167] Blackbourn (2003, pp.143-144).
[168] Blackbourn (1998, pp.188-189).
[169] Faith (1990, p.265).
[170] Pierenkemper & Tilly (2005, p.75).
[171] Kitchen (1978, pp.15-17).
[172] Blackbourn (2003, p.52).

Kitchen reports that by 1801 Franz Karl Achard, with the support of the state, had grown sugar beet and, subsequently, in 1809 published a paper about it. However, at this stage "only 3 per cent of the gross weight of beet could be converted into sugar and the state withdrew its support…[despite this]…by 1850 7.2 per cent of the beet was converted producing 53,000 tons of sugar."[173] This was the start of a very lucrative strand of the economy.

What is often overlooked is that Prussia supplied Great Britain with 30 per cent of its wheat in the early 1860s although within twenty years this had fallen substantially owing to competition from the United States and Russia.[174]

That the railways became heavily involved in supporting both agriculture and later the chemical industry is not surprising, but it is unexpected to learn about the methodology employed when these aspects came together and how the optimum freight charges for transporting fertilisers by rail to specific farming areas were determined. This is explained later when dealing with tariffs.

Apart from the railways' transformational all-weather transportation services, a fundamental issue is that the railways made it possible to bring into cultivation previously inaccessible land. In the historiography, such an outcome was first identified by Fogel in his book.[175]

1866 -A Decisive Year: The Zenith of the *Verein's* Power

Following on from the events of 1848, Blackbourn identifies the subsequent Seven Week's War in 1866 as "the decisive moment in German unification: a German civil war that led to the partition of Germany and the expulsion of Austria."[176] Ploeckl characterises "the swift Prussian victory over Austria (as when) Prussia became the hegemonic power in Germany."[177] By couching 1866 in this manner, Blackbourn and Ploeckl give the reader pause for thought; this in order to grasp the significance of the war in terms of steps in the state building process towards the future unification of Germany in 1871. Blackbourn suggests that the establishment of the *Zollverein* Parliament (the second

[173] Kitchen (1978, p.17).
[174] Tipton (1976, p.54).
[175] Fogel (1964) cited by Leunig (2010).
[176] Blackbourn (2003, pp.184-185).
[177] Ploeckl (2015, p.9).

Zollverein), and the foundation of the North German Confederation which followed the end of the war, were the connectors which facilitated this.

In terms of the railways, Mitchell thought that one of the most important outcomes of 1866 was that extensive railway networks belonging to the annexed states which had supported Austria (Hannover, Frankfurt am Main, Hesse-Kassel and Nassau) fell into Prussian hands and thereby into public ownership.[178] This topic was addressed by the *Verein's* own newspaper, *Zeitung des Vereins,* which predicted that these networks would likely come under North German Confederal authority and would result in more uniformity.[179] Later, another article (in the *Verein's* newspaper) identified the supervisory and legislative rights of the North German Confederation and re-iterated the belief about uniformity.[180] Elsewhere in the historiography, it was noted that the Middle German League, a railway tariff league, was dissolved and gave way to the confederation.[181]

The question to be asked here is whether the *Verein* was displaced in this area of Germany as the co-ordinating railway authority.The conclusion to be drawn is that it had been displaced because the North German Confederal authority arrogated to itself oversight of all the railways in its territories. Nevertheless, while this could have caused tension between the *Verein* and the Confederation, it is not apparent this happened because the *Verein's* powers emanated in no small measure from its being the *de facto* railway technical authority in Germany upon which both railways and state governments depended.

However, with regard to the railways, previous authorities have failed to capture the real significance of the moment: namely that 1866 was the zenith of the *Verein's* influence and a tipping point in its authority and influence.

The next chapter shows the connection between the North German Confederation and the new unified Germany with its evolving governmental structure. It gives an overview of the developments in German society, industry

[178] Mitchell (2000, pp.50-52).
[179] Staatsbibliothek, Berlin. Nr. 4Nz 13615-7. 1867. ZVDEV Nr. 1 /1867.
[180] Staatsbibliothek, Berlin. Nr. 4Nz 13615-7. 1867. ZVDEV Nr. 11 /1867.
[181] Mitchell (2000, p.41).

and agriculture before putting down a marker about the railways and the changing role of the *Verein.*

Chapter 3

Setting the Environment -The German Nation State

The Constitution of the newly unified Germany (referred to variously in the historiography as the German Nation State, the Second Reich, or Imperial Germany) in 1871 was largely carried over from the North German Confederation constitution.[1] Bismarck, as Imperial Chancellor, presided over the Federal Council (*Bundesrat*) which had been established and was composed of representatives nominated by the states which comprised the new Germany. This was a federation of 38 states but where executive authority for many matters remained under the control of the individual states.[2] At the lower level, the parliament (*Reichstag*) was elected by universal male suffrage (males over 25 years) and at first there was public confidence in the elected parliament. Later, however, business alliances and lobbyists acted as pressure groups in order to influence politicians. This served to damage the electorate's perception of democracy with negative future consequences.[3]

From 1871 until 1895, an evolving structure of government displaced the earlier district and provincial government arrangements[4] and the Imperial government arrogated to itself extensive powers over the railways under the new constitution.[5] This had far-reaching ramifications beyond how it affected the *Verein* and is addressed later in the thesis.

The decades following the unification saw rapid change in matters relating to the evolution of society, health, social welfare, religion and politics. New political parties more representative of the population emerged to challenge the influence of the entrenched Liberal Party. Foremost among these was the Social Democratic Party which soon gained popular support beyond its rivals; but its relentless rise and popular agitation were seen by the government as a

[1] Blackbourn (2003, pp.193-194); Mitchell (2000, p.121).
[2] Ploeckl (2015, p.9).
[3] Blackbourn (1998, pp.337, pp.340-341).
[4] This was the situation in Prussia the largest German state and, following Dunlavy, it is reasonable to assume similar arrangements existed elsewhere in Germany.
[5] Meyer (1897, p.80).

threat. As a result, Bismarck sought first to suppress it by the Anti-Socialist Law (1878) and then "to buy it off" by his social welfare reforms.[6]

Blackbourn describes one element of these reforms, the pension scheme, as Bismack's attempt "to bind workers to the state…this was the carrot and the anti-Socialist law the stick".[7] For his part, Henderson observed that while Bismarck's welfare reforms were well ahead of other industrialised countries, these significant social welfare improvements "failed to wean the German workers from Socialism."[8]

These reforms are accepted as a given in the historiography but, as it seems there were no comparable governmental arrangements in Europe at that time, it is curious that no one asks from where Bismarck got his ideas. Research suggests that he may have got them from the example set by August Borsig, the Berlin locomotive manufacturer, who although not a democrat, may be viewed as an early social reformer.[9] Tode et al paint a picture of Borsig as an industrialist who from the beginning had a reputation for maintaining good working conditions in his factory and paying more than his competitors. He provided a canteen and devised a sick pay scheme for his workers which by 1846 had paid out 3,385 thalers (£521). But the canteen was not an entirely altruistic act. He saw it as more a matter of discipline because workers were not allowed to bring their own food and the canteen was open only at certain times. Borsig was also ahead of his time as regards workers councils when in 1848 he agreed to deputies being elected from the workforce and, without whose agreement, workers could not be sacked anymore.[10] Although August Borsig died in 1854, his son Albert who succeeded him, and later August's grandsons, appear to have sustained down the generations the ethos he established.[11]

During this period, although support for the Socialist Party was rising, the influence of the civil service and of the military as instruments of continuity and

[6] Blackbourn (1998, p.263).
[7] Blackbourn (1998, p.346).
[8] Henderson (1967b, pp.45, pp.57-58).
[9] Tode et al (2012, p.32).
[10] Tode et al (2012, pp.28-29, p.31).
[11] Tode et al (2012 p.37).

authority, in the service of three successive Kaisers, kept the brake on the campaign for a more democratic society.[12]

It will be remembered that Blackbourn surprised his readers with his depiction of the developing Germany as "the carceral society". Reinforcing this was the culture of Prussian militarism which became more widespread throughout Germany after the victories over Denmark (1864), Austria (1866) and France (1871). Blackbourn notes that that "the reserve officer corps, 120,000 strong by 1914, was the principal conduit of such values…many were more proud of their rank than their civilian accomplishments". And, again: "former soldiers were given preference in many parts of the non-military bureaucracy through the system of military candidates for posts." Given the absence of reports to the contrary, it is reasonable to infer that this culture of discipline and militarism was reflected in the railways and likely explains why, later in each of the years 1905-1913 when some 200,000 workers went on strike instigated by the Socialist movement, it appears the railways did not become involved.[13]

New Industries after 1871

In the second half of the century, during the so-called second industrial revolution, new industries started to appear: chemicals, shipbuilding and the merchant marine, and an electrical industry consequent on the introduction of electricity.[14]

This period also saw the concentration of industry into groupings called "cartels". This was not a feature unique to German business because similar arrangements had developed in the United States. There, in order to rein-in monopoly power and maintain competition, not least by the railways, the federal government first passed the Inter-state Commerce Act in 1887 and subsequently introduced the Sherman Anti-Trust Act in 1890. While other historians saw cartels as essentially a risk reduction strategy, Henderson offers another context seeing cartels as underpinning the emergent chemical and

[12] Blackbourn (1998, pp.401-402: 1888 *Dreikaiserjahr* -the year of the three Kaisers; pp.405-406).
[13] Blackbourn (1998, p.384, p.376, p.379, p.360).
[14] Blackbourn (1998, p.320, p.332).

electrical industries because “only an association of firms could meet the high cost of maintaining modern research laboratories”.[15]

The chemical industry and shipbuilding respectively relied upon coal, salt, iron and steel being delivered continuously, regardless of the weather, in increasing quantities in order to manufacture their products and to function. The merchant marine similarly was dependent on coal to deliver its services. Equally, for the chemical industry, it needed its finished products to be distributed around Germany and further afield. By 1914 Germany led Europe in chemical production[16] One of its most marketable products was the dye “Prussian blue”.[17] That only the railways could satisfy these transportation requirements shows the extent to which Germany’s economy depended on the railways. Notwithstanding more competitive prices than hitherto, this dependency most probably contributed to the considerable increase in freight carried by water-borne transport during this period caused by other goods being pushed off the rails to make room for coal, iron and steel, and the elements required for the manufacture of chemicals.

Of the emergent industries, the electrical industry attracted the most attention because it was entirely new and heralded a new era. Electricity was introduced in Germany towards the end of nineteenth century and (not counting the installation of lighting at Linderhof palace in Bavaria for King Ludwig II) was first trialled in Berlin by the Siemens company. After initial problems it was soon powering the trams and lighting the streets. But the big problem was to transmit electricity over extended distances; once this was overcome its use was introduced into factories and transformed industrial processes.

As such, this should be viewed as a watershed event, a revolution in its own right (in which Germany was a principal researcher and adopter) because electricity began to replace steam as a major source of power. In tandem manufacturers of electrical products came to the fore, not least Siemens whose importance for employment and the Berlin economy resulted in the Spandau

[15] Henderson (1967b, p.59).
[16] Blackbourn (1998, pp.330-331).
[17] Produced by the company which was owned by the celebrated amateur archaeologist Heinrich Schliemann.

district of the city where its factory was located becoming known as Siemensstadt. Remarkably, given its transformational impact, the electricity revolution is given insufficient recognition in the historiography.

Pinson paints the picture: by 1895 the electrical industry was employing 26,000 people rising to 107,000 in 1906; and by 1913 Germany produced 34 per cent of the world's output of electrical goods making it the world leader.[18] The value of this massive export trade was reported as 220 million Marks (£11 million)[19] in 1913 led by such firms as AEG (*Allgemeine Elektrizität Gesellschaft*) and Siemens. It is little wonder that the historian Clapham considered the electrical industry as "the greatest single achievement of modern Germany".[20]

As far as railways are concerned, this era is notable for the production by Siemens-Werke, Berlin, of the world's first electric powered locomotive in 1879. Insofar as the *Verein* is concerned, it has not been possible to establish a trail of early involvement in the development of electric-powered locomotive technology. However, it is known that, circa 1911, the *Verein* achieved the agreement of its members in adjoining countries to certain elements of electro-mechanical standardisation.[21]

Agriculture after 1871

Earlier it was seen that the advances in agriculture had a consequential impact on industry. At the same time this progress, not least through mechanisation, caused significant redundancies. To put agriculture into perspective, in 1880 it supported 49 per cent of the workforce and even though this figure had fallen to 35 per cent of the working population by 1907, according to the census quoted by Blackbourn, this constituted 10 million people employed in agriculture, forestry and fishing.[22]

It was also seen earlier that by 1850 7.2 per cent of sugar beet production was yielding 53,000 tons of sugar. By 1909 efficiency had increased to enable 16

[18] Pinson (1954, p.227).
[19] Note the different conversion rates for marks - see Appendix C.
[20] Henderson (1967b, p.72): Value of this trade and citing Clapham.
[21] Kühne and Reiners (2010, pp.18-19, pp.52-53).
[22] Blackbourn (1998, p.188, p.313, p.184).

per cent of the beet processed to yield over 2,000,000 tons of sugar.[23] In another illuminating statistic, it was reported that "by the end of the century the value of sugar exports comfortably exceeded those of coal or machinery".[24]

Henderson addresses agriculture mainly in the context of German farmers and east German landowners pressing the government for protection from competition, particularly from America, in the years after unification. As a result, from 1878 to 1887 protectionist tariffs were applied and then further amended so that they included not only cereals but also cattle, wool and other products.[25] While this pragmatic application of protectionism by government ensured the continued health of the domestic market, it will be explained later that Bismarck had his own reasons for introducing the iron and rye tariffs in 1879.

The Railways after 1871

At the time of the unification in 1871, there were over 60 railway administrations in Germany split between state owned and privately owned administrations. The total track distance was 27,970 kilometres by 1875.[26] However, the picture was fragmented in terms of ownership and operational responsibility; for example, some railways were privately owned but operated by the government. Worse still, "there were no fewer than 1510 railway tariffs". This begs the question about the *Verein's* effectiveness as a co-ordinating authority if this is correct. This will be explored later in the thesis.[27]

Also, 1871 was the year in which the death of the *Verein* was assumed by many historians, not least Mitchell who said "the *Verein's* future irrelevance had been sealed by national unification".[28] As will be seen, this assessment was premature. In the decades from 1871 until the turn of the century, the district and provincial government arrangements which had existed hitherto were replaced. Subsequently, in the 1890s, they were further re-constructed. Nonetheless, although the Imperial government was given extensive powers

[23] Kitchen (1978, p.17).
[24] Blackbourn (2003, p.140).
[25] Henderson (1967b, pp.49-50).
[26] See Appendix B.
[27] Fremdling and Knieps (2011, pp.140-141).
[28] Mitchell (2000, p.139).

over the railways under the Constitution of 1871, these were enforced with a light touch through advisory boards. This is examined more fully later in the thesis.[29]

This period held mixed fortunes for the *Verein*.The early demise of the *Verein*, indicated by Mitchell and others, did not materialise. But the announcement of the establishment of the Imperial Railway Office (REA) in 1873 would surely herald its end? Although this did not prove to be the case the *Verein* was already being displaced by the *General Konferenz* (General Conference of German Railways). However, in 1878, it came to the fore again. In that year the economic depression which affected much of continental Europe was in its fifth year. As a consequence, Bismarck was persuaded by the *Verein's* proposal for a Secondary Railway network.[30] This was seen as having economic benefit, not least because of its low construction costs, its planned use of redundant rails and railway equipment, and the use of redundant locomotives. Arguably, the introduction of this secondary railway system had the effect of dampening the economic slump which lasted from 1873 until 1896.[31] These issues are addressed at Chapter 8.

In 1879, the Imperial government encouraged the Prussian government, over which it had especial influence, to take into public ownership (*Verstaatlichung*) the railways within Prussia's jurisdiction. This included *Elsaß-Lothringen* (Alsace-Lorraine) whose railways the REA[32] operated on behalf of the Imperial government following the victory over France in the Franco-Prussian war of 1870-1871.

The historiography tends to the view that the *Verstaatlichung* was intended to be a model for other German states to follow towards the eventual nationalisation of the railways in Germany. However, given the involvement of Bismarck, a question must be asked, namely, was there a hidden agenda? Mitchell put it like this: "Ambiguity had always been a way of political life for

[29] Meyer (1897, p.392).
[30] Kühne and Reiners (2010, pp.28-29).
[31] Blackbourn (1998, pp.190-191).
[32] Henderson (1967b, pp.47-48).

Bismarck."[33] Consequently, it is reasonable to conclude that there was such an agenda: the strengthening of the railway network across northern Germany for military purposes as a precursor to the expected future war with the perceived enemies at the gate, France and Russia. This fear of a future war was prevalent even before the first railways were built in Germany. In 1834, the Prussian minister August von Dönhoff on a visit to Munich "reiterated his worries…[about a railway being built]…in the Rhine corridor, which might be disrupted 'by the enemy.'"[34] This could only be a reference to France.

The policy of taking into public ownership all major railways in Prussia had particular societal and financial impacts. This included the rising importance of professionally trained civil servants, particularly those trained in the law (*Juristen*), in the running of the railways and the hugely favourable impact this had on state finances. These aspects, and the reason why *Juristen* became a pejorative term, and a term not always understood by non-Germans, are considered later in the thesis.

Notwithstanding the confusion of the tariff situation which developed, modern concepts can be seen at work in the management and operation of the railways during this era. Two examples served as models for similar arrangements launched in the twentieth century: (a) the first example describes outsourcing. An example of this was the Bachstein Company which, circa 1879, offered a central administration service for secondary railway lines introduced by the Lines of Secondary Importance Act of 1878. This provided a railway design and build service with a full supporting package: recruitment of labour, payroll, contracting, accounting, procurement and legal services;[35] (b) the second example concerns public and private finance arrangements: this relates to the contractor Lenz & Company which, circa 1883, was engaged by the Duchy of Mecklenburg to excavate the earthworks and lay the line from Mecklenburg to Schwerin (230 kilometres). The deal was that Lenz & Company had to bear one third of the cost of the project (reflected in shares) and to operate the line for the first 10 to 15 years. Such was its success that the duchy bought back

[33] Mitchell (2000, p.154).
[34] Mitchell (2000, pp.38-39).
[35] Kühne and Reiners (2010, pp.30-31).

the shares early and paid Lenz & Company a profit. The Lenz plan became a model for financing, building and operating small secondary railways.[36] In its original form, for the Duchy of Mecklenburg, it was an early example of a public and private finance initiative.

In each of these cases the government concerned maintained ultimate ownership and control over the railways.

The Changing Role of the *Verein*

It has been seen that prior to the unification the *Verein's* character, and its relationship first with the Prussian government, and then with the German Imperial government, began to change. The unification ushered in a formalisation of that change and this is explored in Chapter 8.

Military Strategy and Foreign Policy

After the unification in 1871, Bismarck rejected efforts by German commerce and industry to compete with the older European powers by establishing Imperial colonies. However, he did not discourage firms and traders and left them to their own devices if they acquired territory, or set up trading bases, in such places as the Cameroons, South West Africa, East Africa, Samoa and even China. Blackbourn writes that: "the twin symbols of the German civilising mission were guns and schnapps (and) both sold well in the colonies." More importantly, he observed that most of Germany's putative colonies had little economic value, rather "German informal imperialism was the real success story; the achievement of economic penetration without political annexation or control."[37]

In the meantime, Bismarck's focus was on *Mitteleuropa*, or central Europe. By war Prussia had gained territory from Denmark in 1864 and France in 1870-1871. It had also ejected Austria from Germany's affairs in 1866. But Bismarck, now as leader of the unified Germany, looked to free the country from its dependence on the Austro-Hungarian Empire for a rail route giving access to the Mediterranean Sea; he did this by supporting the St Gotthard Tunnel

[36] Kühne and Reiners (2010, pp.36-37).
[37] Blackbourn (1998, pp.334-335).

project through Switzerland.[38] The tunnel, opened in 1882, transformed the commerce of much of the region, particularly the project partner countries of Switzerland, Germany and Italy, mostly at the expense of France. For Germany this resulted not only in commercial benefit but also increased influence in the Mediterranean; its port of choice then became the Italian gateway port of Genoa. Prior to this, Germany's only direct access to the Mediterranean had been through Austria to Trieste, then the most important seaport of the Austro-Hungarian empire.[39]

Some years after Bismarck's departure from office, in the period 1898-1918, Germany embarked on an ambitious project to build a railway from Berlin to Baghdad.[40] Its purpose was to spread German culture and influence through Serbia and Bulgaria and into the weakening Ottoman Empire. By this means it hoped to gain access to the food produce of those countries, to the petroleum of Romania, and to gain access to the Middle East where its long term ambition was to displace Great Britain as the dominant European power. The Armistice ending the First World War put a stop to these ambitions but, even before that, it appears that insufficient progress had been made in constructing the railway to allow food to be brought to Germany because 750,000 civilians died during the war from starvation as a result of the British naval blockade.[41]

The *Verein* and the Primacy of Language

A connection apparently not made by previous authors has been the integration and assimilation of people achieved by the railways in the period 1835-1914 by means of the promotion and diffusion of the German language. Through aggrandisement of territory, primarily as a result of the Congress of Vienna settlement and from Bismarck's wars, but even pre-1800, Germany had acquired non-German populations on its fringes. Hence it included people whose native languages were Danish, Dutch, French, Swedish (from the former

[38] Mitchell (2000, p.146).
[39] Mitchell (2000, p.40).
[40] McMeekin (2010).
[41] Blackbourn (2003, p.358).

Swedish Pomerania), Russian and Polish;[42] in fact a significant proportion of Prussia's population was Polish.[43]

The *Verein*, and its constituent railway administrations, conducted business and published information in German which forced its non-German (speaking) members and customers to become familiar with the language. Yet it would be another twenty nine years (1876) after the founding of the *Verein* before a law declaring German as the official language of Prussia was promulgated.[44] The conclusion to be drawn here is that the German language became a "glue" which helped hold the country together and contributed to nation building. This last point is consistent with Herder's[45] comment that "language is the clearest expression of national identity." Further, through this promotion of the German language it became the *lingua franca* of Central Europe; it is not unreasonable to infer that this had concomitant benefits for trade. These aspects of the *Verein's* beneficial influence appear to have been completely overlooked.

The First World War 1914

In 1914 Norton observed, in a rural area, a military railway mobilisation station complete with seventy-five to a hundred locomotives and carriages. This was one of many scattered across Germany and "although the locomotives were no longer good enough for heavy or fast traffic they had been sent to the reserve…as war locomotives". They were regularly fired up and tested by a skeleton staff dedicated to holding them ready to transport troops in the event of war, which he later discovered had been imminent.[46]

Wolmar[47] recounts that in the first three weeks of the First World War in August 1914, the German railways moved three million troops to the Western Front. Notwithstanding the work done by the REA to upgrade Germany's railways to military standard in the years prior to this,[48] the *Festschrift* credits the *Verein* with "the uniform technical arrangements, in particular with the Austrian and

[42] Clark (2006, pp.428-429).
[43] Mommsen (1994).
[44] Clark (2006, p.429).
[45] Sheehan (1989, p.166): cites the German philosopher Herder.
[46] Norton (1915).
[47] Wolmar (2012, p.151).
[48] Mitchell (2000, pp.242-243).

Hungarian railways, (which) bolstered the military strength of the Central European States."[49] Consequently, it is reasonable to infer that the movement of these armies was due in no small part to the efforts invested by the *Verein,* and its constituent railway administrations, over many decades, underpinned by its engineering domain knowledge and operational efficiency. Altogether, it was nothing less than an outstanding performance.

In line with Wolmar's account, Mitchell[50] writes that the German railways moved three million troops to the front in 11,000 trains. However, to set it in context, Mitchell also reports that the French railways delivered an equally impressive performance transporting their armies to the front within three weeks and before the German armies reached Namur, the last major bastion (in Belgium) before the French border. Regretably, the railways were a major reason for the static nature and inflexibility of movement in the First World War which resulted in huge casualties. However, this is not the subject of this thesis.

This chapter concludes the historical overview of the thesis. In the next chapter the genesis of the *Verein* is explored. What immediately causes surprise is the status of the *Verein's* executive management. This is comparable to the dignitaries of the more prestigious *Zollverein.* This fact gives a clue to why the *Verein* was so successful and this is examined.

[49] *Festschrift* (1896). *Einleitung*, p.XVIII.
[50] Mitchell (2000, p.266).

Chapter 4

The Emergence of the Association of German Railway Administrations (*Verein Deutscher Eisenbahn-Verwaltungen*) 1847

This chapter traces the ascendence of the *Verein* from its foundation in 1847 until the unification of Germany in 1871. Both the *Zollverein* and the German Confederation had an interest in the railways but fear over Prussia's ambitions inhibited progress on forming a co-ordinating railway body. This requirement was fortuitously fulfilled when the *Verein* evolved out the Prussian railways themselves as a result of their conflicts with the Prussian government. The ensuing organisation was trusted by all parties because of its independent status.

This status was further enhanced by virtue of the fact that the *Verein* became a repository of domain knowledge, a centre of excellence, and by the tacit consent of state governments, the accepted railway authority in Germany.

The Emergence of the *Verein*

The adverse publicity that the Prussian minister responsible for the railways, von der Heydt, attracted has tended to distort the perception of the relationship between the Prussian government and the Prussian railway companies prior to 1846. Yet a close examination of the primary source documentation[1] reveals that this relationship had been deteriorating for some time before the Prussian railways came together in *der Verband der preußischer Eisenbahn-Direktionen* (the Union of Prussian Railway Administrations*)* in 1846, some two years before von der Heydt took up post.

The background is informative and casts a different light on the events which preceded the formation of the *Verband* and its successor the *Verein* in 1847.

[1] *Festschrift* (1896). *Einleitung,* pp.XI-XII.

As the 1840s progressed two[2] matters of concern arose between the railways and the Prussian government: the first involved Prussian railway company administrations who were more concerned about their freedom of action and profitability, both of which in their view were hampered by the Railway Law of 1838, and thus wanted it repealed; the second involved the Prussian government which was set on encouraging the Prussian railway administrations to improve their performance with regard to technical and operational matters.

As background, the Prussian government had been taking a continuing interest in the railways from the outset. For example, it is known from Schot et al[3] that in 1837 it had mandated the 1.435 metre gauge track as the standard for main lines in Prussia. Interestingly, this followed the lead of Belgium which had taken the advice of the British railway engineer George Stephenson and adopted the 1.435 metre gauge for its main lines as early as 1834.

Two dates are of note in this period: 1843 and 1846. Ignoring the complaints of the railways about the Railway Law of 1838, the government applied itself to considering how the railways might be improved and came to the conclusion that this lay in the technical areas of rolling stock design and of operations. Accordingly it called a meeting in March 1843 to discuss technical matters,[4] for example, the dimensions of rolling stock, the distance between double tracks, so as to allow inter-operability between railway companies and to ensure safety. This betrayed a lack of co-ordination between the railway companies themselves which the government sought to rectify.

Despite this, the wrangling continued until 1846 when the government called another meeting. However, making little progress on that occasion, the government intended to call a second such meeting later in 1846, but this time with non-Prussian railway companies also invited to attend. Dunlavy[5] called

[2] *Festschrift* (1896). *Einleitung,* pp.XII-XIII.
[3] Schot et al. (2011, pp.265-289): While Schot et al write (p.272) that it was not until 1845 that the British government made a similar provision, however other authorities maintain that this occurred in 1846. This is a telling example of the British government's laissez-faire approach to pioneering industry.
[4] *Festschrift* (1896). *Einleitung,* p.XIII.
[5] Dunlavy (1990, p.135).

into question the government's motives on this occasion and saw the proposed second meeting with its wider list of invitees as an attempt to limit the agenda to technical and operational matters believing that non-Prussian railway companies would not be interested in addressing the contentious issue of the Railway Law. This was probably the case but it does not give credit to the government for seeking to address these other important issues.

However, 1846 proved to be a momentous year, for the Prussian railways' priority to have the Railway Law of 1838 repealed became more urgent with the fear that the Prussian government intended to apply the law more rigorously than hitherto. Around the same time, the banker Joseph Mendelssohn, who was connected with the Berlin-Stettin Railway Company, came to the realisation that it would make more sense for the Prussian railway companies to negotiate as a single entity with the Prussian government.[6] Doubtless, it was this insight that led Mendelssohn to call the meeting of these companies in 1846 which resulted in the establishment *der Verband der preußischer Eisenbahn-Direktionen* (the Union of Prussian Railway Administrations). At this point, the Union comprised ten railway administrations controlling a total track length of just 1,528 kilometres,[7] but their representatives comprised highly qualified professionals including:[8]

> von Kühlwetter, Government Privy Councillor, subsequently Excellency the Oberpräsident of Westphalia. Chairman of the Board of Directors of the Düsseldorf-Eberfeld Railway Company, 1837-1847.
>
> Costenoble, Government Privy Councillor, Chairman of the Board of Directors of the Lower Silesian-Märkisch Railway Company, 1837-1868;
>
> Rhades, Government Councillor, Chairman of the Executive Board and Member of the Board of Directors of the Berlin-Stettin Railway Company, 1839-1867;

[6] Dunlavy (1990, p.135).
[7] *Festschrift* (1896). *Schlusswort*, p.410.
[8] *Festschrift* (1896). *Bildnisse*, p. XXVII, plate 1.

Neuhaus, Government Privy Councillor, Constructor and subsequently Chairman of the Board of Directors of the Berlin-Hamburg Railway Company, 1840-1876;

Fournier, Government Privy Councillor, Chairman of the Board of Directors of the Berlin-Anhalt Railway Company, 1843-1882;

Zenke, Government Privy Councillor, Chairman of the Board of Directors of the Berlin-Stettin Railway Company, 1843-1876;

von Mevissen, Government Commercial Councillor, banker and President of the Board of Directors of the Rhenish Railway Corporation, 1844-1879.

The ethos of the Union was set by the motion[9] proposed by the Berlin-Stettin Railway Company and later passed:

> *for a permanent Union of Prussian Railway Administrations*, "*the Union*", *to be formed with the aim of* "*promoting the aspirations of the railway administrations through unanimity and, in this way, serving both their own interests and those of the public.*"

Draft Association statutes, that is constitution, drawn up by the Berlin-Stettin Railway Company were adopted with minor amendments. Three provisions of the constitution are highlighted as follows: [10]

"two conferences shall be held each year further to which extraordinary meetings shall be held on request;

the resolutions adopted shall be accepted at the discretion of the members –that is, a voluntary acceptance of resolutions;

[9] *Festschrift* (1896). *Einleitung,* p.XIII.
[10] *Festschrift* (1896). *Einleitung,* p.XIV.

the management (the Executive Board) shall be elected for a term of two years; it shall hold the chair at meetings and shall conduct the Association's business for the duration of its term in office."

The Berlin-Stettin Railway Company administration was elected as the first Executive Board to manage the affairs of the Union.[11] As the Union evolved into the *Verein*, the management board was supported by committees charged with looking after specific topics.[12]

Two particular points of note came out of this meeting. The first made reference to "*serving the public interest*" and is very important to note because it gives an insight into how this budding organisation, from its inception, saw its role as including a duty to serve the public. In other words, it stemmed from the German philosophy of *Genossenschaft,* the co-operative spirit of the German people or in a wider context, as if the railways were a collective enterprise.[13] The second was the provision in the statutes which said: "The resolutions adopted shall be accepted at the discretion of the members". This is important because it indicates the Union satisfied one of the key prerequisites for an institution as described by North[14] namely: "providing a hospitable environment for [the realisation of] co-operative solutions to complex exchange for economic growth." Kaiser and Schot[15] offer a vital interpretation of this environment, namely that it was "'technified' with the aim of forming a consensus around what the experts considered the best technical and scientific solutions to common challenges." They argue that thereby such issues became "de-politicised".[16] Mitchell put it another way: the association "sought to avoid the overt political overtones of the Frankfurt Diet [parliament] and the customs union [the *Zollverein*]."[17]

[11] *Festschrift (*1896). *Einleitung*, p.XIV.
[12] *Rückblick* (1871, p.5).
[13] In reality this was a complex issue because the individual railway companies as members of the *Verein* subscribed to this. But they were first and foremost commercial entities focused on making a profit. This was a cause of continuing tension with the Prussia government, not least because of the interpretation the railways minister, von der Heydt, put on the words "serving the public interest".
[14] North (1996, pp.1-13).
[15] Kaiser and Schot (2014, pp.6-7).
[16] Kaiser and Schot (2014, pp.6-7); and correspondence Schot-Flood 17th March 2015.
[17] Mitchell (2000, p.40).

Thus came into being the Union of Prussian Railway Administrations managed by a board of distinguished individuals who held, or had held, public office and in whom was to be found a fund of professional knowledge and operational experience relevant to the railways. It became an organisation whose distinctive characteristics marked it out as more than just a trade association.

When the Prussian government called the second meeting with the railways later in 1846, the government got diverted from its agenda because the rising civil unrest caused by repeated crop failures and rising unemployment in the 1840s captured its attention. At this point the Union effectively hi-jacked this proposed second meeting with German railway companies and out of this came an agreement by all the railways present to meet again in 1847. In that meeting a proposal to expand the Union into a re-named all-German association of railway administrations, the *Verein Deutscher Eisenbahn-Verwaltungen,* was accepted.

Alternative views as to the *Verein's* emergence

Of note are alternative views on how the *Verein* came into existence:

Henderson,[18] when discussing the *Zollverein*, unexpectedly gives a remarkable insight into this matter quite different from other historians, namely that, "in 1847 *Zollverein* members…reached agreement…on a code governing bills of exchange and on the establishment of the Association of German Railway Administrations." This is an entirely different interpretation of the genesis of the *Verein* and may have come about because of anxieties about losing control of their railways to Prussia if they placed them under the management of the *Zollverein*. Consequently, they saw this necessitated the railways coming under a completely separate organisation.

[18] Henderson (1975, p.38).

As regards the *Zollverein*, Mitchell's[19] comments cast light on the matter when he observes that: "the *Zollverein* was no better suited to regulate the railroads…[than the German Confederation]…but the fear of *Verpreussung,* that is an excess of economic control by Berlin, dissuaded the other German states from committing their rail networks to supervision by the *Zollverein*…[and]…The complementary deficiencies of the German Bund and the *Zollverein* explain the creation in 1847 of the *Verein Deutscher Eisenbahn-Verwaltungen.*"

Lommers[20] has a different assessment and believes that railway experts saw that the *Zollverein's* borders ending with Austria did not go far enough. The implication was that they persuaded the *Zollverein* to support their view that another organisation was necessary to remedy this situation.

Another, but quite different, opinion on the founding of the *Verein* is proferred by Eichholtz, quoted by Ziegler.[21] Eichholtz suggested in his book *Junker und Bourgeosie vor 1848 in der preußische Eisenbahngeschichte* (*Junkers and Bourgeosie before 1848 in Prussian Railway History*) that "the organisation (the *Verein*) was the institutional reflex of a railway cartel." Ziegler refutes this "because the *Verein* never succeeded in getting acceptance for a uniform tariff structure until the end of the mixed system."

While these are interesting interpretations, they fail to take into account the escalating poor relationship between the Prussian railways and the Prussian government prior to 1846 already described.

The *Verein* gets underway

Once the *Verein* got underway in 1847, it was soon apparent that the main business its members wanted to discuss was not Prussian political issues. Rather they were focused on engineering, both civil and mechanical

[19] Mitchell (2000, p.40).
[20] Lommers http://www.inventingeurope.eu/exhibit3tour1item3 accessed 21 October 2014.
[21] Ziegler(1996, pp.125-126).

engineering, and organisational and operational matters. This was because the most pressing issues were about the laying down of robust track, the reliability and safety of locomotives, and signalling problems. But other matters were also of concern: interfacing with other railway companies' tracks, agreeing procedures for the carriage of goods, agreeing tariffs, etc. Many of the issues which today are taken for granted were then problems to be addressed for the first time.

In 1848 the Articles and Rules of Procedure of the *Verband der preußischer Eisenbahn-Direktionen* (Union of Prussian Railway Administrations), which had been tabled in 1847, were amended to reflect its growing membership and evolution into the *Verein Deutscher Eisenbahn-Verwaltungen* (Association of German Railway Administrations) and a commission was established to combine these two documents. The nature of this governance evidences the institutional characteristics of the *Verein.*[22]

Dignitaries of the *Verein* and their Influence

The august standing of the Union's managing body under its new branding as the *Verein* continued down the decades with dignitaries which included (in date order):[23]

> Gerwig, Head of the Technical Department of the Grand Duchy of Baden State Railways. Builder of the Schwarzwald Bahn and Head of Construction of the St Gotthard Railway. Active 1841-1885;
>
> Weishaupt, Ministerial Director, senior civil engineer in the Royal Prussian Ministry of Public Works. Active 1843-1880;
>
> von Traunfels-Stummer, Honorary President of the Technical Committee of the *Verein*; Imperial and Royal Court Councillor; Professor. Active 1843-1882;

[22] *Festschrift* (1896) *Verfassung*, p.3.
[23] *Festschrift* (1896) *Bildnisse*, pp.XXIX-XXXIX, plates 2-7. Except for von Muhlenfels.

von Tschirschky-Bögendorf, Excellency, Director-General Royal Saxon State Railways. Active 1847-1887;

von Badhauser, Royal Bavarian Privy Councillor and Director of Operations of the Royal Bavarian State Railways. Active 1850-1881;

von Maybach, Excellency, Royal Prussian Minister of State and Minister of Public Works; formerly the second head of the Imperial Railway Office; formerly President of the Prussian Railway Directorate in Hanover.[24] Active 1853-1891;

Stambke, Chairman of the Royal Testing and Inspection Office, Royal Prussian Ministry of Public Works, Berlin. Active 1853-1893;

von Carolsfeld, Director General of the Royal Bavarian State Railways. Active 1854-1895;

von Dillenius, Excellency; Director General of the Royal Württemberg Transport Authority. Active 1856-1881;[25]

Rüppell, Head of the Civil Engineering Department in the Royal Prussian Railway Directorate, Cologne. Active 1856-1895;

Sethe, Former Supreme Public Prosecutor; Chairman of the Board of Directors of the Berlin-Potsdam-Magdeburg Railway Company. Active 1857-1872;

Ameshof, President/Director of the Dutch-Rhine Railway Company. Active 1857-1890;

[24] Mitchell (2000, p.124).

[25] Mitchell (2000, p.123): Circa 1874, von Dillenius strongly opposed a draft Imperial Railway Law (*Reichseisenbahngesetzwurf*) from Scheele (Head of the REA) which proposed the "transfer of all authority over construction and operation of German railroads from the individual states to the national regime."

von Kuh, Royal and Imperial Councillor, Director of the Royal and Imperial Private Bohemian West Railway. Active 1858-1894;

Schmidt, Senior Government Finance Officer, originally a Member of the Board of Directors of the Magdeburg-Cöthen-Halle-Leipzig Railway Company. Active 1865-1880;

Jencke, Privy Financial Councillor and Chairman of the Board of Directors of Krupp of Essen; Member of the Board of Directors of the Royal Saxon State Railways. Active 1869-1878;

s'Jacob,[*sic*] Director General of the Company for the Operation of the Dutch State Railways. Active 1869-1879;

von Tolnay, Ministerial Councillor and President of the Royal Hungarian State Railways. Active 1872-1885;

von Czedik-Bründelsberg, Excellency, President of the Royal and Imperial Austrian State Railways. Active 1875-1892;

von Muhlenfels, Editor of the *Zeitung des Vereins Deutscher Eisenbahn-Verwaltungen.* An archive document indicates that he was proposed for a decoration from Kaiser Wilhelm II in 1896.[26]

Archive papers revealed the Verein's Head Office details: [27] *Vereins Deutscher Eisenbahn-Verwaltungen*. *Schöneberg Ufer 1-4, Berlin, W.* Under normal circumstances this would have attracted little attention, but when every piece of the mosaic was "a find", it assumed importance towards completing a picture.

[26] Geheimes Staatsarchiv Preußischer Kulturbesitz, Berlin. I.HA.Rep 89 Nr. 29497- Königliches Geheimes Zivilkabinett.
[27] Geheimes Staatsarchiv Preußischer Kulturbesitz, Berlin. I.HA.Rep 89 Nr. 29497- Königliches Geheimes Zivilkabinett.

Given the number of railway companies in public ownership, the presence of civil servants in the management of the *Verein* was to be expected. But the number of directors who were either serving or former top level government officials might be explained by Dunlavy[28] who reported that Councillor Mellin of the Prussian Finance Ministry had previously worked for the Magdeburg-Leipzig Railway Company before transferring to the civil service. This indicates a reciprocal flow of officials between the two organisations.[29] In this connection (notwithstanding the fact that the *Verein* satisfied the criteria for an institution as put forward by North, Williamson and others) by any criteria this level of public service involvement and the inevitable influence of government culture made the *Verein* a political organisation. This topic is addressed in Chapter 5.

The Railways which acted as the *Verein's* secretariat

The Berlin-Stettin Railway Company which had called the first meeting discharged the secretariat duties of the *Verein* from 1847 until 1854 when the Berlin-Anhalt Railway Company took over until it was nationalised in the 1880s.[30] This hand-over actually occurred in 1882, after which the Berlin-Hamburg Railway Company assumed these duties until 1884, when the Royal Prussian Railways Administration, Berlin, took charge as the secretariat[31] and held this position until after the First World War.[32]

Over the period 1846-1894, first the *Union,* and then the *Verein,* held a total of forty seven conferences[33] not counting those of the *Verein der Deutschen Eisenbahn Techniker.* In order that these should be seen to embrace all the membership and not be dominated by Prussian influence, these meetings were

[28] Dunlavy (1994, p.165): Councillor Mellin who had been nominated to chair a meeting with the *Verein* in March 1848 (which in the event did not take place) had previously represented the Magdeburg-Leipzig Railway Company at an earlier conference in 1843.
[29] The movement of senior management between the civil service and industry and commerce is an arrangement which continues on the Continent, particularly France, until the present day.
[30] Dunlavy (1994, p.169).
[31] *Festschrift* (1896). *Nachweisung der in den Jahren 1846-1894 abgehaltenen Vereins-Versammlungen*. (Record of the Meetings held 1846-1894).
[32] DB Archiv, Nuremberg. *Enzyklopädie des Eisenbahnwesens* (1923, p.95).
[33] *Festschrift* (1896). *Nachweisung der in den Jahren 1846-1894*. (Record of the Meetings held 1846-1894).

held in different locations across Germany and were even held in Austria and other European countries.

The *Verein's* structure and *modus operandi*

The record [34] shows that from the outset, there was agreement amongst members that the railways should aim to operate as a unified network "in such a way that unitary administration and joint operation can actually be implemented." Fundamental to this was that "every railway that belonged to the Union should assume the transport of goods from and to all stations equipped for goods traffic without an intermediary being required for the purpose of the transfer of goods from one railway to the other." Out of all this came the *Regulations for the Carriage of Goods by Rail.* Very quickly the *Verein* devised arrangements for conducting business between members including a procedure for exchanging passenger tickets, a tribunal to deal with disputes and later a General Accounting Office or Clearing House for processing payments between members because payments were received in many currencies: German marks, Austrian guilders, francs, [35] and even Russian roubles.

Apart from the different currencies involved, it would be understandable to think in terms of equating the situation described above to the Railway Clearing House (established 1842) in Great Britain which was a contemporaneous organisation. While the comparison shows similarity with regard to the arrangements for passenger traffic, this was not the case in respect of through goods traffic (defined as the crossing over into another railway company's territory) and the receipts resulting from it. In addition, the Clearing House cannot be compared to the *Verein* in the scope of its responsibilities.

Bagwell [36] reports how first the Clearing House and then the Railway Companies Association, which formed out of the Clearing House in 1868, had

[34] *Festschrift* (1896). *Einleitung*, p.XVI.
[35] Not stated which, but probably Belgian francs.
[36] Bagwell (1968, pp.202-208, pp.212-216, pp.71-72, p.84).

limited success in getting agreement between railway freight wagon owners and operators on the key questions of standardisation of rolling stock and rates for through goods traffic. Here it is important to mention that a significant factor was that wagons were not all owned by railway companies; they could be owned by wealthy individuals as an investment but more commonly were owned by mining companies. This was a situation which impeded the best economical operation of the railways and persisted until the outbreak of war in 1914.

Contrary to a belief that the *Verein* had no permanent staff,[37] the record[38] reveals that the first Executive Board (the Berlin-Stettin Railway) "gained the right (in 1848) to employ an officer to conduct Association business at the expense of the Association…[and that in 1852]…it was decided the Executive Board should only perform duties that required central co-ordination; other matters were to be dealt with by commissions [committees]. It was also given the right to employ…other officers to conduct business. This led to the creation of a *Vereinsbüro* (Association Bureau) and a *Vereinskasse* (Association Fund)." Thus was permanent staff for the Verein established.

Again from the record,[39] initially "until 1875 committees were appointed by the Executive Board or established by the General Assembly to look at agenda items…[Thereafter] from 1875 Standing committees were established." It is reported[40] that the committees were: the Constitutional Committee; the Committee for Matters relating to Passenger Traffic; the Committee for the Regulations for the Carriage of Goods; the Committee for Statistics on the Movement of Goods on the Railways; the Committee for the Association's Rolling Stock Regulations; the Technical Committee; the Committee for the Customs Treatment of Goods carried by Rail; the Committee for Invalidity and Mortality Statistics concerning Railway Officials; the Committee for Ticket Scrutiny; the Committee for Ticket Appeal; the Committee for the Revision of the Association's Ticketing Regulations; the Railway Gazette's Editorial

[37] Dunlavy (1990, p.138).
[38] *Festschrift* (1896). *Verfassung*, p.7.
[39] *Festschrift* (1896).*Verfassung*, p.10.
[40] *Rückblick* (1871, p.5).

Committee. (A newspaper published by the Württemberg Railway Administration was adopted as the *Verein's* newspaper although subsequent developments occurred.)

In 1876, a Pension Fund for Association Officers was established which from 1888 benefitted from an annual grant of 10,000 marks (£500) from the Association Fund and mirrored civil service pension arrangements.[41] This gives some indication that a critical mass of administrators existed who were considered such a valuable asset that their retention was incentivised by means of a pension. This is probably an early example of a high profile institution introducing a pension scheme. It was in line with Bismarck's politically innovative social security reforms of that era thereby setting an example for others to follow. It is not difficult to imagine that the prompt for this came from government through the civil service network alluded to previously.

Thus, the genesis, the structure, the top level management and the constitution of the *Verein* have been considered. Similarly, issues of concern to its members and the manner in which the *Verein* tackled the operational, and financial aspects of the association's business have been addressed. Commercial, technical and political issues are reviewed in subsequent chapters.

Having created a critical mass with a formal structure and leadership, and soon afterwards a constitution,[42] the *Verein* had effectively seized the initiative from the Prussian government which remained pre-occupied with the revolution through 1848 and 1849. By the time that von der Heydt was appointed Minister of Commerce with responsibility for the railways in 1848, the events of 1847 and 1848 had given the *Verein* credibility as a force to be reckoned with on the German political landscape. In particular, the *Verein* was well on the way to becoming the railway authority, albeit a non-statutory authority, in Germany. Ironically, it embarked on this by embracing the very reforms which the

[41] *Festschrift* (1896). *Verfassung*, p.9.
[42] *Festschrift* (1896).

Prussian government had been encouraging the railway companies to introduce from early in the decade.

While cautioning about not over-stating the authority of the *Verein*, Mitchell, citing an article in the *Zeitung des Vereins Eisenbahn-Verwaltungen* dated January 1864, wonders at "how well the *Verein* worked to standardize the operations of more than sixty members whose tracks covered over 15,000 kilometers."[43]

Brophy,[44] looking through the lens of institutionalism (which is considered in some detail in Chapter 5), saw that the struggles of the business community with government during that era caused structures to develop which thereafter formed part of the national fabric. It is reasonable to conclude that the *Verein* became such a structure and evolved into an institution of considerable economic importance to the German state.

The next chapter takes another look at the *Verein,* but from an entirely different perspective, and tests whether it met the criteria for a political institution. It considers the tension between the railways and government before 1871. It also examines the Imperial government's responsibilities for the railways under the new constitution from 1871, the founding of the REA and how the Imperial government's efforts to nationalise the railways were frustrated.

[43] Mitchell (2000, pp.40-41). Given the *Verein's* membership, track distance was not confined to Germany.
[44] Brophy (1998).

Chapter 5

The *Verein* and the Political Dimension

This chapter explores the relationship between the railways and governments in Germany during the period under examination, 1835-1914. In particular it looks at the relationship between the *Verein,* its constituent railway administration members, and government. For clarity, again it is necessary to remember that Germany comprised 38 independent states until the political unification of Germany in 1871. At that point the dynamic changed because each railway then faced two governments: the federal (Imperial) government and the government of the state from which it held its charter to operate.

Initially the chapter looks at the broad sweep of government activity in the period under review before examining how the *Verein* developed into a highly effective institution. Dunlavy's 1990 paper might be taken as only implying that the *Verein* was an institution, but this thesis seeks to go beyond that by drawing out and emphasising this characteristic. This presents a new perspective which casts the *Verein* in a different light, unequivocally identifies it as an institution,[1] and thereby accords it the recognition which its contribution to nineteenth century German trade and industry deserves.

Prussia lays down the Rules: The Railway Laws

Looking first at government activity prior to the unification in 1871, Prussia was the largest and most populous state in Germany with the greatest length of railway track.[2] Consequently, it is no surprise to find that from an early date Prussia recognised the need to control the building and operation of railways and to ensure that entrepreneurs undertaking such ventures were treated in an equitable manner by the state. In this connection its civil servants drafted a bill which subsequently reached the statute book as the Railway Law of 1838.

[1] For the avoidance of doubt, this might be described as a "Northian" institution because it fulfils the characteristics outlined by North (1996).

[2] Railway construction length of track: 1850: Germany 5,875 kms (of which Prussia 2,967 kms); 1873: Germany 23,853 kms (of which Prussia 14,461 kms). Source: German Historical Institute http://germanhistorydocs.ghi-dc.org. Accessed 18th April 2011. Note: These figures are confirmed in Appendix B.

The Railway Law (1838) was the Prussian government's primary instrument of governance for the railways. This outlined the requirements for the construction and running of railways and its provisions detailed the government's right "to set rates and taxes on net profits and required companies operating on Prussian soil to submit annual reports."[3]

However, it is the rules relating to the granting of a government charter for which the Railway Law (1838) is mostly known. Meyer[4] lists the criteria for a proposed railway: (1) proof as to its usefulness; (2) the territory it will pass through must be able to support the railway; (3) the reasons for the choice of route must be given; (4) proof of the company's ability to meet all the requirements of the concession (charter) to be granted; (5) the railway must be technically practicable; (6) it must not frustrate or make more difficult other and more useful enterprises; (7) it must be militarily permissible; (8) above all it must serve the public interest.

It is evident from the criteria that the desirability of, and the justification for, a proposed railway were fundamental questions to be addressed. Meyer[5] observes that the "railway charters of Europe and America were largely influenced by the English experience. The Liverpool-Manchester Railway charter was based upon the earlier English canal legislation, and the general law of Prussia was constructed upon the same model." Meyer summarises the requirement: this was "to satisfy (the authority granting a railway charter) of the public "utility" of the railroads for the construction of which (a charter was desired)."

The comprehensive nature of this law of 1838 made it a unique benchmark in Germany prior to the unification in 1871. In confirmation of Dunlavy's[6] conjecture that other states probably looked to it for guidance, Ziegler[7] identified an actual case, namely that of Bavaria. He writes that Bavaria, by virtue of section 10 of its Railway Act of 1855, followed suit in respect of section 32 of the Prussian Railway Law (1838). This covered competition to serve

[3] Schot et al (2011, p.273)
[4] Meyer (1897, pp.83-84).
[5] Quotations which follow come from Meyer (1897, pp.78-79).
[6] Dunlavy (1991, p.4).
[7] Ziegler (1996, p.126).

particular places and pricing policy legislation; it permitted the government to suspend competition and regulate the prices railway companies were allowed to charge.

Apart from direct intervention by ministers, examples of which follow, it is likely that prior to 1871 the Prussian government applied its influence in a less high profile manner via its district governments. These government bodies of which there were twenty-five sat at quite a low level in the government structure,[8] that is, below the eight provincial councils each chaired by a *Regierungspräsident* (senior government official); most importantly they were under the direct control of government ministries. Given that many factors had to be taken into account as regards the importance of encouraging regional trade by means of commercially viable and profitable railways, it is probable that district governments were the means by which the Prussian government was able to apply nuanced power. That is, as opposed to issuing edicts of general application, it could influence the setting of railway tariffs in specific areas as changing circumstances demanded.

Taking Prussia as a proxy for Germany again, it is not unreasonable to assume that similar arrangements may have existed elsewhere in Germany. This would have contributed to the multiplicity of decisions taken on rates adding to the chaos of rates about which Fremdling and Knieps later reported. The vexed question of tariffs is examined more fully at Chapter 7.

It will be remembered that the Railway Law 1838 was the law at the centre of the confrontational relationship between the Prussian government and the principal Prussian railways. They agitated for its repeal because they claimed it restricted their profitability and ability to make management decisions. The historiography reveals that David Hansemann, a director of the Rhenish Railway Corporation, and a leading liberal (whose trademark, ordinarily, was a clear priority of private enterprise) "criticized…the railway legislation of 1838 as excessively etatist."[9] If the railways' relationships with the Prussian government were awkward at this juncture (1846) they were set to become more difficult

[8] Dunlavy (1994, pp.23-24).
[9] Mitchell (2000, p.39).

with the arrival in 1848 of the new railways minister, von der Heydt, who held the opinion that the railways were primarily a public service rather than a profit making business.[10] Despite a lack of support from his more liberally economic cabinet colleagues, he set himself to use the law to extend the government's control over the railways. Sperber[11] characterised von der Heydt's use of the Railway Law of 1838 as a weapon to nationalise the Prussian railways whenever the opportunity arose.

Two examples show how von der Heydt deployed the 1838 law to good effect for the benefit of the state and the public good. Firstly, there is the case of the Lower Silesian-Märkisch Railway which ran from Berlin via Frankfurt an der Oder to Breslau (at that time the seventh largest city in Germany).[12] Secondly, there is the case of the Upper Silesian Railway which ran from Breslau to Oppeln and joined up with the Austrian railway to Cracow in Poland.

In the former case von der Heydt, dissatisfied with the performance of the Lower Silesian-Märkisch Railway in which the Prussian state owned 1,500,000 shares and had guaranteed a return of 3.5 percent on shares owned by investors, interpreted the law so as to take over management of the line by inserting his own officials in January 1850. By means of economies and offering attractive tariffs, more business came its way especially from the Upper Silesian coalfield where the figures show an increase in coal hauled over the Lower Silesian-Märkisch line from 80,000 tons in 1847 to 1,200,000 tons in 1852.[13]

Kocka's[14] comments about the performance of civil servants involved in railway administration is relevant here, namely, that Germany had a strong and developed civil service tradition before industrialisation (unlike England and the United States). Thus when civil servants got involved with the railways their

[10] Mitchell (2000, p.53): Subsequently, in 1869, Bismarck in correspondence about railways with the Prusssian Minister of Commerce, Itzenplitz, wrote: "Profitability is not the sole interest of the state; the needs of the populace are at least equally valid." In a subsequent exchange in 1870 with the director of the Prussian Railway Administration, Theodor Weishaupt, Bismarck wrote: "But it is important, in my opinion, to bring into harmony the interests of the public and the railway administrations."
[11] Sperber (1999).
[12] Blackbourn (2003, p.152, Table 2).
[13] Henderson (1967a, pp.176-178).
[14] Kocka (1987, p.264, p.266).

performance was generally competent compared to the private entrepreneurial sector's which was weak. It also shows how such companies were in need of the commercially oriented inputs which the *Verein* steadily brought to bear from around that time.

Seeing his chance, von der Heydt put forward a proposal to the Finance Minister, Karl von Bodelschwingh, to nationalise the Lower Silesian-Märkisch railway. This was rejected because the line had become profitable and was already under government administration. Undeterred, von der Heydt appealed to the Minister President Otto von Manteuffel and the purchase of the railway was eventually concluded in February 1852. Nevertheless, in the Prussian Landtag, there was strong opposition to von der Heydt's interference in the running of railways and to the idea of public ownership in general.

The second case[15] concerned the Upper Silesian Railway where von der Heydt had been in dispute with the directors about freight charges. Although it initially gave way and, together with the Lower Silesian-Märkisch line, agreed to von der Heydt's suggestion that one hundredweight of coal should be transported to Berlin at a charge of one silver pfennig per German mile,[16] thus creating the so-called "ein pfennig tariff", the Upper Silesian Railway soon dropped this concession as unprofitable. Thereupon von der Heydt threatened to allow the Lower Silesian-Märkisch Railway, which was under government management, to run its trains on the Upper Silesian's lines as was permitted by the Railway Law of 1838, a provision that had never been invoked previously.[17] This threat forced the Upper Silesia Railway to re-consider its position and from 1852[18] coal was hauled over both the Silesian lines at the one pfennig tariff rate. Figures for the increased traffic do not appear to be available except for those provided by the Lower Silesian-Märkisch Railway and these show an increase in coal destined for Berlin by rail from Upper Silesia from 5,382 tons in 1850 to

[15] Henderson (1967a, pp.182-183).
[16] Henderson (1967a, pp.182-183) commented on the ein pfennig tariff thus: "The One pfennig tariff was equal to 2.2 pfennigs per ton-kilometre in the Mark currency of the Reich (1871)."
[17] Fremdling and Knieps (2011, p.145): The threat proved sufficient. Section 27 of the Prussian Railway Law (1838) was never applied.
[18] Gutberlet (2013a, p.4) cites the introduction from 1849; this was probably the initial date not the re-introduction date.

191,708 tons in 1857. If nothing else, these crude figures demonstrate the order of magnitude of difference resulting from this initiative.

In each of these cases the intervention of government transformed the performance of the railways and brought down the price of coal through the use of lower transportation charges. The “ein pfennig tariff” from Upper Silesia to Berlin is celebrated for making Silesian coal competitive with English coal for the first time on the streets of Berlin. Fremdling cites this case as one of import substitution.[19]

However, it should be noted that Fremdling and Knieps[20] had another take on the “ein pfennig tariff”: “This *Einpfennigtarif* arose from the intermodal competition of waterways and the railway”. This is a very curious observation because the waterway network in Silesia does not appear to offer rapid transportation either to Berlin or even to Breslau, the nearest German city. In addition, the railways would not have been disrupted in the same way as water-borne transport by the fiercely cold winters in Silesia. Hence, the reference to intermodal competition appears to be theoretical rather than practical.

The law associated with the Railway Law of 1838 was the Railway Fund Law of 1842. This became a source of revenue for the government and was used to offset the cost of government assistance and the guarantees it gave to the railways. The Railway Fund law required railway companies to refund to the government whatever they earned above 5 per cent on their capital.[21] However, Dunlavy [22] provides a more nuanced account and reports that a railway company’s profits were circumscribed such that after the first three years of a railways operation, “the state [Prussia] would periodically regulate tolls so that the company’s net profits (income minus expenses and reserve funds) would neither exceed 10 percent nor fall below 6 percent.” The texts give no clue to any conflict between the figures cited by Henderson and Dunlavy and they may be reasonably considered as mutually exclusive, that is, two different measures; a deliberate catch to take account of the fluctuating fortunes of the

[19] Fremdling in O’Brien (1983, pp.134-136).
[20] Fremdling and Knieps (2011, p.141).
[21] Henderson (1975, p.49).
[22] Dunlavy (1994, p.90).

railways which enabled the government to collect taxation when the lesser of the 5 per cent of capital or 10 per cent of net profits figures was breached. As an added benefit for the Prussian government, income from the Railway Fund allowed the government to purchase shares in the very companies making these repayments to its treasury.

By 1857 von der Heydt[23] had achieved a remarkable feat by effectively bringing under government control, or into public ownership, about half the privately owned railways in Prussia by his masterful "the devil's in the detail" interpretations and invocations of the railway laws. In this connection, the state reserved the right to nationalise lines on expiry of their charter.[24] However, von der Heydt was continually working against the liberal instincts of his own government; its antipathy in this matter explains the dilution of the (second) Railway Law of 1853 in 1859, and the winding up of the Railway Fund in 1863, the year after his first retirement.[25]

The State and the Railway Industry: an ambiguous relationship

The period covered by this section is some eight decades and, therefore, spans the twists and turns of government policy and the vagaries of the economy during this time. The early period of the railways in Germany which led to the founding of the *Verein* has already been considered. The period immediately thereafter was heavily influenced by von der Heydt who held office, with responsibility for the railways, from 1848 to 1862.

Henderson's[26] profile of von der Heydt illuminates the political challenges related to the railways at the time. As a former banker and chairman of the Elberfeld Commercial Court, von der Heydt had an excellent understanding of business and the law and clearly recognised the commercial potential of the railways. Despite allegations to the contrary, he operated within the minutiae of the law, and believed that the role of the railways was to serve the state and the public good, not shareholders. Indeed this was a prime tenet of the Railway

[23] Henderson (1967a, pp.183-184).
[24] Henderson (1975, p.49).
[25] von der Heydt retired in 1862 but was called back to office by Bismarck in 1866.
[26] Henderson (1967a, pp.168-189).

Law of 1838 which was his reference. Yet, both his cabinet colleagues and the railways seem to have forgotten this!

Much of the historiography casts von der Heydt in a negative light; for example it will be remembered that unlike Henderson, both Brophy and Sperber were highly critical of him. However, what is often overlooked is that von der Heydt's main responsibilty was as the Minister of Commerce. The conclusion to be drawn here is that his motivation was to ensure that the railways delivered the efficient performance necessary to facilitate the fulfilment of the *Zollverein's* potential, the potential of the coal, iron and other mines and, by running night trains which he was instrumental in introducing,[27] to benefit trade and commerce by the timely delivery of mail, parcels and other articles. That he sought to bring failing railways under state control would have seemed perfectly reasonable to him if through their inefficiency the economy was being adversely affected.

This raises the issue of ownership and control. Kocka[28] brings it to the fore with his observations about the public management of privately owned enterprises such as the railways and the mines[29] in Germany, an arrangement unknown in Anglo-Saxon countries.

Yet, as seen, von der Heydt was a leading exponent of this expedient using the Railway Laws to gain control of railways one way or another. Ultimately the "small print" of the Prussian Railway Law (1838) allowed the government to take over under-performing private railway companies if the government had underwritten the railway shareholders' dividend. That is, it guaranteed to pay shareholders a stated per centage on their shareholdings should the railway company itself be unable to do so at the due time. This did not necessarily mean that the government took these companies into public ownership, it might simply bring them under government management. Earlier, the cases of the Lower Silesian-Märkisch Railway and the Upper Silesian Railway were cited as examples of this, although subsequently both these companies became state owned which was clearly von der Heydt's long term aim. It is of note that

[27] Henderson (1967a, p.181).
[28] Kocka (1987, p.263, p.268).
[29] Faulenbach (1982).

around this time, 1851, the Prussian government held shares totalling over five million thalers (£769,230) in five railway companies.[30] This was just a stepping stone to its controlling over half of the railways in Prussia by 1857.

Like Brophy and Sperber, Klee[31] was one of the historians reluctant to recognise von der Heydt's outstanding performance, instead damning him with faint praise. Klee saw the "one pfennig tariff", and to a lesser degree the introduction of night trains, as the high point of von der Heydt's work. But the tone of his comments is critical: "Otherwise one can hardly call his time in office as a magnificent period in Prussian railway history."

Hence, the actions von der Heydt took put him at odds not only with the railway companies but with his cabinet colleagues. Mitchell[32] particularly highlights the tension between von der Heydt and the Minister of Finance, Karl von Bodelschwing, who was averse to "spiralling public investments, debts and risk." But it is Klee[33] who provides an insightful commentary which gives a different perspective on the situation; a key to better understanding the friction between von der Heydt and other ministers. Klee believes that "the see-sawing of Prussian railway policy between state control and laissez-faire was the expression of a domestic political power struggle…[and]…that the pioneers of these private businesses [the railway companies established in the early days] were frequently liberal opposition politicians some of whom took up post as ministers…after the 1848 Revolution." Kaiser and Schot[34] summarise the same idea like this: "Private ownership [of the railways] fitted the emerging doctrine of economic liberalism."

Nevertheless, although von der Heydt might be seen as out of step with the times, he was not anti-business; his dealings with the firm Union-Giesserei of Königsberg, testify to this.[35] Hence, another interpretation of von der Heydt's actions is possible: namely, that he was acting in the spirit of *Genossenschaft* (that is, for the community through the means of public interest). This would

[30] Henderson (1975, p.75).
[31] Klee (1982, p.129).
[32] Mitchell (2000, p.42).
[33] Klee (1982, Foreward).
[34] Kaiser and Schot (2014, p.121).
[35] Wagenblass (1973).

appear to be the key to understanding how the Prussian government conducted its relations with the railways during von der Heydt's tenure in this office.

Although this may appear to be inconsistent with Dunlavy's hands-off assessment of the Prussian government mentioned earlier, it is not necessarily the case. The timeline is important and apparently von der Heydt's predecessors from 1835 to 1848 were not interventionist (apart from one minister's call for the railways to submit annual reports) which broadly supports Dunlavy.

Notwithstanding any prejudice which Klee may have had against von de Heydt, he perceived that "the government did not want the railways to become too powerful and take on a life of their own, as a state within a state, a fear that was frequently expressed". [36] This is a very illuminating observation not articulated by other historians; by implication it graphically captures the rising power and influence of the railways and thereby by inference their association, the *Verein,* at this time.

The rising power of the railways, what Chandler[37] called "the first big business", and the increasing involvement of the new credit banks from the 1850s meant that the original financiers of the railways, namely private banks, individual entrepreneurs, and governments then faded more into the background. By the end of the decade, von der Heydt's battles had been won. In the same period, once the *Verein* began to get traction, the inefficiencies of the railways began to be rectified by the corrective actions introduced by its procedures and regulations.

Investment in the Railways

The significant flows of investment being channelled into industry, not least the railways, took the pressure off government for it had a continuing responsibility for providing and maintaining the means of transportation. Fremdling, quoted

[36] Klee (1982, p.97).
[37] Chandler (1965).

by Dunlavy,[38] reported that the lion's share of capital in Germany found its way to the railways in the period 1840 to 1880. Gutberlet[39] cited Fremdling (1975) as "estimating railroad construction accounting for ten to twenty per cent of net investment [in Germany] between 1851 and 1879." By comparison Blackbourn,[40] for broadly the same period, reported that "in the years 1850-1875 around 25 per cent of all investment went into the railways." Mitchell[41] assessed the total of German investment during the period 1850-1870 as 2.3 billion marks (£135.29 thousand million). Notwithstanding the slightly different date spans, the differences in these figures can be accounted for by the absence of reliable statistics and that historians were obliged to make best estimates. These estimates show an acceptable margin of error (i.e. a broad consistency) when compared to figures cited by the economic historians Pierenkemper and Tilly.[42] Railway net investment as a percentage in aggregate of the German economy was moving from 11.9 per cent to 25.8 per cent over the period 1851-1879. As regards the front end of this period, Tilly[43] describes the situation: "the railway boom offered more profitable opportunities…and attracted surplus capital, directly through the sale of railway stocks and indirectly through the increase in the volume of trade stimulated by the railways." Considering that Prussia had the largest territory and length of track laid down in this period, it is reasonable to assume that the greatest per centage of capital was invested in Prussia.

Across Germany this was a massive investment in the infrastructure which generated employment, gave rise to new businesses and boosted the economy. That the construction of the railways, with their cuttings, bridges, marshalling yards, maintenance sheds and stations proceeded apace can only be attributed to the *Verein,* and its associated organisation the *Verein der Techniker,* which promulgated standardised regulations, procedures and guidance through its publications. This allowed for what might be loosely

[38] Dunlavy (1994, p.34).
[39] Gutberlet (2013a, p.3).
[40] Blackbourn (2003, p.140).
[41] Mitchell (2000, p.142).
[42] Pierenkemper and Tilly (2005, p.62 Table 15).
[43] Tilly (1980, p.4).

termed “regional” railways to be connected into a national network and ensured inter-operability between railway companies thereby maximising productivity.

These were not the only matters with which the Verein was concerned. Around this time, in 1859, the *Verein* had come into conflict with the commission compiling the German Commercial Code. It was aggrieved that the proposed detail did not reflect the realities of the railway business. The Prussian government lent its support with the result that the *Verein’s* railway freight related procedures were included when the code was finally published. This is a good example of the practical interaction between the *Verein* and the government.

As regards the period after the unification (1871-1890) when the institutions of national bureaucracy were still to be formed, Mitchell’s[44] words are telling: “Railroads were an essential component of this development, both binding the nation economically and, through a succession of controversies, often dividing it politically.” This can be taken as a reference to the railways delivering the potential of the *Zollverein* treaties but at the same time being the source of the conflict between the new nation state, Imperial Germany, and its component parts, the 38 independent states, regarding the revenues generated by the railways, that is, the “particularism” issue.

Mitchell[45] observed that “[German] nationalism and liberalism were the two most conspicuous themes of early German writings about railways.” He also wrote that “it is appropriate to regard the new railway industry as a critical component in the consolidation of German particularism.”[46] These observations make more sense after the unification in 1871.

At that time, tension resulted from the perceived threat from nationalisation of the railways to the railway revenues of the (still autonomous) states of the federation chief among which were Bavaria, Baden, Württemberg, and Saxony. This money ensured their independence from the Imperial government in line with the doctrine of “particularism”. But this over-shadowed a greater fear,

[44] Mitchell (2000, p.120).
[45] Mitchell (2000. p.38).
[46] Mitchell (2000, p.43).

namely that “Nationalisation… would above all mean prussification.”[47] As such, particularism provided a strong counter-balance to the federal government. “The tension between these poles was quintessential to Germany’s emergence as a powerful nation-state in the nineteenth century, just as it is necessarily at the core of its railway history.”[48]

Government Powers over the Railways after 1871

Under the Constitution of 1871, the Imperial government was afforded extensive powers over all the railways in Germany except for Bavaria.[49] This “…excluded Munich from Berlin’s putative control over the railroads…and contained the seeds of particularism not only for Bavaria but, implicitly, for other member states of the Reich as well.”[50] By virtue of these extensive powers, the Imperial government was placed under the obligation “to cause the German railroads to be managed as a uniform network…[and]…strive to introduce a uniform system of regulations for the operation of all German railroads, and a uniform system of rates; that it shall strive to secure the greatest possible reduction of rates, especially for long hauls of articles supplying the wants of agriculture and industry…[and that]…In times of distress and famine the emperor, on the recommendation of the railroad committee of the *Bundesrath,* [*sic*] a standing committee required by the federal constitution, may temporarily fix rates for the transportation of the necessaries of life.”[51]

What strikes the reader as remarkable is the reference to the Imperial government’s duty to manage a uniform railway network with uniform regulations. Yet the foundations, and much more, of a national network had already been laid and established by the *V*erein many years earlier![52] Apart from this, the control of rates attracts the most interest because it was a continual source of debate, tension and inter-dependence between the

[47] Mitchell (2000, p.126).
[48] Mitchell (2000, p.43).
[49] Meyer (1897, p.80).
[50] Mitchell (2000, p.121).
[51] Meyer (1897, p.81).
[52] Schot et al (2011 p.273).

railways, their customers, and government from the earliest days when the Railway Law of 1838 allowed the Prussian government to set rates.

The Imperial Railway Office (*Reichseisenbahnamt* -REA)

As to how the new responsibilities imposed by the constitution were to be carried out by the Imperial government, these fell initially on the Chancellor's office (the *Reichskanzleramt* or RKA*).* Rudolph Delbrück, the RKA's senior civil servant tasked with overseeing these duties, got little support from the individual railway administrations across Germany when in 1872 he instructed them to report new projects. The following year the continuing lack of co-operation and progress resulted in the decision "to found an imperial railway office (*Reichseisenbahnamt or* REA) charged with the supervision of the entire national system." After first gaining the support of the Reichstag, the previously unsympathetic Bundesrat agreed to a bill and the REA was established by law on 27 June 1873. "Bismarck now had an imperial railway office without an imperial railway."[53]

Historians have different views about the REA's priorities. Henderson [54] summarises the situation which prevailed at the time, namely the commercial crisis of 1873. This was the start of the economic slump which lasted until 1895. At the beginning it was notable for a drop in railway receipts and a decline in the value of railway shares. The fraudulent activities of the railway entrepreneur Henry Bethel Strousberg[55] were a contributory factor to this. Strousberg, a railway promotor, paid his suppliers and other industrialists but swindelled his private investors. As a result of the decline in share values, the Imperial government intervened and raised freight rates by twenty per cent resulting in protests from businessmen. This is probably why Mitchell[56] for his part saw the creation of the REA as being "specifically intended to resolve the rate question." Despite this, Henderson's[57] assessment was that the REA was set up "to administer the Alsace-Lorraine railways, to enforce the carrying out by all railway administrations of their legal duties, and to prepare draft laws for

[53] Mitchell (2000, pp.121-123).
[54] Henderson (1967b, p.47).
[55] Henderson (1975, pp.168-169).
[56] Mitchell (2000, p.144).
[57] Henderson (1967b, p.47).

the consideration of the Reichstag." This positioning of the administration of the Alsace-Lorraine railways first, and thus prioritising it, would have been deliberate for "The railways of Alsace-Lorraine…[taken over after the Franco-Prussian war 1870-1871]…were the property of the Reich."[58] The conclusion to be drawn here is that, as these were the only federal railways, they were the only railways which the Imperial government itself had to manage. At this point a blurring of responsibilities between the Imperial government and the Prussian state becomes apparent. This results from an observation by Kech[59] who believed that "the Office [REA] was seen as a successful extension of Prussian policy and strengthened Prussia's economic and political significance in the non-Prussian part of Germany." This indicates that Bismarck, who was both the Imperial Chancellor and Minister President of Prussia, used the Prussian civil service to staff the REA and execute Imperial policy. In order to facilitate this, in this instance it appears to have been achieved through the mechanism of the Imperial government leasing these lines to Prussia.[60]

The problem of rates is addressed more fully later in Chapter 7.

The Frustrating of the Imperial Government's Plans for Nationalisation of the Railways

If Bismarck believed that his plan for nationalising Germany's railways would be realised through the creation of the REA he was to be disappointed.[61] The first Head of the REA, Friedrich Wilhelm Scheele, failed to gain support for a draft on this very subject that he had circulated to state governments. A response from Friedrich von Dillenius, head of the railways in Württemberg and a director of the *Verein*, was a scathing attack on the proposal. But in view of subsequent developments it was representative of the opinions of other state railway administrations. As a result Scheele resigned and was succeeded by Albert

[58] Henderson (1967b, p.47).
[59] Kech (1911, p.99).
[60] Meyer (1897, p.80).
[61] It was not until 1st April 1920 that Bismarck's dream of nationalisation of all the railways in Germany was finally achieved under the Weimar Republic.

von Maybach.[62] Von Maybach adopted a more subtle approach and called a meeting of state representatives in 1875, but this too failed.[63]

Despite further attempts by Bismarck and von Maybach to promote nationalisation of the railways little progress was made. Bismarck put great significance by his plan for nationalisation of the railways in Germany. This was revealed by his comment in cabinet: "the most important thing is the implementation of the Reich's constitution, and that is impossible without concentration of the railroads in the Reich."[64]

Given the importance Bismarck attached to nationalisation of the railways, another plan was devised with the assistance of von Maybach. In 1876 this resulted in the Prussian parliament passing a law which allowed the Prussian government to negotiate the sale of the Prussian railways to the Reich.[65] This is what probably led to the challenge from the prime minister of Saxony, Richard von Friesen. Friesen pointed out that "any purchase of railroads by the Reich automatically became a matter for its member states."[66] There followed an exchange between the two about interpretations of the constitution and the negotiations between Prussia and the Reich appear to have stopped. But fearing Bismarck's motives both "Saxony and Bavaria moved to purchase the remaining private railways in their territory, with the manifest objective of precluding the direct acquisition of them by the Reich."[67]

The final outcome was that Bismarck caused a draft law to be submitted to the Prussian parliament in 1879 notifying the Prussian government's intention to take into public ownership some 5,000 kilometres of line in its territory. Subsequent acquistions followed in 1882 (3,145 kilometres) and 1884 (3,766 kilometres). Acquisitions under this campaign were directed by von Maybach.[68] While they are usually taken as commencing from 1879, Meyer[69] charts the

[62] Mitchell (2000, p.123) indicates that Scheele was the first head of the REA, whereas Henderson (1967b, p.47) believes it was von Maybach.
[63] Mitchell (2000, pp.123-124).
[64] Mitchell (2000, pp.123-125).
[65] Henderson (1967b, p.47).
[66] Mitchell (2000, p.125).
[67] Mitchell (2000, p.126).
[68] Henderson (1967b, p.48).
[69] Meyer (1897, p.91).

parliamentary steps through the Prussian *Landtag*: Resolution (1879), Bill (1880), Law (1882). The reasons for this stepped progress were that the Prussian Landtag would only give its approval after securing certain economic guarantees from the Prussian government. Cohn [70] explains that these guarantees related to financial and industrial security. As regards financial aspects, the Prussian treasury was to be protected against variations in the proposed state railway's finances, and provision was to be made by the proposed railway for wiping out the debt on state railway capital. As regards industrial security, "the safety of industries of the country was to be secured by the establishment in the separate districts of boards representing the business interests concerned, known as "district railway councils" whose duty it should be to inform the state railway management of the needs of trade." A law to this effect had actually been placed on the statute book at the instigation of the REA on 11th January 1875 requiring all railways in Germany to adopt such arrangements; but it is unlikely this was followed.

In amplification of the above, the arrangements referred to, launched by the Imperial government's railway administration authority in Alsace-Lorraine (namely the REA) required that "…the more important questions of railway management should be decided only after consultation with the representatives of the commercial, industrial and agricultural interests." This became law in Prussia on 27th June 1878. This was to prove a development of unforeseen import. This brought together in a symbiotic relationship the many diverse administrative bodies within the new government structure. It seems that for the first time the different government bodies responsible for agriculture, for trade, and for industry, worked closely with non-governmental stakeholders, and ultimately with parliament, in an inter-active project which became a novel driver for the economy.

The belief that the taking into public ownership of the railways in Prussia was to construct a model for the future nationalisation of Germany's railways can be accepted only as a partial explanation. Fremdling and Knieps proposed two

[70] Cohn (1893, p.187). The quotations and information up to and including 'This became law in Prussia on 27 June 1878' are covered by this reference.

reasons for this: firstly[71] "the major reason for nationalisation was that railway revenues served as a substitute for proper taxes in order to finance Prussia's budget"; secondly[72] it aimed "to solve…problems of monopoly and collusion."

Brophy[73] saw nationalisation as mutually beneficial for both the entrepreneurs who owned or financed the railways as well as for the state. He believed the railways rejected public ownership "as long as they persisted as a lucrative sector for capital investment." This assessment could be misunderstood if it is mistakenly interpreted as applying to all railways in Germany rather than limited to Prussia alone, for in the south many of the railways were already in public ownership.

Ziegler[74] reports that by the 1880s almost all the private railways in the medium-sized German states had come under public ownership caused by the re-introduction of customs tolls on grain and iron, and disagreements on through traffic and connecting traffic tariffs in a period of unresolved tensions between co-operation and competition, the so-called "mixed system". The implication appears to be that a combination of changing economic circumstances and business difficulties resulted in these railways falling into the hands of government. By 1882 the German railway network totalled 35,081 kilometres[75] of which 29,000 kilometres[76] were under state control.

With many railways already publically owned, the takeover of private railways in Prussia from 1882 brought them under the control of civil servants; together these now formed the Royal Prussian Railways which was the largest transport business in the world.[77] A key point identified by Taussig[78] was the change in culture of the combined railway companies once taken into state ownership. The new organisation became a hierarchical bureaucracy governed by regulations. Arguably, the most important members of it, the mechanical engineers without whom there would have been no operational railway, were

[71] Fremdling and Knieps (2011, p.153).
[72] Fremdling and Knieps (2011, p.129).
[73] Brophy (1998, pp.168-170).
[74] Ziegler (1996, pp.133-134).
[75] See Appendix B.
[76] Cohn (1893, p.187).
[77] MacMahon and Dittmar (1939, pp.481-513).
[78] Taussig (1894, pp.77-87).

then relegated to the bottom of the pile in favour of legally and financially trained, state licensed, administrators, the *Juristen*.[79]

In reality, the Prussian state railways had become an arm of government, a part of the civil service, where formal education was preferred over mechanical and engineering training and practical ability. Not surprisingly, the consequent deterioration in service and safety resulted in letters of complaint to the press, including to the *National Zeitung*[80] of Berlin in 1891, and sparked debate in German society over technically trained versus degree educated officials and their place in the new meritocracy.[81] It is noteworthy that Chandler[82] in writing about the American railways and their corporate management identified three professionally trained railway engineers, Benjamin H. Latrobe, Daniel C. McCallum and J. Edgar Thomson as "having the strongest claims for the title of founders of modern business administration." The primacy of the professional engineer in the American railways contrasted sharply with the Prussian state railway during this period. In Prussia, legal and financial qualifications were deemed prerequisites for railway executive management positions over-riding any consideration of technical domain knowledge.

Nevertheless, the *Juristen* were financially competent. Cohn[83] commented on the dependence of the Prussian state on railway revenues: each year these enabled payment of the interest on the entire railway and state debts and yielded a surplus. In the financial year 1889-1890 revenues reached 145 million marks (£7.25 million). This raises the question as to whether the public finance model was applied by the *Juristen* and that this might have contributed to the substantially enhanced Prussian State Railway's balance sheet. The historiography[84] would suggest quite the opposite. By contrast, the evidence points to the fact that from as early as 1838, when the first accounting law for the railways was passed, private railway companies played a major role with other joint stock companies in the diffusion of historical cost accounting

[79] *Juristen* was also the term used to describe the Board of Management of a company. However, in the context used here, it refers to a class of specifically qualified individuals.
[80] Taussig (1894, p.78).
[81] Gispen (1989).
[82] Chandler (1965).
[83] Cohn (1893, pp.188-189).
[84] Richard (2012).

principles which led to capitalist accounting. However, arriving at that point involved accountants, lawyers and civil servants (including Scheele head of the REA in 1873) acting for the Prussian government in a long campaign. This recognised that the commercial and tax laws were not fully appropriate to the railways and something else was required. Over an extended period, 1838-1884, cashflow accounting and the methodology for the evaluation of assets were replaced to reflect the railway operating environment. As such, the victory of the Prussian railway "dynamic" accounting model over public finance accounting was achieved. Hence, when the private railways were taken into public ownership in Prussia starting, 1879-1882, this benefited the new Prussian State Railway because the "dynamic" accounting model was fit for purpose. Thus, in so far as the new accounting system resulted in an enhanced balance sheet and profitability, prima facie evidence indicates that this was not attributable to the *Juristen.* However, notwithstanding engineering issues, what can be said is that the *Juristens'* procurement and other management decisions very likely drove efficiencies and contributed to the financial results achieved.

Wagner[85] reported that the revenue from the Prussian state railways (and other unspecified government property), a process replicated in other German states, together paid for the operation of the railways themselves and half the cost of the Army and Navy. Funding for the remaining half, and the cost of the civil service, was found from taxation. On the debit side, Fremdling and Knieps made the observation that this healthy revenue flow permitted the Prussian government to further delay necessary tax reforms.[86] This is an oblique reference to the Prussian government's wish to avoid conflict with the Prussian *Landtag* (parliament) over budgetary matters.

At this point it is appropriate to remember how the Prussian state railway had evolved from a purely public service enterprise to a commercially profitable one: in 1861 the *Verein* through its newspaper ZVDEV[87] defended the Prussian government against the popular press which was criticising it for the lack of profit returned from the railways it operated. The ZVDEV contended that the

[85] Wagner (1902, p.144).
[86] Fremdling and Knieps (2011, p.153).
[87] Staatsbibliothek Berlin. ZVDEV Nr.27. 4Nz 13615-1. 1861.

government was providing a public service because commercial companies assessed that such lines would not be profitable.

As a final word on the *Juristen*, it is reasonable to conclude that it was the *Juristen* who in 1892[88] influenced the re-incorporation back into the *Verein* of the *Verein's* technical arm (*Verein der Deutschen Eisenbahn-Techniker)* which, arguably for professional reasons, had in 1850 set itself up as an independent body. Hence, in the period after the the private railways came into public ownership in Prussia (1882), the suspicion arises that the *Verein* was manipulated by the Prussian government and this casts serious doubt on its independence after this date.

Looking back over the decades, in the pre-unification era state governments' relationships with the railways displayed considerable complexity. On the one hand some states, notably Prussia and Bavaria, sought to use railway laws and the periodic mandating of tariffs to closely control private railway companies. On the other hand, all states relied on the *Verein* to provide technical and business leadership for all the railways, whether privately or publicly owned. In the post-unification period, the federal government is seen becoming more inter-active with stakeholders in the principal sectors of the economy and using the railways, and in particular freight charging rates, as an instrument of economic policy.

To complicate matters, in states where the government owned or controlled the railways, the question arises as to whether governments through their railways' membership of the *Verein*, and its representatives who were civil servants, raised the *Verein's* level of professional competence and gently guided the *Verein* to mutually successful decisions. Were civil servants a critical factor in its success? Conversely, did the *Verein,* and its constituent railway companies, put up with civil servants, as well as the retired military personnel they were obliged to employ in certain circumstances, on sufferance? Although the picture is not clear, the strong evidence relating to the membership and composition of the *Verein,* and its technical arm the *Verein der Techniker,* indicates that the

[88] *Festschrift* (1896). *Bau, Betrieb und Betriebsmittel*, p.45.

former was the case: the presence of civil servants was an essential ingredient in their success.

Consequently, although at the outset of this thesis it was believed that the *Verein* was an organisation independent of government and in overall control of railway matters in Germany, the evidence has shown that this proposition cannot be sustained.

The *Verein*: more than a Trade Association - a Political Institution

The *Verein* was perceived solely as a trade association when, arguably, it was always also a political institution. How could this be?

First we examine what is meant by an institution, how it differs from an organisation, and how the gains from trade are captured and expressed in terms of social savings. Only then do we examine the *Verein* to establish to what extent, if any, it may be said to fit the profile of an institution and to what extent it may have captured the gains from trade and contributed to the economy.

So, what is meant by an institution in the business context and why wasn't the *Verein* viewed as an institution before? The answer almost certainly lies in the emergence of "new institutional economics" out of American political science in the 1980s described by Dunlavy.[89] This provided a new set of lenses with which to view material. The main thrust of Dunlavy's paper is how different political structures and institutions, or lack of them, influence business outcomes. Hence, in the case of railway companies in the nineteenth century, it argues that in Prussia the structure and procedures of the unitary-state bureaucracy incentivised the formation by Prussian railway companies of the Union of Prussian Railway Administrations in 1846. This developed into the *Verein* which was then able to make progress in the standardisation of the railways in technical and operating terms. It argues that, by contrast, the *Verein's* American counterparts, operating in a fragmented federal-legislative political structure, were retarded in their efforts to form a similar permanent association despite many attempts because their activities, and inter-actions

[89] Dunlavy (1990, pp.133-142).

with government had been primarily at the state government level, not the federal government level which could have resulted in national solutions. As a consequence, it took the United States until 1886 to achieve a permanent national railway association and achieve comparable benefits.

Although Dunlavy spells out the criteria for an institution, the fact that the *Verein* might have satisfied these requirements and might itself have been considered an institution has not been clearly acknowledged. But Dunlavy cites the activities of the American National Railway Convention (NRC) which came closest to achieving a permanent railway association in those years. It is interesting to note that the NRC regarded and referred to itself as an institution: Dunlavy[90] citing the proceedings of the NRC in May 1867 reports that: "…the committee…[of the NRC]…took the federal government as its point of reference, recommending that the…[permanent]…bureau …[of the NRC]…be located in Washington, where it would enjoy 'the facilities and encouragement which the Government would naturally be disposed to extend to [such] an institution'…"

As regards the criteria for satisfying the requirements of an institution, Dunlavy draws from many sources including North[91] and Williamson[92] saying that: "…institutions are inherently political entities…[which]…consist of rules, compliance procedures and norms that order relationships among individuals. In doing so, institutions necessarily spell out a distribution of power, and in that sense they must be considered political…" Commenting on this latter point, "must be considered political" (and before amplifying the characteristics of an institution) there is another reality at work here: Dunlavy[93] reports how the banker and railway entrepreneur Joseph Mendelssohn, of the Berlin-Stettin Railway Company, realised that it would make more sense for the Prussian railway companies to band together into a society of railway interests and negotiate as one with the Prussian officials of this unitary-bureaucratic state rather than each going it alone to negotiate charters separately. In other words, Mendelssohn realised that railway companies acting as a mirror image of the

[90] Dunlavy (1990, p.138).
[91] North (1996).
[92] Williamson (1985).
[93] Dunlavy (1990, p.135).

unitary bureaucracy was the political reality. This gave rise to a new strategy which led Mendelssohn to call a meeting of Prussian railway companies in 1846. However, we know from *Festschrift*[94] that Mendelssohn did not attend this meeting. Rather, the lead for the Berlin-Stettin Railway Company was a retired government councillor, Dr Rhades, who proposed that: "a permanent Association of Prussian Railways be formed with the express fundamental idea of promoting the aspirations of the railway administrations through unanimity and, in this way, serving both their own interests and those of the public." Given that the Prussian railway companies in question were privately owned, it is reasonable to assume that notwithstanding Dr Rhades' previous connection with government and talk about the railways serving the interests of the public, his loyalties lay with the railways and their interests.

Looking more closely at the prerequisites for an institution, North[95] described institutions as "the framework within which human interaction takes place" and placed great weight on institutions "reducing uncertainty by establishing a stable structure to human interaction" and providing "a hospitable environment for co-operative solutions to complex exchange for economic growth". These principles can be seen as being respected in the resolution of the battles within the *Verein* around unanimity. The historiography records the development of voting arrangements on resolutions which were not binding and how to make them so. Schot et al[96] write that "A proposal…[by the *Verein*]…in 1852 to make binding for all members any resolutions passed by three-fourths of the membership met with sharp criticism. The main critique levelled against this proposal was that the association had been created to foster co-operation, not coercion. This approach became an important element of the culture of the *Verein*, and was one of the building blocks of the technocratic internationalism."[97]

The *Festschrift*[98] puts it like this: "Unanimity was ensured by the requirement for decisions to be passed by a majority, but approved unanimously afterwards,

[94] *Festschrift* (1896). *Einleitung*, p.XII (footnote).
[95] North (1996, pp.1-13).
[96] Schot et al (2011, p.275).
[97] Kaiser & Schot (2014, p.6).
[98] *Festschrift* (1896). *Schlusswort*, pp.411-412.

which prevented and delayed useful improvements, but also precluded over hasty measures. This promoted the Union's expansion because no new member had to fear the imposition of unwelcome innovations. Otherwise state railways might not have joined in case sovereign rights were encroached upon. By the time unanimity was largely abandoned (in 1875)[99] the Union had demonstrated its measured approach."

Returning to Schot et al,[100] how did individual railway administrations see the *Verein* manifesting North's "hospitable environment for co-operative solutions to complex exchange for economic growth"? The consistent resolution of difficult issues and the rapid construction of an inter-operable national network evidences the fact that they must have viewed it as providing a framework and a neutral setting, free from the tensions and rivalries between nation-states and companies, wherein the exchange of information and ideas, a technocratic internationalism, could flourish.

North saw human co-operation as the principal problem influencing whether the potential gains from trade could be realised for the benefit of the economy. In summary, North believed that in so far as institutions beneficially impacted the costs of exchange (transaction[101]) and production (transformation[102]), then together with other factors such as technology they contributed to the reduction in total costs in an economy. Dunlavy[103] expressed this in terms of linkage between transaction cost economics, the economic impact of institutions and their political dimensions, interpreted via the "new institutionalism". In this connection, North[104] differentiated between institutions and organisations. He likened institutions to the body which makes the rules whereas organisations are the players who play within the framework of such rules. Consequently,

[99] Schot et al (2011, p.275).
[100] Schot et al (2011, p.275, p.282 et seq.).
[101] Transaction costs are costs associated with the production and sale of articles or the provision of services. They may include legal fees, transport charges, the cost of bought-out items embodied in a major equipment etc. A company will need to decide whether it can discharge any of these activities itself more (cost) effectively rather than outsourcing them. This is known as the Make or Buy decision.
[102] North (1996, p.13) observed that: "It takes resources to transform inputs of land, labor and capital into the output of goods and services and that transformation is a function not only of the technology employed, but of institutions as well. Therefore, institutions play a key role in the costs of production."
[103] Dunlavy (1990, p.133).
[104] North (1996, p.2).

North viewed organisations as the agents of institutional change. To close the loop, North reported that: “Coase said a number of fundamentally important things in both this essay [*The Problem of Social Costs* (1960)] and his *The Nature of the Firm* (1937). The most important message, one with profound implications for restructuring economic theory, is that when it is costly to transact, institutions matter.”[105]

At this point it is necessary to go back and look more closely at transaction and transformation costs and capturing the potential gains from trade, measured in terms of social savings, for the benefit of the economy.

The particular question to be posed in the context under review is: if transaction and transformation costs are reduced by the influence of institutions such that they can be deemed to capture the benefits of trade, how can this be demonstrated? Leunig[106] provides the answer when he cites the economist Robert Fogel’s invention of measuring the economic impact of introducing a new technology. This was given the name “social savings”. Leunig then goes on to report Fogel’s study of American railways in 1890. This included the new concept of social savings first published in Fogel’s preliminary article in 1962 and then in his 1964 book *Railroads and American Economic Growth: Essays in Econometric History.* The concept proved controversial. Subsequently, in his 1978 presidential address to the Economic History Association, Fogel inter alia responded to criticisms which had been made since 1964. This was published in March 1979 as *Notes on the Social Savings Controversy*; see Bibliography.

Leunig[107] reports that, in these 1979 notes, Fogel wrote that “I defined the social savings of railroads in any given year as the difference between the actual cost of shipping goods in that year and the alternative cost of shipping exactly the same bundle of goods between exactly the same points without the railroad.”

[105] North (1996, p.12).
[106] Leunig (2010, p.9, LSE Research Online version).
[107] Leunig (2010, p.9. LSE Research Online version).

Gourvish observed that Fogel's 1964 book provided two calculations: i] an 'alpha', upper bound estimate of social savings, in which the counterfactual alternative to railroads would have to move the same amount of freight as the railroads actually did in 1890; and ii] a lower estimate, accepting that some of the traffic in 1890 would not have existed without the railroads.[108]

Leunig reports that Fogel's work showed that the exploitation of certain agricultural land was only made viable by virtue of the proximity of the railway which made shipping produce affordable. Addressing viability from another perspective, Leunig considers the issue of climatic variation thereby increasing the potential gains from trade. A good example of this would be the eastern lands of Germany in winter, particularly Prussia and Silesia, where the rivers and wagon ways would have frozen over seriously dislocating transportation prior to the advent of the railways. However, Leunig makes the following observation: "…the annual value of a railroad to a piece of agricultural land cannot exceed the value of the crops produced on that land…"[109]

Finally, Leunig reports that Fogel's work covered comparisons with canal and wagon transport, but after "crudely extrapolating his results to cover non-agricultural products but not passengers", even calculating on the alpha basis, Fogel estimated that the total value of the railways to the United State's economy in 1890 did not exceed 4.7 per cent of GNP.[110]

However, as most available data is on the basis of GDP rather than GNP,[111] in order to make a comparison we need to use GDP statistics. Zegarra[112] provides such figures: Fogel[113] calculated the social saving of the railroads in the United States in 1890 as 8.9 per cent of GDP. O'Brien,[114] reported that for

[108] Professor T.Gourvish (LSE) communication to Flood, 3rd October 2019.
[109] Leunig (2010, p.10, p.17. LSE Research Online version).
[110] Leunig (2010, p.11. LSE Research Online version).
[111] GDP (Gross Domestic Product) is a measure of the monetary value of goods and services produced within a nation's boundaries. But any profits realised by a foreign company from such production and repatriated to its home country will be deducted from this figure. GNP (Gross National Product) is the measure of the monetary value of all products or services provided by citizens of a nation wherever they are located, inside or outside the country, provided the monetary value of their output reverts to their national economy.
[112] Zegarra (2012, p.4).
[113] Fogel (1964) in Zegarra (2012, p.4).
[114] O'Brien (1983) in Zegarra (2012, p.4).

Great Britain Hawke[115] had estimated 11 per cent in 1890, and for Germany, "according to Fremdling (1983), the social saving was 5 per cent in the 1890s".[116]

These figures have to be taken as very rough estimates because economic historians sometimes differed amongst themselves as to what should or should not be included in calculations supporting such figures.[117]

The foregoing paragraphs have described the background against which the claim that the *Verein* satisfied the requirements for an institution was tested. They also include comments on the *Verein's* contribution to Germany's GDP.

To provide the proof it is necessary to turn to the primary sources such as the *Festschrift.*[118] This describes how the statutes of *der Verband der preußischer Eisenbahn-Direktionen* (the Union of Prussian Railway Administrations), proposed by the Berlin-Stettin Railway Company, were adopted with minor amendments in 1846 and how within a year the Union, with an expanded all-German membership, had been renamed *die Verein Deutscher Eisenbahn-Verwaltungen* (the Association of German Railway Administrations). Of particular note are the provisions of the Association's statutes which relate to the election of a *Geschäftsführende Direktion* (management board) for a term of two years and the voluntary acceptance of resolutions by its railway company members.

It is possible to establish from the *Festschrift,* [119] from the *Rückblick auf Gründung und Wirksamkeit,*[120]and from the *Rückblick auf die Thätigkeit…in Technischer Beziehung,*[121] that the committee structure which was set up, as well as the establishment of the technical arm of the *Verein* (*Verein der*

[115] Hawke (1970) cited by O'Brien in Zegarra (2012, p.4).
[116] Fremdling (1983) cited by O'Brien in Zegarra (2012, p.4).
[117] On a general point, economic historians have been critical not only of the nineteenth century records and statistics available to them but also of the methodologies and conclusions of their peers. An example is Fremdling's comparative paper on *Railroads and Economic Growth* (1977, pp.598-599) which calls into question omissions in Hawke (1970) which he alleged created a misleading impression. (This reference is not related to Hawke's calculation of Great Britain's GDP figure quoted above.)
[118] *Festschrift* (1896).
[119] *Festschrift* (1896).
[120] *Rückblick auf Gründung und Wirksamkeit* (1871).
[121] *Rückblick auf die Thätigkeit…in Technischer Beziehung* (1900).

Techniker), were instrumental in agreeing construction standards for the laying of track, agreeing technical standards for locomotives and other rolling stock, agreeing operating instructions and commercial procedures, all on a voluntary basis, and all of which were published. Often these were also publicised via its weekly newspaper, *Zeitung des Vereins Deutscher Eisenbahn-Verwaltungen,* or its technical journal *Organ für die Fortschritte des Eisenbahnwesens in Techniker Beziehung* (*Magazine for Progress in Railway Technical Matters).* All of this plays to the arguments put forward by North that "a stable structure reduces uncertainty and a hospitable environment is conducive to the production of co-operative solutions to complex exchange problems for economic growth", thereby maximising the possibilities of the potential gains from trade being realised for the benefit of the economy.[122] Hence, in this context, a reliable and efficient railway, promoted by the exchange of technical information, contributed to the smooth running of the economy.

It is clear therefore that the *Verein*, as well as being a trade association, satisfied the tests for being a political institution. It is only because of the *Verein's* co-ordinated actions to establish a workable railway network throughout Germany that the two industrial revolutions in Germany got properly underway. As reported, this produced significant social savings calculated by Fremdling as 5 per cent at the end of the nineteenth century. Under the circumstances, it is not unreasonable to claim that the *Verein* was not just a political institution but an actively beneficial one in terms of the German economy.

The next chapter examines the prime business of the *Verein*, engineering. It explains that the *Verein* did not limit itself to mechanical matters but also embraced the scientific aspects of railway technology. Such was its success that it was recognised as the centre of railway excellence. After 1871, this transcended all else in a changing political environment and ensured the *Verein's* survival.

[122] North (1996, pp.1-13).

Chapter 6

The *Verein* as an Engineering Authority

This chapter highlights the fact that the technical arm of the *Verein*, the *Verein der Deutschen Eisenbahn-Techniker (Association of German Railway Engineers*), in this thesis referred to as the *Verein der Techniker,* was involved in all aspects of engineering affecting the business of the railways in nineteenth century Germany. More importantly, it makes clear that the fundamental essence of the *Verein's* continuing power and influence was the *Verein der Techniker's* agency as a centre of technical excellence and its involvement in science and technology. These facts do not appear to have been clearly stated by other historians.

The historiography takes as given that the *Verein's* contribution to the German railways was delivered primarily through technical means. Provided that this belief embraces both mechanical and civil engineering it is not unreasonable but, if that was all, it would not have been enough to provide an effective railway system across Germany. Other aspects such as the benefits of its being an institution and its commercial initiatives, which are addressed elsewhere in this thesis, were ingredients which consolidated its success.

At the outset of the *Verein* in 1847*,* its engineering department was an integral part of the organisation. This was a period when the *Verein* was finding its feet, and it commissioned a committee to look into ideas relating to railway track gauge, construction, clearances etc. for presentation at the *Verein's* General Assembly at Dresden in 1848 with a view to petitioning (state) governments for a common German Railway Act.[1]

At the next General Assembly in Vienna in 1849 the committee, citing a memorandum from the Royal Hanoverian State Railways dated 27th September 1849, recommended that the focus should be on the development of a uniformly designed railway system covering the construction of railways, rolling

[1] Helmholtz and Staby (1930, p.304).

stock and a telegraph system. Under each heading was a detailed list of topics to be addressed.[2]

In addition, proposals were put forward for agreement on the implementation of regulations until such time as general legislation was adopted. The committee also recommended that an assembly of engineers be called, including from railways which were not members of the *Verein*.

The Founding of the *Verein der Deutschen Eisenbahn-Techniker* (Association of German Railway Engineers) - *"Verein der Techniker"*

The recommendation made at the General Assembly in Vienna in 1849 led to the first Assembly of German Railway Engineers in Berlin, 18th-27th February 1850, which adopted the recommendations refered to above and drew up the principles for the design of Germany's railways.[3] During the meeting, the committee originally set up by the *Verein* tabled a motion on the founding of the *Verein der Deutschen Eisenbahn-Techniker* (Association of German Railway Engineers)*;* this was approved by all parties.[4] This was to be an association focused on engineering for engineers, of engineers employed by *Verein* member companies but not representing them.[5] This reflected the belief of the membership that a focus on "technology united people whereas politics created artificial divisions."[6]

This was an era of great change. The old social structure, where the aristocracy and landed gentry through birth-right were dominant in society, had been giving way to a meritocracy comprised of academics, those professionally qualified in the law, arts and sciences, and latterly those successful in business. This gradual societal revolution had begun during the Enlightenment (*die Aufklärung*), increasing in momentum as the industrial revolution gained traction in Germany. Against this background, it is not unreasonable to speculate that engineers becoming conscious of their own value and importance saw an opportunity to establish their status in the rising

[2] *Rückblick…Technischer Bezihung*. (1900, pp.42-46).
[3] Helmholtz and Staby (1930, p.306).
[4] *Rückblick…Technischer Bezihung*. (1900, pp.6-7).
[5] Schot et al (2011, p.273).
[6] Schot et al (2011, p.276).

meritocracy. This was most probably the inspiration for the formation of the new association, deemed to be a private association.[7] In reality it served as a professional body and remained dedicated solely to the work of the *Verein.* Some decades later, in 1892, it was incorporated back into the *Verein.*

The Composition of the *Verein der Techniker*

The record[8] indicates the importance attached by authorities to the *Verein der Techniker* as shown by the professional and official status (and the location of their railway administrations) of those nominated to the Executive Committee, as well as other senior officials. Three officials from Berlin were elected to the Executive Committee, namely: Neuhaus; Hoffman; and Hartwich.

Six officials from outside Berlin were nominated, namely:

Hummel, Senior Engineer, from Munich;
Kirchweger, Master Mechanical Engineer, from Hanover;
Klein, Government Construction Councillor, from Stuttgart;
Klemensiewicz, Inspector, from Vienna;
Rupert, Assessor, from Karlsruhe; and
Wiebe, Government Construction Councillor, from Bromberg.

Other senior officials of the new association included:[9]

Bissinger -Government Councillor (Construction), Grand Ducal Baden State Railways;
Buresch -Privy Councillor (Construction). Chairman of the Grand Ducal Oldenburg State Railways, later Director of the Kiel-Eckenförde-Flensburg Railway;
Kargl -Ministerial Councillor. Head of the Mechanical Engineering Department of the Austrian Railway Ministry;
Klose -Senior Councillor (Construction), Royal Württemberg State Railway;

[7] *Rückblick…Technischer Bezihung*. (1900, p.9).
[8] *Rückblick…Technischer Bezihung*. (1900, p.9).
[9] *Rückblick…Technischer Bezihung. Bildnisse* (1900, pp.31-37).

Middelberg -Director Mechanical Engineering, the Dutch Railway Company. later Director of the Netherlands-South Africa Railway Company;

Mohn -Senior Councillor (Construction). Director General of the Royal Hanover Railways and Telegraphs. Co-founder of the *Verein der Techniker;*

Nowotny -Senior Financial Controller, Royal Saxon State Railways;

Pellenz -Master Mechanical Engineer, Aachen-Düsseldorf Rurhort Railway. Co-founder of the *Verein der Techniker;*

Stambke -Senior Privy Councillor (Building), Prussian Ministry of Public Works;

Sloot -Mechanical Engineer, Company for the Operation of the Netherlands State Railways;

Volkmar -Government Privy Councillor, Reich Railway Administration in Alsace-Lorraine after its acquisition in 1871;

von Carolsfeld -Director General, Royal Bavarian State Railways;

von Traunfels -Austrian Imperial and Royal Court Councillor. Professor. President of the Board of Directors of the Imperial and Royal Private Emperor Ferdinand North Railway. Honorary President of the Technical Committee of the *Verein.* Co-founder of the *Verein der Techniker*;

von Tolnay -President of the Royal Hungarian State Railway;

Wöhler -Government Privy Councillor, Reichs Railway Administration Alsace-Lorraine after its acquisition in 1871. Co-founder of the *Verein der Techniker*.

The Ethos of the *Verein der Techniker* -the secret of its success

The way in which the *Verein der Techniker* conducted its business may help explain its success. It collated questions received and passed them to the *Verein* for distribution to all the *Verein's* members. These would be reviewed at the *Verein der Techniker's* next assembly. Given the *Verein der Techniker's* exclusive relationship with the *Verein* such meetings were held only at the

instigation of the *Verein* and only fourteen meetings were held over a period of forty three years.[10]

At the *Verein der Techniker's* assembly these questions were discussed and conclusions arrived at, some of which were published. If further investigation was required by the *Verein der Techniker*, the findings would be published later. For example, following the *Verein der Techniker's* Assembly at Frankfurt am Main in 1856 a publication on the design of iron framework and suspension bridges was issued.[11] Publication was usually as a supplement to the *Organ für die Fortschritte des Eisenbahnwesens in Techniker Beziehung* (the Magazine for Progress in Railway Technical Matters). This publication also presented a forum for discussion and the sharing of best practice, both technical and operational. Also of note, because not everything was centred in Berlin as might have been expected, is that the *Verein's* newspaper, *Zeitung des Vereins Deutscher Eisenbahn-Verwaltungen* was first printed in Stuttgart in the 1840s, before moving to Leipzig in 1862 and finally Berlin.[12]

The way of conducting business described above allowed for stakeholder involvement. Kaiser and Schot capture the essence of the *Verein der Techniker's* methodology and success as "engineers fostering a specific culture of discussing different options and seeking concensus in order to mediate tensions between both companies and states."[13]

At that juncture this was especially important because, despite the fact that the Prussian Railway Law of 1838 had addressed the question of the construction of railways, and that in 1843 the Prussian government had followed-up about improvements in railway matters with Prussia's railway companies, these efforts can be seen as essentially relating to minimum standards. Hence, until 1850 there had been no standardisation and as a result much expensive re-working had to be done. A particularly high profile example, already described, was Baden which originally had adopted a track gauge of (1.6 metres) as opposed to the emerging British-led European standard of (1.435 metres),

[10] *Festschrift* (1896). *Bau, Betrieb und Betribsmittel*, p. 44.
[11] *Rückblick…Technischer Bezihung*. (1900, p.19).
[12] Mitchell (2000, p.40).
[13] Kaiser and Schot (2014, p.123, Fig. 4.3).

although this was not adopted by Russia or Spain.[14] For example, in 1862, Russia constructed the St Petersburg-Warsaw line in two parts, one with the European standard 1.435 metres track gauge and the other with the larger Russian gauge of 1.524 metres.[15]

Fundamental Principles

Accordingly, in 1850, to bring uniformity to the building of railways, the *Verein der Techniker* created standards for the whole field of railway engineering under the title *The Principles for the Design of Germany's Railways.*[16] This specified the requirements for the construction of railways including: the permanent way and its sub-strata; station installations; locomotives and rolling stock; signals; the procedures for marshalling and for handling rail through-traffic; and safety provisions including for equipment. This was soon followed by *Uniform Regulations for Through Traffic*.[17]

In parallel with its engineering and technical work carried out by the *Verein der Techniker* to bring standardisation to the railways, the *Verein* itself was aware of an equally pressing need to rationalise arrangements across railway companies for the carriage of passengers and goods. This groundwork resulted in the *Verein's Regulations for Passenger and Goods Traffic*.[18] The *Festschrift* cites this as the basis of German rail freight law, the subsequent railway operating regulations in Imperial Germany, the Austro-Hungarian Empire and The Netherlands, and the Berne International Convention concerning the *Carriage of Goods by Rail*.

By this means the *Verein* enabled inter-operability of freight handling first across the expanding German railway network and then, by influencing the railway authorities of adjoining countries through its multi-national membership, across central Europe. Although no statistics have been identified, it is reasonable to surmise that this must have given a tremendous boost to trade and commerce across north central Europe.

[14] Mitchell (2000, p.48).
[15] Tode et al (2012, p.57).
[16] *Rückblick* (1871, pp.23-25) and *Festschrift* (1896) *Einleitung*, pp.XVII-XVIII.
[17] *Festschrift* (1896). *Bau, Betrieb und Betriebsmittel*, p.44.
[18] *Festschrift* (1896). *Einleitung*, p.XVII.

In order to give some idea of the size of the task which had faced the *Verein* and its subsequent achievement, at the end of March 1896, the 74 different administrations that belonged to the *Verein* operated a track distance of 80,998 kilometres (50,331 miles) of railways across continental Europe.[19]

It is notable that on 1st April 1895, the track distance figures for railways in Prussia, the largest railway operating area in Germany, was 27,060 kilometres but it is of note that only 10,479 kilometres were two or more tracks.[20] This illustrates the priority of laying down initial track across this geographically large country at the expense of a higher grade network.

Science, Technology and inter-action with other Railway Industry players

Industrial business practice in engineering research and development made it inevitable that the *Verein der Techniker* would work closely with other companies in the railway industry. Such links to locomotive manufacturers and suppliers can be demonstrated by the trial,[21] carried out at the Borsig locomotive factory in Berlin on 22nd February 1850 with the *Verein der Techniker* in attendance, to test and compare cast steel axles manufactured by Krupp and by Werner.

As a result of subsequent serious accidents caused by axle failures and breakages, in 1854 the Austrian Trade Ministry[22] requested the *Verein der Techniker* to begin collecting information on such incidents. The statistics produced were published in 1857 and indicate that some retrospective work was necessary to compile these figures. They showed the number of axle failures in 1852 was 89 and in 1853 was 74. During the period 1870-1880, the figure was an average of 70 per year.[23] Unfortunately, the historiography does not provide an explanation for the decline over the years. However, it is reasonable to assume that the *Verein* would have highlighted possible overloading issues to its membership and, or, axle manufacturers introduced modified designs.

[19] *Festschrift* (1896). *Einleitung* p. XVI.
[20] Meyer (1897, p.89). These figures for Prussia have been found only in Meyer.
[21] *Rückblick…Technischer Beziehung* (1900. Anhang II, p.52).
[22] *Rückblick…Technischer Beziehung* (1900, pp.22-23).
[23] Helmholtz and Staby (1930, part II, p.319).

Other material shows the scope and level of detail covered by the *Verein*'s own investigations. An edition of the *Magazine for Progress in Railway Technical Matters* summarised the proceeds of a plenary session of the *Verein der Techniker*.[24] This gave a detailed report (of the session) authored by Edmund Heusinger von Waldegg, a member of the *Verein der Techniker* and inventor of the Heusinger steering gear. This plenary session brought together the results of prior sessions which had agreed questions to be addressed, apportioned investigative tasks to particular railway administrations and subsequently heard their recommendations. These concerned issues such as boiler tube fabrication, oils and sealants, and the technical design of locomotives, for example the levels of steam pressure which could be safely used. All this came at a time when locomotive design was helping push forward the boundaries of science and technology and where "steam power and metallurgy were…tandem technologies."[25]

It is known from Helmholtz and Staby[26] that in the early years locomotive development was slow because there was a lack of a scientific information, effective instruments and testing procedures to make accurate assessments. The process of combustion, the characteristics of steam, the implications of friction and the science of materials were not fully understood. For example, forty-six locomotive boilers exploded in England during the period 1845 to 1867 but, according to records from the late 1840s, only seven occurred among the *Verein's* member companies.This difference may be attributed to section 19 (Safety Regulations) of the *Principles for the Design of Germany's Railways* (1850) promulgated by the *Verein.* These required inspection of the boilers at one and a half times the permitted overpressure at specified intervals. If such tests indicated deformation of the boilers at these pressures they could not be used.[27]

As everything had to be found out empirically through experience, it could take several years to reach a fact-based decision about a design or a component. In the meantime, premature and erroneous conclusions might be drawn. Races

[24] Staatsbibliothek, Berlin. 4 Nz 13603.
[25] Mitchell (2000, p.158).
[26] Helmholtz and Staby (1930, *Vorwort*, pp. III-IV).
[27] Helmholtz and Staby (1930, part II, pp.400-401).

between locomotives seem to have been a source of such errors with the consequential boost in sales for the winner; clearly speed was not an indicator of operational performance (torque/pulling power, reliability and durability). By contrast,[28] exhibitions offered potential buyers time to look over the engines on display, to ask questions and make more considered judgements about a particular engine's suitability for a given role. This would be reinforced where expert technical appraisal by judges led to an award such as Borsig's winning of the gold medal at the commercial exhibition in Berlin in 1844.

It is inevitable that similar inter-actions involving the *Verein der Techniker* (as described above between the *Verein der Techniker*, Borsig, Krupp, and Werner) took place with other locomotive and rolling stock manufacturers such as Henschel of Kassel, Maffei of Munich and, later, Siemens-Werke on the first electric locomotive. Similarly, other parties would have been part of the *Verein der Techniker's* network, for example, the Association for Railway Science (*Verein für Eisenbahnkunde* –VfEK) which Dunlavy writes was "the first formal institution associated with the railroad industry…and which survived…from 1842 to 1892".[29] Dunlavy further reports that the VfEK's membership, which met monthly in Berlin for dinner, comprised not only railway men but middle grade civil servants and military officers. As such, it could be said to be more of a dining club and discussion group, as its name might imply, rather than a technical forum for proposing standards or procedures.

A file[30] referring to the VfEK gave the names of some its members. In addition the file held correspondence between the Imperial government and the *Verein* at its Berlin address (*Schöneberg Ufer 1-4, Berlin, W.)* concerning an international conference in 1896 and listed the names of certain members of the *Verein.* That the names of members of both vereins were found in the same file would normally be particularly important when seeking to establish the *Verein's* wider network. This is because connections between the *Verein*, railway operating companies, their suppliers, industrialists, bankers, etc. could

[28] Tode et al (2012, p.26).
[29] Dunlavy (1994, pp.158-159). Dunlavy uses the word "science" (in the Association for Railway Science) as was its usage then, not "knowledge" as today.
[30] Geheimes Staatsarchiv Preußisches Kulturbesitz, Berlin. I.HA.Rep 89 Nr. 29497- Königliches Geheimes Zivilkabinett.

be revealed. Unfortunately, there were few enclosures of any kind in the file and no further leads were identified.

Separately, from Dunlavy,[31] it has been possible to make a tenuous link between Joseph Mendelssohn, the Berlin banker and director of the Berlin-Stettin Railway Company and a member of the *Verein*, and August Borsig, the Berlin locomotive manufacturer and member of the *Verein für Eisenbahn-Kunde*. This arose by virtue of the fact that the VfEK met at Mendelssohn's Berlin-Stettin Railway depot. Further, under the same reference from Dunlavy another possible connection arises, namely Georg Neuhaus, a member of the VfEK who was building the Berlin-Stettin railway, and who might be one and the same person as Baurath (government construction councillor) Neuhaus from Berlin, one of the three nominated members of the *Verein der Techniker's* board.[32] Unfortunately, no material was found to confirm this, even in the *Allgemeine Deutsche Biographie* (General German Biography).

In the 1870s new manufacturing methods for iron and steel were introduced[33] which made it necessary to revise the technical data about these materials. The *Verein der Techniker* undertook tests on such aspects as elasticity and the strength of different materials and this led to the production of a position paper for a state-recognised classification of iron and steel. The *Verein's* General Assembly in The Hague in 1887 decided to forward this paper to all the governments in the *Verein's* territory. Given the subject matter and the link between the *Verein* and Krupp of Essen through Herr Jencke, a former senior director of both organisations, it is unlikely that this position paper was produced by the *Verein der Techniker* in isolation.

The Involvement of other interested Parties

Information about any direct interface between Borsig and either the *Verein* or the *Verein der Techniker* appears sparse. However, it seems Borsig either attended or wrote to the *Verein* (it is not clear which) probably around 1850. On the basis of experience gained, this recommended that the width of railway

[31] Dunlavy (1994, pp.158-159, p.162).
[32] *Rückblick…Technischer Beziehung* (1900, p.9).
[33] *Rückblick…Technischer Beziehung* (1900, p.23).

rolling stock wheels should be 3/4 inch for wagons and carriages and 7/8 inch for locomotives. This implies that Borsig was in dialogue[34] with the *Verein der Techniker* but no further information has come to light.

Earlier it was reported that prior to the founding of the *Verein* in 1847, the Prussian government had been active in seeking to persuade the Prussian railway companies to "raise their game" technically. What is overlooked as a result of the concentration on the social and political unrest of that era is that the Prussian government continued to interest itself in the operational problems of the railways. Helmholtz and Staby[35] report that as a consequence of the number of derailments in the winter of 1852-1853, the Prussian government set up a commission which travelled all over Prussia looking at locomotive designs with the task of making recommendations to reduce the number of incidents. To this end the commission carried out trials on seven types of trains in two categories: express locomotives with coaches, and freight locomotives with wagons, looking particularly at suspension systems, arrangement of axles, and the maximum running speeds before it became dangerous or the locomotive was unable to accelerate further. For express locomotives the highest speed reached was 112.5 kms/hr and for freight locomotives 75 kms/hr.

The subsequent report by the commission[36] included recommendations for express locomotives that the rear axle should be re-positioned behind the firebox [to improve traction] and the boiler should be lowered [to improve the centre of gravity]. For freight locomotives, the recommendations included the weight of the locomotive, the size of the driving wheels, that axles could be positioned in front of the firebox, the gradients the engines should be working at, and optimum steam pressures for different boilers.

Given that this was a government report it is most curious that there is no reference to the *Verein* picking-up on this, but the reference text by von Helmholtz and Staby was written some eighty years after the event and the original papers may have suffered the fate of other "lost" material. Nevertheless, it reveals a level of competition between the Prussian

[34] *Rückblick…Technische Beziehung* (1900, p.58).
[35] Helmholtz and Staby (1930, p.331).
[36] Helmholtz and Staby (1930, pp.331-333).

government and the *Verein* (and its technical arm) in the early days of the association.

It is noteworthy that, at some point, possibly after the First World War, locomotive manufacture gave rise to the formation of the *Deutsche Lokomotive Verband* (German Locomotive Association).[37] But no date is given for this, and reference to this association has not been found in literature other than that quoted. This would provide a separate topic for further research.

Similarly, more research is also required to identify the *Verein* and *Verein der Techniker's* networks beyond what has been described in this thesis. However, given the paucity of information, it points to the fact that records may no longer exist for the reasons given in the Introduction.

The *Verein der Techniker* –Auditor and Compiler of Modern Statistics

An essential part of the *Verein der Techniker*'s work involved auditing. This would have been necessary to check the accuracy and integrity of technical information before recommendations could be made, for example, from the previously mentioned plenary session. But other audits were more like surveys to enable statistics to be compiled. Such an exercise was commissioned by the *Verein der Techniker* meeting held at Dresden 11th-16th September 1865 requesting every railway administration to report on newly built iron bridges of over 15 metre span with full supporting technical information. It also requested a report on such bridges previously built but not reported. The results[38] from this survey, compiled in tabular form, covered 183 bridges in Germany but also included bridges in Austria and The Netherlands reported by members. Only one bridge over the River Rhine (between Ludwigshafen and Mannheim) and one bridge over the River Nogat (at Marienburg) were reported but none over the River Vistula. This is of significance because it helps establish when the principal bridges over the rivers Rhine, Nogat and Vistula were built, that is, when the west-east railway lines across northern Germany were connected all the way through. Statistics of this nature are probably amongst the most

[37] Helmholtz and Staby (1930, *Vorwort*).

[38] Staatsbibliothek, Berlin. 4Nz 11249. *Die Eisenbahn Brücken über 15 metre Spannweite auf den Bahnen des Verein Deutscher Eisenbahn-Verwaltungen.* (Railway bridges over 15 metre span on lines in the *Verein's* area).

reliable in nineteenth century Germany and it would be reasonable to infer that they enabled trends in the rise of the east-west movement of labour and consequential economic impact to be date-pointed.

On the question of statistics, the *Verein der Techniker* began collecting information on axle failures in 1854 at the request of the Austrian Trade Ministry.[39] Later it started to collate statistics on a range of topics including rails, sleepers, wheel components, suspension systems, and boiler plate material. Again, it would be reasonable to conclude that such monitoring in turn led to statistics on the reliability and maintainability of the articles and components in question. If so, this in turn very likely would have influenced procurement decisions. As such, given the size of the railway organisation covered, in this particular role the *Verein der Techniker* might be likened to a (military equipment) central defect authority. The same primary source reported that "the sale of these statistics showed there was a very lively interest from manufacturers in these publications." Under the circumstances, the *Verein* might be considered as an early adopter and practitioner in the use of statistics.

The genesis of the Secondary Railway system

Gradually the *Verein* and the *Verein der Techniker* must have become aware of redundancy in first generation railway track. This redundancy would have also affected equipment and rolling stock. This occurrence almost certainly resulted from the heavier more powerful locomotives being deployed onto the growing rail network.

Yet much of this redundant material must still have been serviceable. It is reasonable to conclude that discussion about putting this to good use resulted in the idea of constructing a second tier railway system. The Assembly of German Architects and Engineers met in Hamburg in September 1869 and suggested that similar technical principles be drawn up for such a network as for the main line railways.[40] How this professional body became involved is not clear, but it is possible this occurred through involvement with the *Verein der Techniker's* civil engineers on railway construction and bridge building matters.

[39] *Rückblick…Technischer Beziehung* (1900, pp.22-23).
[40] *Rückblick…Technischer Beziehung* (1900, p.16).

As to which organisation came up with the original idea about the secondary railway, on balance it is reasonable to infer it was the *Verein,* and that subsequently the Assembly of German Architects and Engineers proposed the methodology for construction, that is, the civil engineering. The *Verein* appears to have taken on board these suggestions and after technical input presented proposals to governments in the territory of the *Verein.* These requested that they should take these principles into account when considering applications for charters or concessions. The record shows that "the numerous letters of acknowledgement that were received from the governments in response… testify to the great interest…by these parties."[41]

Gründzuge für die Gestaltung der Sekundären Eisenbahnen (Principles for the Design of a Secondary Railway)[42] gives a detailed exposition of the design requirements for such a system. This addresses railway construction; station installations; signalling systems; locomotives; wagons; railway crossings; organisation of an operational service; inspections, etc. Within each heading there is a considerable level of technical detail. The document is dated 1876 some two years before the Imperial government adopted the *Verein's* proposal and passed an Act permitting the building of a secondary railway system. Most significantly, this would operate under reduced speeds in order to enhance and satisfy safety requirements. This document testifies to the leadership of the *Verein,* and to the technical competence of the *Verein der Techniker*, which issued it from a special meeting, *Techniker-Versammlung des Vereins,* held in Konstanz, 26th-28th June 1876.

An Attempt to re-write History

The concluding chapter of the *Festschrift*[43] states that "The nationalisation of many states' railways achieved much of what the *Verein* was seeking: unitary organisation of the railways." But this statement is a distortion of the facts by the re-writing of history. It might be explained by the agenda of the Prussian civil service which had (also) shaped the development of the *Zollverein*.

[41] *Rückblick…Technischer Beziehung* (1900, p.17).
[42] Staatsbibliothek, Berlin. Nz 15808.
[43] *Festschrift* (1896). *Schlusswort*, p.409.

At no point did the *Verein* seek the nationalisation of railways in Germany to achieve the unitary organisation of the railways; nor did it need to! Apart from periods of economic slump when some private railways became financially unviable and were taken into public ownership, the *Verein's* German railway administrations members, both public and private, (with the exception of Prussia which was effectively under the control of Bismarck through his ministerial nominee Albert von Maybach) actively sought to protect their railway revenues because they ensured independence from the Imperial government. It will be remembered that the shorthand for this struggle was "particularism".

Given these conflicting assessments, what was the reality? The reality was that the *Verein* achieved the "unitary organisation" of the railways. This was primarily "the uniform design of the railways (in terms of construction) and equipment (including rolling stock) to permit rolling stock to pass from one railway (area) to another." [44] It realised this through the technical recommendations of the *Verein der Techniker* being accepted first by the *Verein's* Committee for Technical and Operational Affairs[45] and subsequently confirmed for acceptance on a voluntary basis by the *Verein's* constituent railway administration members in accordance with the *Verein's* Articles of Asssociation (Constitution).[46] Equally important was the agreement reached amongst members that the railways should aim to operate as a unified network "in such a way that unitary administration and joint operation can actually be implemented."[47]

In conclusion it can be noted that the *Verein der Deutschen Eisenbahn-Techniker* celebrated its fortieth anniversary in Berlin in 1890. At that event, Albert von Maybach,[48] the Prussian Minister of Public Buildings and Works responsible for the Royal Prussian Railways, which at that time was "the largest single industrial enterprise in the world"[49] paid tribute to the professionalism of the association. It had not been led by material interest but the pursuit of higher

[44] *Festschrift* (1896). *Bau, Betrieb und Betriebsmittel*, p.43.
[45] *Festschrift* (1896). *Bau, Betrieb und Betriebsmittel*, p.44.
[46] *Festschrift* (1896). *Verfassung*, p.11.
[47] *Festschrift* (1896). *Einleitung*, p.XVI.
[48] *Rückblick…Technischer Beziehung* (1900). *Schlusswort*, pp.25-27.
[49] Mitchell (2000, p.136).

standards. He claimed that the work of its first assembly (and the regulations subsequently produced by its engineers), and the decisions taken then, were fundamental and still sound. Its member railway administrations had adhered to these foundations and governments had also made use of them in legislation and state ordinances. Its work had been characterised by expert knowledge and thoroughness and this explained the high level of railway technology across the European railway network. In conclusion, von Maybach spoke of the fraternal spirit of the engineers and the challenges ahead, for example on electrification, which looked as if it would come to dominate the railways. He finished with a poem:

> "Gleich sei keener dem Andern, doch gleich sei jeder dem Höchsten!
> Wie das zu Machen? Es sei jeder vollendet in sich!" [*sic*]
> auch fernerhin bumüht bleiben,
> zur Förderung des Eisenbahnwesens das Beste zu leisten!
>
> No-one is the same as others, but everyone is the same as the highest!
> How can that be? Everyone is perfect in themselves!
> And so in this spirit, the engineers will endeavour to do their best
> To promote the railway industry.

Two attitudes are expressed in this poem, the respect in which engineers are held and the underlying Prussian pietism from *die Aufklärung* (the German Enlightenment) which reminds the individual of his worth and inspires him to do his duty to his profession, in this case in the railway industry.

The next chapter addresses a completely different theme, the commercial dimension. This is a multi-faceted topic which casts light on the many challenges the railways had to face as the first big business. How these challenges were met is examined; the question is also asked whether the *Verein* was the successor to the *Zollverein* in the commercial field.

Chapter 7

The *Verein* and the Commercial Dimension

In the nineteenth century Germany was quite different in character from other western European countries. Although it was not a great maritime trading nation, it had the benefit of being the crossroads of northern Europe. Thus by custom and practice it had evolved trading arrangements over the centuries, including with Russia. In these matters the Hanseatic League, led by German maritime trading cities such as Lübeck, was prominent.

This chapter considers how the arrival of the railways emphasised Germany's position as the hub of north central Europe, and how the improvements in transportation led to heightened competition first between the railways and traditional horse-drawn carriers, then between the railways and waterways resulting in lower trade costs which boosted the economy and GDP. It also looks at the associated, but contentious, subject of tariffs in connection with which the *Verein* was deemed by some historians to have failed. This charge will be examined, as will the spill over of the *Verein's* commercial practice into German business. This demands enquiry as to the extent the *Verein* may be considered to be the commercial successor of the Zollverein.

At the close of the Napoleonic war in 1815, Germany had three main commercial challenges: firstly the *kleinstaaterei* (self-interest) of the individual states; secondly the absence of a transport system linking regions; and thirdly few major maritime outlets on its own soil for trade, save for Hamburg. The railways went a good way to providing the solution to each of these problems. First the railways made possible the fulfilment of the *Zollverein's* potential which gave states a new guaranteed source of revenue which reduced the incidence of destructive commercial differences between them. Next, thousands of miles of track were laid down across the country linking cities and principal towns by 1860. Finally, the railways extended first into Belgium (from Cologne) and later

through the St Gotthard Tunnel into Italy (Genoa) dispensing with the need to go through Austria to Trieste.[1]

Commercial Problems encountered in the Early Years

The new commercial environment which emerged in Germany after 1834 owed its genesis to the launch of the Customs Union, the *Zollverein*, in 1834 and the introduction of the railways in 1835 which the entrepreneur Friedrich List referred to as "Siamese twins born together and inseparable, both providing the basis for material co-operation and economic progress."[2] Together, these developments were instrumental in facilitating the modernisation of industry and agriculture in a country which was still, as yet, a fragmented collection of independent states largely reliant on craft work, cottage industry, the cultivation of land and the raising of livestock.

For a long time historians viewed the *Zollverein* as purely a trade related initiative, a customs union, as its name denoted, one which had evolved over many decades, but a union which became redundant with the establishment of the German Empire in 1871. This disregarded the fact that Prussia's efforts to form a customs union had begun in 1819 and did not conclude until 1885. Nevertheless, to most historians, such as Mitchell, it had run its useful course and the book was closed.[3]

In a similar way, the *Verein* was depicted as no more than a trade association to which the many German railway companies belonged. This existed to share knowledge and agree common operating practices, but which too became defunct with the establishment of the German Empire and the subsequent foundation of the Imperial State Railway Office in 1873.

While the *Zollverein* recovered from this initial assessment through a belated reappraisal of its seminal role in the politics relating to founding of the unified German state, the *Verein* was afforded no such re-evaluation which, as seen, was the inspiration for this thesis. Yet, a noted authority on the *Zollverein*

[1] Mitchell (2000, p.55).
[2] Sheehan (1989, p.468).
[3] Henderson (1939, Reprint 2013, p.336) reports that the *Zollverein* covered the period from the first treaty with Schwarzburg-Sondershausen, in 1819, until the last with Bremen, in 1885, some sixty six years. But the life of the *Zollverein* was extended until 1886 (Henderson, 1967b, p.26).

believed that it was “the *Zollverein* and the railways together (that) set Germany on the road to industrial success”.[4]

It is often forgotten that the railways were the first big business and pioneers in modern corporate management as Chandler depicted them.[5] Consequently, at the outset, and for many years after, the railway companies were struggling to cope with new situations across the full spectrum of business. In Germany this was exacerbated by being faced with diverse denominations of weights, measures, and currencies; even the time of day differed across Germany. As the German railway network grew and interfaced with those of other countries, for example the Austro-Hungarian Empire, Belgium, The Netherlands and Russian-occupied Poland, this would have presented additional commercial difficulties which were intensified by the lack of a common language on the borderlands of Germany itself where other national powers had previously ruled.

It is likely that the central European practice of estimated equivalence decided currency, price, weights and measures but the legal situation was more complex. Clark[6] reports that after 1815 in the new western regions of Prussia, namely the Rhineland and Westphalia which had been under Napoleonic administration, French law still prevailed, while the former Swedish area of Pomerania retained its legal system. Although there were other pockets of dispensation, these were the principal exceptions to the Prussian General Code. So, what of the remainder of Germany? Information on this is sparse but the historiography indicates that many states were taken as following the Prussian General Code unless there was extant law, for example, law which had its genesis in the days of the Holy Roman Empire. The historian Joachim Whaley, quoted by MacGregor, explains: “The princes and Imperial cities (of the Holy Roman Empire) were not independent and sovereign. They were subordinate to the Empire and they all worked within the common framework of

[4] Henderson (1975, p.52).
[5] Chandler (1965, pp.16-40).
[6] Clark (2006, pp.427-428).

law, which was agreed jointly between the Emperor and the princes at the Imperial Parliament (the Diet) on a regular basis."[7]

While the *Verein* made progress in addressing the day to day challenges faced by its railway company members, in the background governments worked to address the problems of the new age.[8] Events indicate that they viewed the standardisation of commercial law as the means by which business could be made more efficient across the German states. Although it was Württemberg which first proposed a German commercial code as early as 1836, it was the revolutionary National Assembly of the German Confederation meeting in Frankfurt am Main in 1848, the so-called Pauluskirche parliament, which established a commercial code in its draft constitution. However, this fell with the parliament in 1849.

Henderson describes what happened next.[9] In 1853 Württemberg again proposed a German commercial code to the *Zollverein* General Congress but this was not taken up. Later, Prussia, which had been working in the background promoting a commercial code, presented its offering but this too failed to gain support. Next, Bavaria took up the fight but hoped to circumvent the Prussian-led *Zollverein* and made its proposal to the Diet of the German Confederation in Frankfurt am Main in 1856. In accordance with Bavaria's wishes the matter was considered further, not by the *Zollverein*, but by the Commercial Commission especially set up by the Confederation and charged with producing an updated code of commercial law. Although the Commission was chaired by a Bavarian judge, and sat in the old Bavarian city of Nuremberg between 1856 and 1861,[10] the draft produced by the Prussian Ministry of Commerce, and not by Bavaria, found favour as the basic drafting document and was finally ready in 1861. This was entitled *Allgemeines Deutsches Handelsgesetzbuch* (*ADHGB),* The General German Commercial Law, sometimes referred to as the German Commercial Code. By 1865 this had been adopted in all but a few states in Germany.

[7] MacGregor (2014, p.80).
[8] *Rückblick* (1871, p.18).
[9] Henderson (1939, Reprint 2013, pp.241-242).
[10] Flume (2014). Flume reports that sections of the maritime law were written in Hamburg at the same time.

In this regard, the *Verein* played a leading role between the code's first appearance in 1859 and its full acceptance by the majority of state governments in 1861. This came about because, initially, the *Verein* did not consider that the code took sufficient note of the rail freight procedures it had developed and made a challenge accordingly. A journal article[11] then appeared supporting the Commission and questioning why the Commission, having taken opinion from a wide section of the business community, would have ignored the railways and would want to damage them. The article was sarcastic and scathing of the *Verein's* stated position; it considered as false the *Verein's* assertion that the Commission's proposals were inappropriate and could not be implemented in certain aspects. This they attributed to "the interests of the railways…and its ideas which were often dubious." In conclusion they "hoped the German governments would not allow the work of the Commission to be spoiled by allowing the railway administrations to retain their autonomy which would make the best provisions of the legislation illusory." This article, dated 23rd June 1860, has especial value because it was signed by three government councillors in Munich, namely Stöhr (Commercial), Schutze (Trade) and Haenle (Manufacturing), and is a rare public criticism of the *Verein*. The implication of this might be that the *Verein was* viewed as Prussia's agent by Bavaria given the *Verein's* roots and background in Prussia. If so, what transpired next would have confirmed this to the Bavarians.

Notwithstanding this very public rebuttal, the *Verein* mounted a campaign for the inclusion of its procedures in the code and this was successful after an appeal to the Prussian government which supported its case. In this instance the *Verein* was dependent on the government not only for support but for its credibility. In the end the *Verein's* campaign was a major achievement in that it captured and publicised practical knowledge with regard to the rail freight business. It is reasonable to conclude that associated commercial processes were equally publicised at the same time.

Logic suggests that just as there was a common framework of law in the Holy Roman Empire there was probably a common currency. But this appears not

[11] Staatsbibliothek, Berlin. BDR.BV020123261.60901. *Kritische Beleuchtung der Denkschrift des Verein Deutscher Eisenbahn-Verwaltungen vom 12. Dezember 1859 u.s.w.*

quite to have been the case. MacGregor[12] provides guidance: “every member of the Diet, whether a city, elector, prince or bishop was allowed to strike his own coin.” To this had to be added the coinage of states, such as Prussia, which were not a part of the Holy Roman Empire but, where through historical linkage, the party involved was entitled to sit in the Diet. For example, the King of Prussia in his role as Elector of Brandenburg held a seat in the Diet as did, amongst others, King George I of Great Britain as Elector of Hanover. MacGregor reports that although this resulted in some 200[13] coins being produced across Germany, “the gold and silver coins, wherever issued, were struck to a fairly standardised system of weight and subdivided into relatively consistent smaller units…and they would often have on one side a common symbol -the Imperial eagle- showing they were part of…an integrated system”.[14]

Notwithstanding MacGregor’s explanation of equivalence, this relates more to the period before 1800. Conversely a close study of approximate equivalents of German money, lengths and volumes at the time of the *Zollverein*[15] reveals some quite considerable differences between the German states themselves. Hence it is reasonable to assume this was also the case as compared to the Austro-Hungarian Empire.

But time had moved on and the nineteenth century demanded more modern arrangements. Henderson[16] recounts how the *Zollverein* worked to address these issues by achieving a degree of compatibility on currency in 1838 when “the thalers of the northern German states and the florins of southern Germany were set in a fixed relationship on the basis of the Cologne silver mark”. He also recounts how in 1857 came an initiative to align with the Austro-Hungarian Empire which together with the German states was still a member of the German Confederation. Curiously this was proposed “not as against (a monetary standard) the Cologne silver mark, but against the *Zollpund* (metric pound) which weighed 500 grammes…[and] where a given number of each the

[12] MacGregor (2014, pp.79-81, pp.86-87).
[13] MacGregor (2014, p.79).
[14] MacGregor (2014, p.86).
[15] Henderson (1939, Reprint 2013, p.345, Appendix I).
[16] Henderson (1939, Reprint 2013, pp.250-251).

Prussian thaler (30), the South German florin (52.5) or the Austrian florin (45) should be coined from one metric pound of fine silver…[however]…the three new coins [produced] did not secure a very general circulation…and Austria retained its fluctuating paper money which caused the tri-partite arrangement to fall…[nevertheless]…it held between the North German thaler and the South German florin."

While this may have facilitated acceptance by equivalence of German and Austro-Hungarian coinage, it still left problems regarding other currencies. We know from the *Rückblick*[17] that as regards currency, the *Verein* decided in 1853 that "gold and silver coins accepted on neighbouring railways were to be accepted." The conclusion to be drawn here is that regardless of the currency proferred, for example gold roubles, if acceptance was good enough for one railway administration it was deemed good enough for all, with a consequent domino effect across the system.

Inevitably, because of its multi-national membership and in the absence of a single currency, the *Verein's* constituent railway administrations would have been faced with difficulties in making payments directly to, and receiving payments directly from, other member companies. The *Verein* resolved this problem by organising a Clearing House in 1871 [18] whose task it was to collate all the debts, and receipts, of railway companies in respect of services they had provided to one another and payable in the currencies permitted by the *Verein*, namely: thalers (and later the mark from 1873), francs,[19] roubles and kroner. The figures were consolidated twice per month and used to calculate the sum in each currency that the railway administrations finally had to pay in, or receive

[17] *Rückblick* (1871, pp.12-14).

[18] (1) DB Archiv, Nuremberg: Minutes of the General Meeting of the *Verein*, Frankfurt am Main, July 1884. (2) *Festschrift* (1896). *Verfassung,* pp.19-22: The General Accounting Office ("Clearing House") was first established and managed from 1871 by the Berlin-Potsdam-Magdeburg Railway on behalf of the *Verein*. Because its name misled third parties as to its function, in 1882 this was changed to *Vereinsabrechtnungsstelle* (*Verein* Clearing House) and it was converted to an institution of the Verein; this was formalised in 1883.

[19] Understood to be Belgian francs.

from, the Clearing House. The table below shows the escalating use of this form of exchange. [20]

	1883	1903	1913
Debts and Receivable Transactions	91,200	132,392	218,729
Value in Marks	268,137,280	441,010,627	1,370,836,968
Netted out in Marks (rounded)	107,000,000	144,000,000	255,000,000
£ sterling equivalent[21]	5,350,000	7,200,000	12,750,000

Prior to this, to cover the expenses of the *Verein's* executive board and its committees, in 1848[22] it had set up the *Vereinskasse,* an accounts and cash office, to receive dues from members, for which payment was stipulated in marks: 200 marks (£15, 7 shillings and 7 pence) for members and 50 marks (£3, 16 shillings and 10 pence) for associate members, with a surcharge of 1 mark (1 shilling and 6 pence) for each kilometre of track managed by the member.[23]

As for weights and measures, the *Rückblick*[24] shows that the *Verein* was pro-active in these matters. In 1847 it petitioned the Prussian government for the general introduction of the standardised *Zollgewicht* (dutiable weight) and later this was adopted as the standardised *Eisenbahn-gewicht* (railway weight).

Measures appear to have presented more of a problem. Circa 1849, in the promemoria published in the *Rückblick…in Technischer Beziehung*[25] proposing that common standards be drafted, the Chairman of the *Verein der Techniker*,

[20] DB Archiv, Nuremberg. *Enzyklopädie* (1923, p.98).These are rounded sums as the final digits on the photo plate are blurred in the last column of figures.
[21] For conversion rate, see Appendix C.
[22] The dates cited in the *Festschrift* (1896) *Verfassung,* pp.7-8, are inconsistent and show 1848 and 1852. It is more likely that the *Vereinskasse* was established in 1848.
[23] Note the different conversion rates for marks- see Appendix C. Also, the conversion terms used here are the pre-decimal sterling terms which prevailed at the time and the sums quoted are approximate.
[24] *Rückblick* (1871, p.12).
[25] *Rückblick…in Technischer Beziehung* (1900, p.54).

expressed his regret that there was no German national system of measures. Nevertheless, he thought that the railway administrations should feel fortunate at least to have the English system, with which they were familiar through the purchase of rails and locomotives, and he advised that the English measures be adhered to for the time being.

In 1850 the *Verein* issued a list of weights and measures showing conversions to the French metric system.[26] Although this was an early attempt to standardise and familiarise the public with this system, it did not gain universal approval from all the *Verein's* railway administrations. Over the years many attempts were made unsuccessfully to achieve this as the records of the *Verein's* General Assemblies show. However, it was not until 1868 through one of the reforms introduced by the North German Confederation, and later extended across the whole of Germany, that the metric system was introduced to standardise weights and measures.[27]

Regarding distances,[28] it was not until 1864 that the General Assembly at Hamburg decided that timetables should give distances in local miles and in kilometres in order to promote metric measures. However, the *Festschrift* recounts that one North German railway administration would not agree to this although it was implemented by the other administrations. This was not seen as a spoiler because the *Festschrift* further comments that: "Here too, the *Verein* therefore paved the way for the subsequent approach taken by the German Empire." This lack of unanimity may explain why later, at the 1871 Berlin General Assembly, the *Verein* "decided that the kilometre should be obligatory for distances alongside which each administration was free to use a second measure of distance as well".

During these early years another problematic measure was time, that is, the absence of a standard time, with its consequences for timetables and inherent risks for locomotive and train safety of not having an agreed standard time especially before dual tracks became the norm. (It will be remembered that even as late as 1895 less than half of Prussia's railways were two or more

[26] *Festschrift* (1896, p.358).
[27] Henderson (1939 Reprinted 2013, p.327).
[28] *Festschrift* (1896, p.358).

tracks.)[29] This was, of course, a concern for railways in other countries and it is of interest first to consider what happened in Great Britain and in the United States.

Bagwell[30] recounts that in Great Britain, prior to the railways, the guard on the mail coach from London to Holyhead which carried the post for Ireland took with him a watch set to Greenwich Mean Time so that clocks at each stop along the way could be adjusted to correspond with that time. This is reminiscent of the methodology used by the English watchmaker John Harrison, and described by Sobel,[31] to determine a longitudinal meridian (from Greenwich) and thereby a local mean time. From Bagwell it is known that with the advent of the railways this practice was not only continued but encouraged by the Railway Clearing House which in 1847 "recommended to each company to adopt Greenwich [mean] time at all its stations." However, not all railway companies were members of the Clearing House and there was not universal take-up. It was not until "1876 that the Clearing House rules gave detailed instructions for the observance of Greenwich [mean] time throughout the railway system". As such, all but a few small railway companies fell into line and "it reminds us of the importance of the railways…as an agency for achieving common time throughout the kingdom."[32]

In the United States, a continent with standard time issues comparable to continental Europe, the railways were just one of many organisations concerned with this problem because their interest arguably was the most pressing given the implications for safety. Bartky,[33] a United States civil servant specialising in standard time, reports that much effort was spent on this topic by the railways in the United States which had even established a General Time Convention (1872-1885) with a permanent secretary, William F. Allen. "The…convention's members were general managers and superintendents of the major eastern lines and it had been established to settle questions of running time for through trains. Time uniformity became the convention's

[29] Meyer (1897, p.401).
[30] Bagwell (1968, pp.54-55).
[31] Sobel (1998).
[32] Bagwell (1968, pp.229-230).
[33] Bartky (1989, pp.25-56).

first…issue." But there were many stakeholders in the United States involved in trying to solve the problem of standard time over a prolonged period. It is not the task to review this here in any detail, only to highlight that the same problem existed in another country which like Germany had become railway dependent for its continued progress. The four time zones in the United States were introduced by the Standard Time Act (1883) which was ratified after the First World War.

In Germany, standard time was the subject of review by the *Verein* especially after the Grand Duchy of Baden had success using mean time.[34] As a result, a Professor Erb from Baden suggested that "all the *Verein* railways should start to use the 'mean time' of the 'upper meridian' 28 degrees 35 minutes east of Ferro…[which lies 20 degrees west of the Paris meridian]…and that an observatory be set up on this meridian that would determine the correct time and be in charge of setting all railway clocks". But the difference in times (time over distance) between the furthermost points within the Baden area (8 minutes) and such times within the greater *Verein* network area (almost 60 minutes) had not been given sufficient consideration and was therefore impractical. In any event, in 1852 at the *Verein's* General Assembly, the Austrian Ministry of Trade, Commerce and Public Structures reported that "the [Erb recommended] meridian was incorrect, it should have been 37 degrees 52 minutes east". As a result the proposal was not adopted and the *Verein's* railway administrations reverted to using their local times.

In later years the *Verein* made further attempts to standardise time: "at the 1890 Dresden Assembly [of the *Verein*] it was agreed to introduce time zones internally on the railways and recommend them for the whole population, but not to use standard time in published timetables until it had also been introduced generally." [35] However, subsequently, at the 1892 Hamburg Assembly [of the *Verein*], "the 1890 decision was amended so that standard railway time would be used in all dealings with the public."[36]

[34] *Festschrift* (1896, pp.351-352). This reference covers the information and quotations in this paragraph.
[35] *Festschrift* (1896, p.353).
[36] *Festschrift* (1896, p.354).

In 1892 “four time zones were in use: Central European Time in Germany, Luxembourg and the Austro-Hungarian Empire; Western European Time [Greenwich Mean Time] in Belgium and The Netherlands; Eastern European Time in Romania; Standard national time in Russia [being] one hour and one minute earlier than Central European Time”.[37]

On an associated matter, watch-making received a tremendous boost from the requirement for most railway personnel to have a pocket watch. As for private individuals, Sheehan [38] commented that “Owning a watch was a sign of autonomy since it implied a kind of power over time…but it also suggested the owner’s voluntary conformity to the authority of schedules and timetables.”

Bagwell [39] wrote that the British Railway Clearing House Rules of 1876 encouraged “observance of Greenwich [mean] time throughout the railway system…Each guard must, before starting on his journey, satisfy himself that his watch is correct with the clock at the station from which he starts, and must again compare it and regulate it if necessary by the clock at the station where his journey ends, before commencing the return journey.”

In Great Britain watch makers such as J.W. Benson of Ludgate Hill, London, benefited greatly from the railway boom and the resulting demand for pocket watches. In the United States a similar situation obtained, but an almost new industry sprang up where firms such as the Waltham Watch Company made railway-standard pocket watches specifically for railway employees. Today, Benson and Waltham pocket watches produced during this period are much sought after by collectors.

In summary, throughout the early years of the railways and the *Verein* itself, it is clear that, despite the *Verein’s* best efforts, a good deal of imprecision prevailed in the equivalence of currency, in weights and measures, and in the agreement of time across its operating areas. Notwithstanding progress made

[37] *Festschrift* (1896, pp.353-354).
[38] Sheehan (1989, p.799).
[39] Bagwell (1968, pp.229-230).

over the years, it was not until the formation of the North German Confederation (1867-1870) that the metric system of weights and measures was introduced by Bismarck.[40] As regards currency,[41] this was standardised throughout the unified Germany with the passing of the Currency Law of 1873 which introduced the mark (divided into 100 pfennigs) and replaced the thaler, guilden and other coins. It also introduced the gold standard in place of that based on silver and thus followed Great Britain. However, the decision on time was left to governments to agree because this was beyond any single organisation's ability to standardise. Little appears in the historiography about the *Verein's* struggles with regards to time beyond what has been reported here.

It has been seen how the commercial initiatives of the *Verein* enabled commerce to function more smoothly in what was hitherto a fragmented and often chaotic situation. This is manifestly at variance with the comments of Mitchell[42] who remarked, in connection with the proliferation of railway tariff leagues in the 1850s and 1860s, that "their very existence indicated the inability of the [*Verein*] to provide a sufficient basis for commercial activity."

Drawing Central Europe together and making Germany the Hub

Although Germany's first British-built railways used 4 feet 8 1/2 inch (1.435 metre) track gauge, it might be claimed that it was the Belgian government which at the outset influenced and assisted the process of making Germany the commercial hub of Europe.

It needs to be explained why this is the case. It is likely that Belgium was a close observer of the friction between the German states and The Netherlands over the tariffs the Dutch levied on German water-borne goods traffic transiting the Lower Rhine as it flowed through Holland and saw the opportunity to acquire this trade. Belgium had followed George Stephenson's advice in 1834[43] and standardised on 1.435 metre track gauge for its main lines, and before too long had reached agreement with Prussia to link Antwerp via Liege with

[40] Henderson (1967b, pp.44-45).
[41] Henderson (1967b, p.46). See also Appendix C.
[42] Mitchell (2000, p.41).
[43] Schot et al. (2011, p.272).

Cologne using the same gauge. This was realised in 1843 thus connecting one port on the North Sea with another on the Rhine (where water-borne traffic which previously had to access the North Sea through The Netherlands could transfer cargo onto the railways at Cologne), thereby establishing the first international railway line.[44]

The Belgian railways were state owned and the historiography indicates that Belgium also took shares in the railway company which operated the German side of the line.[45] This was because it wanted the power to set competitive rates, or indeed no rates at all if an attractive deal could be secured. Accordingly, in 1844, Belgium agreed not to levy any tariffs on the line in question and in return Prussia granted Belgium preferential treatment for her iron exports to Germany.[46] Given the difficulties German states had with the Dutch over the Rhine tariffs, it is reasonable to conclude that Prussia in its negotiations with Belgium was acting on behalf of the *Zollverein*.[47] It is also reasonable to deduce that this mutually beneficial arrangement was the subject of negotiation over a period of years before the railway connection was actually achieved; also that it was a factor in Prussia's decision to mandate the 1.435 metre track gauge in the charters it granted from 1837[48] onwards prior to the Railway Law of 1838.

Subsequently (1845-1850) The Netherlands attempted to reach an agreement with Prussia for a railway line from Amsterdam to connect with the Cologne-Minden railway. However, this would have necessitated transfer of passengers and goods at the border because The Netherlands had already decreed a different gauge of track from the Prussian 1.435 metre. Prussia would not give way on this and, probably remembering the difficulties it had encountered previously with the Dutch over Lower Rhine tariffs for water-borne traffic, also refused to agree similarly attractive arrangements to those agreed with Belgium. As a result the Dutch were forced to replace the Amsterdam line with 1.435 metre gauge track, in order that Prussian trains could travel directly to

[44] Schot et al. (2011, pp.266-267).
[45] Schot et al (2011, p.267).
[46] Henderson (1967b, p.18).
[47] Ploeckl-Flood correspondence August-September 2018 supports this theory.
[48] *Festschrift* (1896). *Einleitung*, p.XVII.

Amsterdam. Logic and commercial prudence then demanded that it adopted this 1.435 metre gauge as the national standard across The Netherlands.[49]

From these developments, it will be noted that the Prussian government was pro-active some years before the *Verein* came on the scene but even then the *Verein* did not feel able to mandate the 1.435 metre track gauge as standard until 1850.[50] However, the growing acceptance of the 1.435 metre gauge track as the standard and the development of railway regulations and procedures promulgated by the *Verein,* after agreement by its members, began a process of uniformity and inter-operability across Central Europe stretching from Belgium and The Netherlands across Germany to Russian-occupied Poland and into the Austro-Hungarian Empire as far as the Balkans. Later, the opening of the St Gotthard Tunnel in Switzerland (of which a leading board member of the *Verein,* Gerwig, was Head of Construction of the St Gotthard railway element) gave Germany access through Italy to Genoa, Italy's burgeoning gateway port on the Mediterranean. According to Mitchell[51] the opening of this tunnel was a prize as valuable in its commercial implications and impact as the Suez Canal. Later, the Berne Convention of 1890, in which the *Verein* was arguably the principal player, further extended the European international network of which Germany, lying at the heart of Europe, had become the hub with its attendant commercial benefits.

The Vexed Question of Tariffs- the *Verein's* failure?

If there is one contentious issue surrounding the *Verein* it is probably the question of rates and tariffs, that is, charges, and the categorisation of freight. This is because some historiography suggests that the weak point of the *Verein* was that its practice of relying on members reaching voluntary agreements hampered its ability to resolve some difficult issues with this being a prime example.

[49] Schot et al (2011, pp.265-267).
[50] Dunlavy (1994, p.198).
[51] Mitchell (2000, p.146).

To set the scene two views are considered, first that of Meyer then that of Mitchell. Meyer[52] reported that "Among the various railway traffic, and rate-unions which might be mentioned, none have exerted an influence on rates at all comparable to that which has been exercised by the Society of German Railroad Administrations [the *Verein*]." For his part, Mitchell[53] saw the *Verein* as "a veteran champion of mixed railroad governance" which could be taken as an implied criticism.

This raises the question: did the *Verein* support mixed railroad governance only by default because it vacillated, or were there other factors which influenced its actions depending on circumstances? A close reading of the texts shows that the *Verein's* ability to influence these matters was limited owing to: the size of the country; the number of railway administrations involved (some private, some public); the charter conditions under which individual railway companies operated from their state government; the classification [54] of railways (*Hauptbahnen* (Primary), *Sukundärbahnen* (Secondary), *Kleinbahnen* (Local), etc.) and the different rate regimes each attracted under government rules; whether special tariffs were being mandated by government via government-controlled councils; whether freight charges were appropriate to local or long distance routes given the demands of competition; and the different economic factors from region to region. Clearly these considerations influenced the *Verein's* response to any particular situation. Hence, it held to the view that tariffs were not calculated from theoretical principles but in response to practical needs and conditions.[55] In this connection, a review[56] given with the benefit of hindsight came to the conclusion that "the Verein dealt less frequently with the agreement of tariffs because they were addressed on a more regional basis."

[52] Meyer (1897, p.97).
[53] Mitchell (2000, p.128).
[54] Meyer (1897, p.82, p.85).
[55] DB Archiv, Nuremberg. Miscellaneous papers believed to be linked to the *Verein's* Extraordinary General Assembly held 20-23 January 1873 in Frankfurt am Main.
[56] DB Archiv, Nuremberg. *Enzyklopädie des Eisenbahnwesens –Zehnter Band* (1923, p.98).

Dunlavy[57] talks about officials "controlling rates and schedules" and later refers to railways "forming regional rate associations". Looking first at rates and schedules: in this connection Meyer[58] reveals that under the terms of the Prussian Railway Law (1838) the government reserved for itself the right to supervise, approve or reject all tariff schedules and rates, or proposed changes to existing rates, after three years from the first of January next [*sic*] following the opening of the railway. But Meyer notes that "the three year limit is practically void because of the reservations which the state makes in granting concessions." This has to be seen as an observation of some importance given that obfuscation is not associated with the Prussian civil service. It therefore raises the question as to whether this was a deliberate ploy to allow flexibility at a time when the government was uncertain how to proceed with nascent capitalism. In addition, the law retained for the state the right to nationalise a railway line on expiration of its charter.[59]

Taking up Dunlavy's second point about railways "forming regional rate associations (*Tarifverbände*) that draw up freight classification schemes and set rates for through traffic." Mitchell[60] has another take on this believing that the purpose of these regional groupings "was to set rates and exchange rights-of-way." Ziegler,[61] who is mainly concerned with the non-Prussian railways and thereby gives a good picture of what was happening outside of Germany's foremost railway operational area (Prussia), refers to railway companies forming *Eisenbahnverbände* (railway leagues) from 1848 with the aim of increasing cross-border traffic by charging the same prices; it was also intended to increase integration (of timetables and the use of rolling stock) while extending competition further to neighbouring areas. Ziegler says that it soon became apparent to railway companies that if they did not join a league they would soon lose all their through traffic; thus joining became a question of survival.

[57] Dunlavy (1990, p.136).
[58] Meyer (1897, p.83). This reference also covers the subsequent Meyer quotation in this paragraph.
[59] Henderson (1975, p.49).
[60] Mitchell (2000, p.41).
[61] Ziegler (1996, pp.126-129).

Dunlavy[62] highlights the fact that in 1850s Prussia, when railways wanted to increase their capital or get the state to guarantee interest on shares, as a quid pro quo, the minister responsible for railways, von der Heydt, negotiated state control of rates and schedules. This was consistent with his motivation to influence or mandate tariffs, for example, the "ein pfennig tariff" on the Silesian railways. The intervention of government in such matters is examined further in this section.

Referring to the situation which existed in the 1860s, Fremdling and Knieps[63] believe that "The co-existence of different rates, rate schedules and tariff systems that prevailed in the 1860s was perceived as being chaotic."

In these circumstances, the question to be asked is why the *Verein* did not play a more constructive role in this whole matter. A defence to a possible charge of vacillation against the *Verein* has already been presented, but it can also be said that the *Verein* did make positive efforts in this direction albeit only with very limited success. These efforts can be evidenced[64] from the *Verein's* own newspaper *Zeitung des Vereins Eisenbahn-Verwaltungen* (ZVDEV) during the course of 1861 which repeatedly addressed the continuing debate about tariffs. Of particular note is ZVDEV Nr.3 which refers to "a *Verein* tariff for transport to a *Verein* station", and ZVDEV Nr.15 which explains how higher rates might be caused unintentionally by the workings of *Verbändes*, i.e. the small groupings of adjacent railways operating across multiple boundaries.

From another source [65] it is revealed that "in 1862…[a committee] recommended a list of goods classified under 33 main headings with various sub-headings." This seems to have presented a good opportunity for the *Verein* to make some headway on this contentious matter but there is no indication that anything came of it.

[62] Dunlavy (1991, p.26).
[63] Fremdling and Knieps (2011, p.140).
[64] Staatsbibliothek, Berlin. Nr. 4Nz 13615-1.1861. Bound volume holding ZVDEV Nrs. 2, 3, 4,5, 7 ,11, 13, 14, 15.
[65] *Rückblick* (1871, p.11).

Ziegler[66] comments on the evolving chaos: it was more than simply the multiplicity of firms which had emerged over the years and the manner in which regulation weakened in the face of competitive considerations. Rather, it was the decree issued in 1863 by the Prussian Trade Minister that ended Prussian state price regulation of railway tariffs which caused serious volatility. In explanation he says that this was because "while a railway company could belong to several leagues all of which set different tariffs for the same route, this system worked only while that operator had a monopoly in its own territory…[however]…this was destroyed by the Prussian policy of free competition."

Some idea of how the pursuit of profit by private railway companies in Germany corrupted and distorted the tariff system is gleaned from an unnamed British book published in 1905 but cited in the historiography:[67] "Eventually in such a system, secret tariffs evolve…which allow railways to charge more for captive traffic (e.g. your neighbourhood coalmine) and less for traffic they wish to win…There is generally no 'transparency' for less significant consumers, for example, small shippers and even individual railway passengers."

Ziegler[68] reports that from this chaos emerged a divided tariff structure which encouraged long distance rail traffic at the expense of local rail traffic. This was unpopular, even among railway operators, as was the Prussian government's unwillingness to reverse its decree of 1863. In 1865 this led to a commercial conference, the *Deutsche Handelstag*, which was normally non-interventionist, calling upon the government to re-establish control of private railway pricing. Again from Ziegler, it is learned that a different situation prevailed in the southern states. There much of the railway system was state owned and the local lines were less likely to be disadvantaged. The conclusion to be drawn here is that, in the south, railways were viewed as an instrument of integrated regional economic policy. Hence, there was less dissatisfaction with railway tariff arrangements in that part of the country. Ziegler also observed that in

[66] Ziegler (1996, pp.129-132).
[67] Norton (1915, p.2).
[68] Ziegler (1996, pp.131-132).

Prussia, as it became increasingly difficult to maintain monopolies, the railway companies became more willing to accept unified tariffs.

Fremdling and Knieps[69] comment that: “during the period of competition among lines the regulatory framework of the Prussian railway law had been ineffectual. It was particularly detrimental that a new supplier did not enter the railway market by making use of the existing network but only via the building of new lines…[but]…the railway law already included all the necessary elements to enforce an efficient regulation...”.This was noted previously: section 27 of the Prussian Railway Law (1838) allowed railway companies other than the track owner, after the first three years of its operation, to use such lines after payment of *Bahngeld* (a toll) to the owner after first acquiring a licence to operate from the Minister of Commerce.

With one exception, namely Minister von der Heydt’s “ein pfennig tariff” intervention, the Prussian government failed to utilise[70] section 27 of the Prussian Railway Law (1838). This might be seen as evidence of the struggle between statism and capitalism within the Prussian government itself.

Given the continuing interest and importance of the subject, in 1867 the ZVDEV[71] published a condensation of four articles by one O. Michaelis, an economist and politician. These argued that in respect of tariffs, there should be no government intervention, rather the market should decide. Subsequently, tariffs were again the focus of debate, and again the *Verein’s* newspaper ZVDEV[72] published the view that on long distance journeys it was competition that forced prices down.

Fremdling and Knieps[73] quote Cauer[74] when saying that: “from the 1840s to the 1870s all attempts [by the *Verein*] to reach a thorough agreement on standardizing the tariffs failed. The driving force towards this kind of agreement emerged out of the rates associations themselves in creating larger cartels.”

[69] Fremdling and Knieps (2011, p.144).
[70] Fremdling and Knieps (2011, p.145): This was by means of a threat rather than actual application.
[71] Staatsbibliothek, Berlin. Nr. 4Nz 13615-7. 1867. Bound volume. ZVDEV Nr.6.
[72] Staatsbibliothek, Berlin. Nr. 4Nz 13615-7. 1867. Bound volume. ZVDEV Nr.7.
[73] Fremdling and Knieps (2011, p.142).
[74] Believed to be Wilhelm Cauer (Snr), Professor of Railway Engineering at the Technical University, Berlin.

Fremdling and Knieps make a telling observation when they say: “This indicates that competition among lines eventually led to collusive behaviour.”[75] This should be seen as a harbinger of how the tariff problem would be eventually resolved, by co-operation rather than collusion, which conveys a connotation not just of conspiracy but a suggestion of illegality. This is credible given the repeated references in the historiography to secret arrangements.

Although rates associations had been around since 1848, Fremdling and Knieps[76] note that it was not until 1868 that real progress was made in bringing uniformity across multiple railway borders by virtue of the German central and north-western railway companies forming a *Tarifverband* (in 1868) and agreeing “a simplified uniform value classification of the commodities for fixing rates, with three classes being introduced. But, the member companies still fixed their internal tariffs according to their own principles.” It is reasonable to conclude that these German central and north-western railway companies were the emergent *General Konferenz* (General Conference of German Railways), see below.

However, this progress was short-lived because other parties preferred the wagon-load classification (based only on weight or volume x distance) probably because it was already used more extensively. To complicate matters, a third classification appeared in 1874 in Bavaria and Württemberg, the so called “mixed system” classification. This charged on a wagon-load basis but charged separately for parcels (as in Alsace-Lorraine). However, the “mixed system” applied the three value classes method (as did the central and north-western railways). Hence, the 1868 proposal of the German central and north-western railway *Tarifverband,* which appeared to be a resolution of the tariff problem, was set at nought. Consequently, by the mid 1870s, there were three main classifications in use: by value, by wagon-load, and mixed.

During this period, perhaps in a final attempt to salvage a rational set of tariffs and a tariff classification regime from the chaos which had developed,

[75] Fremdling and Knieps (2011, p.142).
[76] Fremdling and Knieps (2011, pp.142-143).

documents[77] reveal that in January 1873 in an Extra-ordinary Assembly of the *Verein* a report was reviewed about the feasibility of introducing a uniform classification of goods. The Prussian State Railway,[78] via its proxy the Lower Silesian-Märkisch Railway, took advantage of the occasion to ask that the optimum capacity system introduced successfully in Alsace-Lorraine should be taken into account. It is not without note that the Alsace-Lorraine Railway was managed by the (Imperial) REA which was staffed[79] by people from the Prussian Ministry of Public Works and that the Prussian State Railway was behind the question asked. This question was positively received by Director Schmidt of the Magdeburg-Leipzig Railway Company who agreed that attempts should be made to get the best use of capacity. However, he counselled against moving to such a scheme immediately as the Alsace-Lorraine system was based on the optimum use of capacity which depended on rolling stock being of standard dimensions. Further, it would cause upheaval to the existing arrangements. Schmidt, therefore, proposed that the Alsace-Lorraine system could be borrowed by means of rewarding better utilisation of the capacity of rolling stock. Although there was considerable support for the proposal, it became obvious that there was already a good deal of complexity in the existing arrangements through the multiplicity of charges applied, for example, for the use of covered or non-covered wagons, or based on weight etc. While it can be concluded that such diversity demonstrated sensitivity to the demands of the market, it also cast the Alsace-Lorraine system as inflexible and concern was expressed mainly on that basis. In the end much time was spent during the meeting fine-tuning existing arrangements. The Berlin-Stettin Railway Company recommended that the Alsace-Lorraine charging system, based on space utilisation, should not be rejected out of hand but should be referred for further investigation of the financial impacts.

In 1876 "(a further) initiative of the north-western German *Tarifverband* finally succeeded in introducing a reformed tariff schedule…From then on the mixed

[77] Deutsche Bahn Archiv, Nuremberg. *Protokoll.* Extra-ordinary General Assembly of the *Verein* held 20th-23rd January 1873 in Frankfurt am Main.
[78] This term is used here to describe those railways in Prussia which were already in public ownership and under the control of the Ministry of Public Works. This was prior to the taking into public ownership of all railways in Prussia from 1879, referred to as *Verstaatlichung*.
[79] Kech (1911, p.99).

tariff system was to be the guide line for fixing rates."[80] Notwithstanding this development, Henderson reports that in 1877 the *Verein* agreed common principles for the fixing of freight rates.[81] Yet it is unclear how this played out because the *General Konferenz* was already supplanting the *Verein* in German affairs as will be seen.

At this point it is necessary to draw attention to the special provisions applying to the Lines of Secondary importance introduced by the Law of 1878. Meyer[82] says that "for the first eight years of their existence…[they were allowed to]…raise or lower rates to meet their own desires, provided they…[did]…not go above a certain maximum prescribed by the minister for that period of time." Hence, still another complication was added to the whole business of rates.

As indicated above, it is reasonable to deduce that the *General Konferenz* had its genesis in the banding of railway companies operating within the North German Confederation (1866-1871). It is of note that the confederation's constitution formed the basis of Imperial Germany's constitution and contained some nine articles covering railways. Together, these factors formed a sound basis for the formation of a rival to the *Verein,* albeit without its depth of technical knowledge and expertise, and this seems to have happened. The *General Konferenz*[83] appears to have evolved into a loose association of all the German railways, under the influence of the Prussian state railways, and met annually to discuss matters concerning tariffs, fees and operating regulations. It is also credited with systematically developing under its guidance the *Reformtarif*, or reform of German railway rates. To assist in this task it had two subordinate bodies, the *Tarif-Kommission* and the *Ausschuss der Verkehrsinteressenten* (Tariff Commission and the Committee of those Interested in Transportation). Meyer[84] makes reference to the German Reform Tariff "first introduced in 1877 and through the influence mainly of the general conference [*sic*][85] it…[became]…generally more unified." It is believed that this

[80] Fremdling and Knieps (2011, p.143).
[81] Henderson (1967b, pp.47-48).
[82] Meyer (1897, p.85).
[83] Meyer (1897, p.96).
[84] Meyer (1897, pp.100-101).
[85] The text indicates that this is a reference to the *General Konferenz.*

is one and the same as the reformed tariff schedule cited by Fremdling and Knieps as being agreed in 1876.[86]

What can be drawn from the foregoing profile of the *General Konferenz* is that it was working in the background in parallel to the activities of the Imperial civil service, first Delbrück in the Chancellor's office, then the REA, followed by von Maybach and finally Bismarck himself. Bismarck secured the national rate plan into legislation by the *Bundesrat* in 1879. This is expanded below.

Amid the "to-ing and fro-ings" described above, in 1873 the Imperial government stepped in and founded the REA. Mitchell [87] recounts what happened. He saw this as "specifically intended to resolve the rate question." This was the time when the tensions between the federal government and the independent states over interpretations of the constitution were becoming marked. Subsequently, in 1875, with little progress having being made by the REA, Bismarck gave von Maybach the task of formulating a national rate plan for presentation to the *Bundesrat*. Not unexpectedly, endless discussions followed and "Maybach was forced to concede that the constitution did not actually mandate national uniformity in setting railway rates." Behind the resistance of the states was their belief that the Imperial government's policy should be transmitted by means of guidelines, but it was for the states to determine their mode of application.

Over an extended period and several conferences, a national rate plan, "the rate policy of the German Railways", comprising thirty-five articles was drafted. It is reasonable to conclude that this must have relied significantly on the work of the *General Konferenz*. Driven by Bismarck this was submitted to the *Bundesrat* in 1879 and passed into law the same year. But this belied a major split: the law had been passed by thirty-two votes to twenty-five but the four biggest states (not counting Prussia) had voted against it. To ensure common standards were applied throughout Germany, Bismarck suggested extending the authority of a special supervisory committee on rates but this was rejected. The rebuttal, supported by other railways, was voiced by Friedrich von Dillenius

[86] An apparent discrepancy in dates is a recurring feature in the historiography. Some historians quote the date an agreement was finalised, others the date of its implementation.
[87] Mitchell (2000, p.144).

(head of the railways in Württemberg and a director of the *Verein*) who it will be remembered had previously strongly opposed Scheele's plan for nationalisation of the German railways.

There were four reasons for states' resistance. Firstly, there was no agreement about the way rates should be fixed. Should this be by the value of the goods to be carried, or by the capacity of the railway wagons, or a combination of both (a mixed system)? In 1874 Bavaria and Württemberg implemented a mixed system and this was adopted nationally (pro-temps as it turned out) in 1876. Secondly, there was no arbitration body. Thirdly, the Imperial government powers of taxation were limited to indirect taxes and international tariffs whereas direct taxation was left to the states. However, "Bismarck came to realize…in the late 1870s, it lay in the Reich's interest to press for lower rates on Germany's internal transport of freight and for higher protective tariffs." Clearly this aimed to channel funds into the Imperial coffers. Fourthly, in June 1878 Switzerland called a meeting of the leading Continental countries to discuss better aligment of trade regulations; this inevitably included railway aspects.[88]

Ziegler[89] reports that by the 1880s almost all the private railways in the medium-sized German states had come under public ownership. This was caused by "the re-introduction of customs tolls on grain and iron" (see below), unresolved tensions between co-operation and competition (which Ziegler refers to as the "mixed system" but which is different from the definition used earlier in connection with tariff classification), and changed economic circumstances. These included the slump following the stock market crash of 1873 and the fall in the value of railway shares resulting from the fraudulent activities of the railway promoter and stockbroker Henry Bethel Strousberg. Ziegler believes that these factors, which had an adverse impact on business in general, conspired to make a timely case for the Imperial government's plan to nationalise all the railways in Germany. While this resulted in private railways being taken into public ownership in Prussia from 1879, it did not constitute full nationalisation, bringing all the railways in Germany under the control of the

[88] Mitchell (2000, pp.144-145).
[89] Ziegler (1996, pp.133-134).

REA, which was Bismarck's plan. Rather, it set the scene for bringing into public ownership many of the privately owned railways still in existence. However, the implication of this consolidation is that the Imperial government could then better influence the freight charges to be used by railways across Germany thus continuing the rationalisation of rates begun in 1876-1877 and the passing of the national rate plan into law in 1879.

Returning now to the customs tolls on grain and iron highlighted by Ziegler. Zussman[90] offers a view about these tolls which he calls "the 1879 German iron and rye tariff". In his assessment of the records, Zussman challenges the general view that this protectionist measure resulted from the *Junkers* and the iron and steel manufacturers petitioning Bismarck to shield them from foreign competition. Rather, Zussman identifies the prime cause as the severe economic imbalances caused by the early repayment by France of the Franco-Prussian war indemnity. As a consequence, significant inflows of capital into the new federal Germany in the early 1870s led to price inflation and when the inflows stopped a depression ensued.[91] In the depression, which it is understood from other historians corresponded with a period of increased foreign competition, the demand for protection increased. However, Zussman explains that the catalyst for the iron and rye tariff was that the depression made the Imperial government even more dependent for funds on the states. This was because it had only one source of independent revenue (namely, indirect taxation from customs and excise duties) and the states which constituted federal Germany traditionally had made good any shortfall in such revenue flows to enable the federal government to function. However, Bismarck wished to keep as free as possible from potential constraints imposed by them and seized the opportunity to introduce the iron and rye customs tariff in 1879. In a similar vein, Pierenkemper and Tilly[92] saw protective tariffs introduced around this time as "the strengthening of the Reich relative to the states". However, they noted that the power of the federal states became evident when an amendment to the 1879 tariff ("the Franckenstein clause") limited the Reich

[90] Zussman (2008, pp.1-10).
[91] Mitchell (2000, pp.142-143) challenges the idea of "The Great Deflation". This is addressed in Chapter 8.
[92] Pierenkemper and Tilly (2005, p.141).

to drawing down "130 million marks (£6.5 million) per year…[of the tariffs collected]…and called for the rest to be redistributed among the German states."

Government involvement in the setting of tariffs was a particularly complicated area which is best considered in terms of before and after the unification in 1871. The model described below relates to Prussia, but it is reasonable to assume that other states, which looked to Prussia as the largest operator of railways in Germany, followed its lead especially after the unification. But this leaves open the question of how this evolution was integrated into a German national structure following the reforms of 1895 described below. However, in view of the complexity of the task and lack of readily available material this would have to be considered as a separate research project.

As it stands, the historiography reveals the following situation: (a) before the unification, in Prussia, district governments were strongly influenced by the local nobility who played an important role in the formulation of legislation. These district governments were managed by a *Regierungspräsident* (a government appointed president) but under the direct control of ministries.[93] Ideally this linkage should have helped shape an appropriate policy on the optimum rates for the region in question to support agriculture and stimulate trade. Whether this was realised is debateable given the power and influence of vested interests, such as the *Junkers* in East Prussia. Further, there was a link under section 32 of the Prussian Railway Law (1838) between competition to serve particular places and pricing policy legislation which permitted the government to suspend competition and regulate the prices railway companies were allowed to charge;[94] (b) after the unification, in Prussia, an evolving structure of government displaced the earlier district governments. Meyer[95] reports that initially there were in Prussia eleven *Eisenbahndirektionen* (railway operations offices*)* and seventy five *Eisenbahnbetriebsämter* (railway administration offices) reporting to the Minister of Public Works, who was the executive head of the railway administration.

[93] Dunlavy (1994, pp.23-24).
[94] Ziegler (1996, p.126). Ziegler identifies a similar right under section 10 of the Bavarian Railway Act (1855).
[95] Meyer (1897, pp.87-89).

Although from 1 April 1895 a re-structured and refined organisation was introduced, in 1878 the Prussian government gave effect to a law placed on the Imperial statute book on 11 January 1875. This Imperial law had directed all railways in Germany to adopt a railway advisory board model pioneered in Alsace-Lorraine by the REA.[96] This required that "…the more important questions of railway management should be decided only after consultation with the representatives of the commercial, industrial and agricultural interests."[97] It is not clear from the historiography to what extent states other than Prussia complied with the federal government's edict. It has been noted already that they ignored other instructions and requests for information. However, in so far as Prussia was concerned, railway advisory boards played a unique role in agreeing realistic tariffs.

Cohn[98] summed up the government's responsibility regarding railways saying "it is the duty of the state…to take care that the capital of the country is employed only where it can exert a fructifying influence." The Prussian case is evidence that in the post-unification era the Imperial government sought to devise ways, for application via its constituent member states, of ensuring that its major capital asset, the railways, were used in an efficient and effective manner. An emphasis on economic considerations including the setting of realistic rates was seen as an essential ingredient in this by means of consultation with stakeholders. This supports Cohn's proposition.

Meyer illustrates and brings to life one such case.[99] This concerns a request to the government in October 1893 to introduce reduced special rates for fertilisers "in order to maintain and promote agriculture, and to increase the receipts of the railroad from the traffic with the interior." The government then acting through "its ministries of public works, and of agriculture, domains and forests, supported by agricultural experimental stations, set about establishing

[96] In addition to its normal responsibilities, the REA had been assigned the task of acting as the Imperial government's railway authority for Alsace-Lorraine.
[97] Cohn (1893, p.187).
[98] Cohn (1893, p.185).
[99] Quotations in this paragraph come from Meyer (1897, pp.105-107). Regarding the National Council, this was the advisory board to the government and considered submissions on railway matters, particularly tariffs, from subordinate Circuit Councils. The text implies that the National Council was in existence prior to the re-structuring of the government bureaucracy in 1895.

the occurrence and production of natural and artificial manures in different parts of the country, their price and value in use, and the nature of their application." In addition, a number of bodies reported on "the prices different fertilisers could be profitably used on different soils. The agricultural authorities showed where and to what extent these soils existed, and elaborate statistics of the railroads and manufacturers told how much had actually been consumed." The aim of this level of enquiry was to determine "the capacity of the land to absorb profitably artificial manures, and, the ability of the farmer to secure them." Despite this the National Council was not satisfied that the evidence was sufficient to justify approval of the 500 page submission, and it further demanded "that an exact and conscientious examination of the effect of existing rates on the widest and most effective use of these was necessary." Consequently, all the evidence from stakeholders was scrutinised again before it was tabled for a final verdict. This level of stakeholder involvement, meticulous specialist input, transparency and the fairness of the process secured the active support of all the parties involved.

Other historians have reported the facts relating to the re-organisation of the Prussian government which evolved after 1871, namely a structure with integral and obligatory railway advisory bodies. However, these historians have failed to emphasise the uniqueness of this construct. Its principal feature, a formalised democratic process of extensive consultation with stakeholders, had not only an economic but a political dimension because, paradoxically, it gave voice to every (potential) stakeholder, or anyone affected by an issue, at a time when political agitation was resulting in suppression and led to the Socialist Party being proscribed by the Imperial government. Further, the diverse membership of advisory body meetings constituted a symbiotic relationship between representatives of all elements of the economy, a process that could only serve to deliver economic benefit. Referring to railway freight charges, Huebner[100] put it like this: "[the revised arrangements] have made it largely possible to bring Prussian rates into conformity with economic needs."

[100] Huebner (1907, p.80).

As regards the *Verein,* what is noteworthy about this Prussian government consultation initiative is that the *Verein* was not considered important enough to hold a prominent position of membership, rather it was relegated to a minor role in the advisory process and is shown on the organisation chart at level III under *Imperial and International bodies.* Its entry reads*:* "the Society of German Railway Managements [*sic*]…considers international traffic questions under the Berne treaty."[101]

Archive documents[102] reveal that a meeting held in 1912 by the Imperial government comprised only the REA and the Prussian Ministry of Public Works together with 52 railway administrations, 30 of which were outside Prussia. Another 36 railways were not represented. However, at this meeting the amendments agreed (by weighted voting according to railway company size) were in respect of previously agreed tariff regulations. The significance of the archive material is that the *Verein* is not mentioned thus giving credence to the fact that by that time it had been supplanted in purely German affairs by the *General Konferenz*. Further, despite 30 of the railway administrations present being from outside Prussia, they appear to have been following the Prussian line. Growing economic competition and great power politics might also have forced them closer to Prussian / German allegiance. Thus, by this time, the contentious question of tariffs seems to have been brought under control to a significant extent. This is credible given the earlier references to the work of the *General Konferenz*.

In fact the improvement was probably achieved well before 1912. The historiography,[103] citing reference to an unnamed British book published in 1905, reported how observers in Great Britain had taken note of the many improvements wrought in the Prussian railways since they were taken into public ownership. It said: "the German freight tariff is of beautiful simplicity…every trader possesses a little book by means of which the office boy can calculate in a moment the exact amount of the freight charges for any weight between two stations." Further, it noted that "in Great Britain, it requires

[101] Bradford (1907, p.77).
[102] Staatsbibliothek, Berlin. 4 Nz 36009/36. *Niederschrift über die Tarifangelegenheiten abgehaltene Generalkonferenz der deutschen Eisenbahn-verwaltungen verhandelt*. Berlin, den 20 Dezember 1912.
[103] Norton (1915, p.3).

years of travel and careful observation to learn one's way across the country…and to avoid the many pitfalls which are everywhere placed in the way of the inexperienced traveller. In Germany such pitfalls do not exist, and the greatest simpleton will travel as cheaply, and comfortably, and as rapidly all over the country as will the most cunning commercial traveller."

In conclusion, it is considered that the *Verein* was confronted with an impossible task as regards rationalising railway tariffs. Ziegler[104] explained the issues when he wrote about railway companies forming *Eisenbahnverbände* (railway leagues) to agree cross-border prices. Ziegler believed that this came about because the *Verein* was unable to act as a useful intermediary given the complexities of the situation. He observed that the railways were operating in a free market where competition was believed to deliver the "right price". However, such prices could only be arrived at for particular destinations across borders through bi-lateral agreements between railway companies. The conclusion to be drawn here is that railways alone had full and current knowledge of the competition from road and waterborne hauliers in their immediate areas, and the maximum prices which they could set competitively to win business in that situation.

Nevertheless, this was not the full picture; railways were in competition with one another and the winning of profitable business remained a commercial imperative. Hence, while railway companies could not function effectively without the *Verein* feeding them technical information and guidance on operational and inter-railway administrative matters, in the matter of pitching their prices in competition against other rail carriers, each railway had to be its own master. This demonstrates the limits of the *Verein's* influence and usefulness to its members.

The rest was down to the Prussian government which played an inconsistent game, first it removed the constraints of state price regulation of railway tariffs in 1863 and thus opened the way for to free market competition. Later, it introduced a mechanism, based on law, whereby railway advisory boards with stakeholder membership became part of the government administrative

[104] Ziegler (1996, pp.126-128).

machine with a key role in regulating the railways and setting economically realistic freight charges. No research has been carried out to unearth statistics (if they still exist!) which might demonstrate that this radical approach, certainly by the standards of those days, helped beneficially transform the Prussian economy. Nevertheless, anecdotal evidence of the type cited by Meyer and quoted earlier is plentiful and it seems reasonable to conclude this was the case.

As stated at the beginning of this section, the models considered here have been Prussian. However, it is unlikely that seeing the success of the consultation initiative with railway stakeholders through the railway advisory boards, the non-Prussian states did not eventually decide to comply with the Imperial government's law of 1875. To establish this and to quantify the benefical economic impact for Germany as a whole would require a separate project.

The Railways' Effect on Transportation Costs and the Economy

The arrival of the railways began a transport revolution which transformed economies and societies wherever they were introduced. As far as Germany was concerned, in broad terms, the principal economic effects were to catalyse the process of industrialisation and, as seen, to bring about major improvements for agriculture. This could not have come about nationally, across Germany, by the railways alone without the involvement of the banks and workers to provide labour for the mines and emergent industry. Yet, both of these factors involved the railways. In the former case "railways…mobilized large, unprecedented sums of capital. They did so largely through the banking system. For this reason…[this]…can be viewed, in a sense, as a backward linkage generated by the former."[105] In the latter case, it was the railways which provided the means of mobility for the use of "redundant" labour from the eastern regions consequent on the *Bauernfreiung* (repeal of serfdom) in 1807 and urbanisation attendant on industrial development. This law did not have immediate effect as is sometimes implied in the historiography but took decades to work through. The resulting stream of landless labourers sought

[105] Pierenkemper and Tilly (2005, p.64).

work in the coalfields and iron works of North Rhine-Wesphalia, the coalfields of Silesia, and in Berlin.

The introduction of the railways is seen as a transport revolution because its immediate effects were to provide an all-weather, rapid, transport system which could haul far greater amounts of freight in a single train load than was hitherto possible by horse-drawn carts.[106] The all-weather aspect was particularly important because it ensured availability and reliability regardless of the vagaries of the weather. Typically, at the outset of the railways, depending on topography, journey times could be halved. This figure steadily improved as locomotives increased in power and speed, and connectivity between lines built by different companies was achieved. This latter point was attributable solely to the *Verein's* campaign for standardisation. Altogether this was an immense leap forward as the journey times by stagecoach could take well over a week: it once took nine days to travel from Frankfurt am Main to Berlin a distance of only 342 miles.[107]

As a consequence, after the advent of the railways in Germany in 1835, traditional pricing for the transportation of freight and passengers no longer applied. Not only were cost calculations affected by quantum reductions in the time necessary to cover distances and increases in loads hauled, but the terms and conditions of a railway's charter from government, government rules on tariffs and restrictions on profits, and the forces of competition, all had to be taken into account in costings to arrive at a price. Then, "real costs per passenger kilometre and per ton kilometre of transport services fell sharply."[108]

Until 1835, most transport in Germany was on roads or by inland waterways. Road hauliers were not only constrained by the load a horse-drawn cart could carry and the weather, but in Prussia they also had to pay road tolls until 1875.[109] By contrast waterway users were probably helped, in the short term, by the Congress of Vienna (1815) declaring the freedom of navigation on the

[106] O'Brien (1983, p.4) reports that not only horses, but oxen and even mules, were involved.
[107] Blackbourn (1998, p.9).
[108] O'Brien (1983, p.4).
[109] Kopper (2015, pp.224-225).

River Rhine.[110] Although the railways soon displaced road transport as a preferred carrier, except where roads were more convenient, it would be some time before railways displaced water-borne transport.

Gutberlet[111] provides an explanation for this. As most early railways followed long established trade routes[112] along major rivers this might have presented an opportunity for the railways to take over from water-borne transport part way through a journey. However, the cost of reloading between the barges and railways proved too expensive for long distance haulage by rail.

However, this was not the full story, for at this point the *Verein* had not yet come into existence to bring order to arrangements between railway administrations. This was especially apparent regarding the requirement to off-load and re-load freight where different railway company boundaries were crossed thereby generating a cost penalty. Thus in 1846 railways were, on average, significantly more expensive than water-borne transport. Initial impetus for the convergence is credited to the introduction of the "ein pfennig tariff" in Silesia in 1849.[113] This was adopted by other railway companies "so that by 1862 the special coal tariff applied to all important northern German lines."[114] It then took some thirty eight years, from 1846 until 1884, for freight rates for carriage by rail and by waterborne transport to converge.[115]

In the economic historiography of Germany relating to the period 1840-1860, the linkage between the railways, coal and iron ore is a recurring theme. Fremdling[116] wrote: "the interplay between the railway and heavy industries formed a leading sector complex of German industrialisation." Of the mineral deposits, it was coal that had the most resources with vast coalfields in Silesia, the Ruhr and the Saarland. It was coal that fed burgeoning industry because it is both a fuel and a raw material. Yet, this "feeding of industry" was possible only as a result of the huge quantities of coal which the railways were able to

[110] World Bank on Transport Costs. pp.173-175. https://siteresources.worldbank.org Accessed 1 February 2019.
[111] Gutberlet (2013a, p.4) citing Heinze and Kill (1988).
[112] This assessment is at variance with Hornung. See Regionalism in Chapter 8.
[113] Gutberlet (2013a, p.4) citing Heinze and Kill (1988).
[114] Gutberlet (2013a, p.4) citing Fremdling (1995).
[115] Gutberlet (2013a, p.4).
[116] Fremdling in O'Brien (1983, p.136).

haul unceasingly, together with the ensuing lower transport charges they offered. Besides coal and iron ore, Germany was rich in other mineral resources and had deposits of lignite (brown coal), lead, zinc and potash (found in 1904 in occupied Alsace).[117] Rail freight allowed all these minerals to be exploited to their full potential and thereby for the mines to realise economies of scale. Consequently, when these cost savings were passed onto the mines' customers, they were instrumental in the industrial and agricultural sectors being able to market their products more cheaply.

Understandably, the historiography focuses on the economic impact of transport which was felt throughout the economy. However, here it is the railways' particular effect on transportation costs and the economy which is being considered. The quantum leap in the amount the railways were able to transport has been noted, as has their all-weather advantage over alternative modes of haulage. However, the concentration on these factors and the continual arguments about freight rates over many decades fails to provide perspective. Changing the focus immediately presents a new picture which demands a re-appraisal.

The initial stages of the railway network in Germany were well on the way to being completed by the end of the 1850s. After this came the upgrading and a slower construction of double-tracked lines. Nevertheless, at this time railway freight in Prussia, the most industrialised area with the largest concentration of railways, constituted only one per cent of Prussian freight.[118] Another source,[119] reports that "bulky commodities such as coals…barely reached one per cent of total (German) railway revenues during the early 1850s." The other bulky commodities referred to (which included grains) had low value in relation to weight; these were shipped more cheaply on waterways. However, because the volume of this business during the period 1830s to 1850s was below a critical minimum it did not attract the level of investment which would have financed the building of new canals as a viable alternative to the railways. The conclusion to be drawn is that water-borne traffic in particular continued to be a

[117] Henderson (1967b, p.45).
[118] Pierenkemper and Tilly (2005, p.67).
[119] Fremdling in O'Brien (1983, pp.139).

viable alternative for certain categories of freight until then. Given the figures quoted, the question arises as to what other goods the railways carried, and what of passenger traffic? The same source identifies passengers as delivering more than fifty per cent of railway revenues in Germany in 1850 and that "goods with high value-weight ratios dominated freight transportation."

Earlier it was noted that the additional cost of re-loading cargo from barges to railways had proven prohibitive in the early days. Gutberlet[120] gave this as an explanation why the railways attracted mainly passenger traffic.

By 1860 the picture had changed so that in Prussia rail freight amounted to fourteen per cent of all freight.[121] Much of this was attributed to "coal transportation, facilitated by special train rates." This was a reference to the "ein pfennig tariff" forced upon the Upper Silesian railway by the Prussian government. While this doubtless was a major impetus in transforming the figures for rail freight in Prussia, others factors came into play. Between 1852 and 1882 the total track[122] laid down in Germany increased from 6,605 kilometres to 35,081 kilometres and railway net investment as a per centage in aggregate of the German economy was moving from 11.9 per cent to 25.8 per cent over the period 1851-1879.[123] This investment was a powerful push to extend and establish the railways. It was assisted in no small measure by the diffusion of engineering knowledge and business administration techniques, and by the campaign for standardisation and inter-operability of railway lines, all promoted by the *Verein* and the *Verein der Techniker.* These developments made railways the dominant means of transportation and the efficiencies realised allowed price reductions, gave competitive advantage over other forms of transport and created new markets. Here, it is appropriate to examine the term "new markets". Obviously, providing farmers with the means of speedily delivering perishable produce to a distant city for the first time constituted such a market. However, in the early days of coal mining most of the output went to factories close to the pit head. The "ein pfennig tariff" changed that by make it

[120] Gutberlet (2013a, p.4) citing Heinze and Kill (1988).
[121] Pierenkemper and Tilly (2005, p.67).
[122] See Appendix B.
[123] Pierenkemper and Tilly (2005, p.62 Table 15).

financially viable for the first time to haul coal from Upper Silesia to Berlin, thus Berlin was a new market.

Earlier in the chapter the vexed question of tariffs was addressed. This looked at tariff leagues (groups of companies) and at competition between railway companies. All of these initiatives were aimed at securing profitable business or, doubtless in some cases, just staying in business.

In this connection, the ending of Prussian state price regulation of railway tariffs in 1863, the agreement of a mixed tariff system in 1876 (which unexpectedly became just an interim measure), and the national rate plan which became Imperial law in 1879, all served to stabilise and move towards a necessary rationalisation of railway tariffs. At its worst "there were no fewer than 1510."[124] Thereafter, in Prussia, the railway advisory councils and the nationalisation of Prussia's railways (1879-1882) most certainly drove the attainment of more economically realistic tariffs. In parallel, Prussia showed leadership through its membership of the all-German *General Konferenz.* It will be remembered that at the time of the unification, in 1871, there were over 60 railway administrations in Germany split between state owned and privately owned administrations. These managed a total track distance of 27,970 kilometres by 1875.[125] From the activities and decisions of the *General Konferenz* described earlier, it is reasonable to conclude that the direction of travel on tariffs across Germany followed that of Prussia.

However, this has to be considered as one side of an equation. The other side was undoubtedly the re-emergence of canals as a viable alternative to the railways. Apart from any other increases in efficiency which may have been realised, the principal reason for this was the introduction of steam to power water-borne vessels. Hence, where railways competed with steam-powered boats for the transportation of bulky or heavy commodities, "the decline in costs per ton-kilometre of freight carried was…much less obvious."[126] This can be interpreted as a closing of the gap between the two price offerings driven by

[124] Fremdling and Knieps (2011, pp.140-141).
[125] See Appendix B.
[126] O'Brien (1983, p.5).

competition. Fremdling [127] summarised the situation thus: “Compared to transportation by inland waterways the railways peaked in the 1870s. Until the First World War both means of transportation (measured in tons-kilometres) grew roughly at the same rate.” It is seen that this assessment of when the railways peaked (in the 1870s) is somewhat at variance with Gutberlet’s more recent research (which cites 1884). What can be said is that railway traffic increased as the railways supported the new chemical and shipbuilding industries. Further, the diversion of certain freight from the railways to accommodate this new business undoubtedly benefited waterborne carriers. This would explain the equalisation between both modes of transportation and in the context of the last quarter of the century the difference in dates is neglible.

This marked the end of the primacy of the railways and engendered investment interest in canals. The construction of the Dortmund-Ems Kanal connecting the Ruhr via the River Rhine with the North Sea commenced in 1882 and it opened in 1899. This was followed by the Mittelland Kanal. Hence, well before the end of the century water-borne transport had become a viable option to the railways, albeit dependent on vehicular transport to complete the journey (unless the goods were to be stored in dockside warehouses). [128] The construction of the Mittelland Kanal was a massive project to connect the river basins of the River Rhine and the River Elbe. This would take until 1938 to complete, but in the meantime “this suggested that railroads had the potential to greatly reduce transportation costs between these two (river) systems.”[129]

In summary, under the influence of the Imperial government, operating through its proxies the Prussian government and the Prussian State Railways, and as a result of the re-emergence of competitive water-borne traffic, freight charges which were susceptible to market forces were inexorably driven down. This explains O’Brien’s report that “freight rates on German railways declined over the nineteenth century to one quarter of their level for 1845.” [130] Still, this appears to be an under-estimate (a difference of fifteen percent) because some

[127] Fremdling in O’Brien (1983, p.137).
[128] Fremdling in O’Brien (1983, pp.137-139).
[129] Gutberlet (2013c, p.1).
[130] O’Brien (1983, p.11).

years later Fremdling published a new set of figures. The interpretation suggests that "during the second half of the nineteenth century… the railroad boom cut freight rates [in Germany] by as much as ninety percent for overland transportation." [131] Nevertheless, there are grounds for arguing that the increased revenue of the Prussian railways in the last quarter of the century demonstrated an elasticity of demand connected with the reduced freight charges. This in turn, freed-up funds in the German economy as a whole which financed other activities.

The *Verein* -successor to the *Zollverein* in the Commercial field?

Often in recent times historians have pointed out the similarities between the *Zollverein* (the Customs Union) and the European Union (under its various titles). Each started off as a trade and economic community, but the underlying dynamic and direction of travel of the *Zollverein* was political, sustained and underpinned by committed professional civil servants. Consequently, as the *Zollverein* developed, its political priorities overshadowed the more mundane aspects of its work connected with trade, and trade came to be more associated with the *Verein.* But, as was noted by the entrepreneur Friedrich List,[132] the *Zollverein* and the *Verein* were as "Siamese twins" because their activities in many ways were intertwined.

Fischer[133] compares the *Zollverein* with the European Economic Community (forerunner of the EU) in terms of motives, institutions and significance. This is of value in seeking to compare how the *Zollverein* might have been similar to the *Verein* and how the *Verein* might even be considered the successor to the *Zollverein* in the commercial field. Fischer[134] explains the two different views of the *Zollverein*: (a) that it was an economic construct, a free trade zone; (b) that it was a campaign aimed at unifying Germany politically. Fischer appears to dispose of the latter point saying that German unification was only visualised by the liberal bourgeoisie, but he later qualifies this assessment. Nevertheless, he believes that the initial driver for most states was trade and the realisation of a

[131] Gutberlet (2013b, p.5) citing Fremdling (1995).
[132] Sheehan (1989, p.468).
[133] Fischer (1961).
[134] Fischer (1961, pp.105-109).

better revenue stream for state coffers; for Prussia it was "to have an effective external customs border around its own state."

Although the *Zollverein* proposed many commercially oriented ideas it was unable to implement them; only the *Verein* through its day to day business was able to put these into effect thus strengthening the perception of its being the *de facto* successor to the *Zollverein*, while the *Zollverein*, concentrating on its political initiatives, was capturing the press headlines. Sometimes these initiatives, for example regarding rates proposed by the *Zollverein* and its protectionist stance in 1861, were challenged by the *Verein* as being against the common interest and inimical to the health of the economy.[135] On such occasions it is likely that it was then perceived as more than a trade association, a more important institution, perhaps even a counter-balance to the *Zollverein.*

In this thesis, in order to compare and evaluate the two organisations, reliance has been placed principally on primary sources as well as the writings of the following historians: Blackbourn, Clark, Dunlavy, Fischer, Henderson, Kaiser and Schot, Kreutzmann, Lommers, Ploeckl, and Mitchell who view the *Zollverein* from different perspectives and whose assessments of the achievements and influence of the Customs Union vary significantly. Looking first at the *Zollverein*, at the outset it is important to note that the *Zollverein* evolved over a period of sixty six years from the first treaty in 1819 until the last in 1885. After the German empire was established in 1871 the *Zollverein* became part of its political structure.[136]

The *Zollverein*

Tilly sets the scene:[137] "Germany's industrial development lagged behind that of England, France and Belgium in the first half of the 19th century…There were various plausible reasons for this, e.g. political fragmentation, which hindered the formation of a united German market."

[135] Staatsbibliothek, Berlin. ZVDEV Nr.4Nz 13615-1.1861. Nr.8.
[136] Hahn (1982) and Henderson (1984) cited by Ploeckl (2010, p.4).
[137] Tilly (1980, p.1).

What then was the genesis of the *Zollverein*? This takes us back to the period immediately after the end of the Napoleonic Wars which concluded with the Congress of Vienna in 1815. From Clark[138] it is known that the small print of the settlement delivered by the subsequent German Confederal Treaty (1815) reduced the number of German states to 38, all independent but brought together in a loose confederation, but with the addition of Austria, called the German Confederation. This had a diet, or parliament, in Frankfurt am Main, but it had no executive powers. Its effectiveness was therefore limited to providing a focus for diplomatic interactions. This was Austria's preferred solution, not Prussia's, and left Prussia without structures to which it could turn to support its initiatives relating to its two major concerns: customs arrangements and military security. As regards customs measures, Fischer[139] cites Article 19 of the Confederal Treaty as making provision for a customs union, however, Austria was not supportive of the idea. Nonetheless, this presented Prussia with the opportunity of taking leadership on such matters.

To appreciate Prussia's concerns it is necessary to understand the settlement of 1815. Prussia secured new lands which greatly increased its size such that it stretched from Aachen in the west to Königsberg in the east. The only problem, as Clark [140] relates, was that its newly acquired territories in Rhineland-Westphalia and in (part of) Saxony were separated by Hanover, Brunswick and Hesse-Kassel. While this was a gap of only 40 kilometres at its narrowest point, clearly it presented sovereignty issues relating to borders.

Prussia was changed in another way as regards its geography by the Congress of Vienna settlement. The newly acquired lands meant that its "centre of gravity" shifted westward such that it then straddled north central Europe. This was to have significant consequences when the railway age arrived in Germany in 1835.

By coincidence the newly acquired territory of Rhineland-Westphalia, and Silesia which it already owned, lay at the periphery of Prussia's kingdom and were also rich in minerals, particularly coal and lignite, which could only be

[138] Clark (2006, pp.389-391).
[139] Fischer (1960, p.69).
[140] Clark (2006, p.389).

exploited by improved means of transportation and by lowering existing tolls. This explains Prussia's two concerns: customs arrangements with neighbouring states in order to facilitate trade, and access to its newly extended lands for reasons of military security. To address these issues, Prussia took steps to form a customs union and set about repairing the highways, rivers and canals which had been neglected or damaged during the Napoleonic War to allow the rapid deployment of troops. But this section is only concerned with the customs union.

It will be remembered that at war's end Prussia was in financial difficulty. To encourage trade and business the Prussian Finance Minister, Maassen, simplified its customs system and over the period 1818-1828 Prussia persuaded some states to adopt this system thus establishing the Northern Customs Union.[141] By this means customs duties were reduced and the passage of goods eased across one another's territories. Hence began one of the three main strands of what would evolve into the *Zollverein*. The others were the South German Customs Union (1819-28)[142] led by Bavaria-Württemberg and, over an extended period, the Middle German Commercial Union (1828-54). This latter customs union had been set up belatedly by Hanover, Brunswick, Frankfurt am Main and others worried about the free flow of trade from the northern German ports. Along the way some of its members made accommodations with Prussia but it continued independently with a reduced membership beyond 1834 when the Northern and Southern Customs Unions joined together to form the *Zollverein*.[143] Given that the original purpose of the Middle German Commercial Union had been to frustrate any link between the Northern and Southern Customs Unions, and that it had been

[141] Henderson (1975, pp.32-34, p.37) reports that Karl Georg von Maassen, Finance Minister (1818), simplified Prussian customs duties and tariffs, and that "the Maassen Tariff was considered the most liberal in Europe in the 1820s". Subsequently, in 1828, agreement was reach with Hesse-Darmstadt which was seen as "the first step towards the establishment of a German customs union based on the Prussian tariff." This was realised fully in 1833 when all members of the putative *Zollverein* agreed to adopt the Prussian tariff.

[142] The timescales around the founding of the *Zollverein* used here are based on Henderson's dates. By contrast Clark (2006, p.391) implies that Bavaria-Württemberg had formed its customs union in 1825. Such discrepancies may be explained by the complexity of events at this time and time lags in implementing agreements.

[143] Henderson (1967b, pp.17-18).

supported by Austria for this reason, Henderson[144] reports that the celebrated German historian Treitschke "later denounced the (Middle German Commercial) union as 'a malicious and unnatural conspiracy against the Fatherland'."

The launch of the *Zollverein* on 1 January 1834 was a cause of great excitement and jubilation. The German historians Treitschke and Fischer are most quoted on this matter. Henderson[145] quotes Gustav Fischer: "At the stroke of midnight (31st December 1833) every turnpike was thrown open, and amid cheers the wagons hastened over frontiers which henceforth they could cross in perfect freedom. Everyone felt that a great object had been attained."

Henderson[146] reports that the *Zollverein* established a market of over twenty three million people in eighteen states using a single tariff set by Prussia, the proceeds of which were shared proportionally according to the members' populations. Henderson[147] further recounts that in the early years total revenue increased from 14.5 million thalers (£2.23 million) in 1834 to 27.4 million thalers (£4.21 million) in 1845 and that *Zollverein* members were well satisfied with these commercial and financial results. But what of the political implications? These had profound consequences which Henderson[148] highlights when he reports that "While Austria dominated the Confederation at this time, Prussia was the leading state in the *Zollverein*. In December 1833, on the eve of the founding of the Customs Union, the Austrian delegate to the Diet of the Confederation wrote: 'The *Zollverein* is one of the chief nails in the coffin of the German Confederation…Prussia is now taking over the actual leadership of Germany's policy, Austria's leadership being merely formal'." Clearly, this was a major watershed in modern German history and, consequently, might be seen as a critical stepping stone on the path to unification.

The *Zollverein* was covered by an initial treaty of 8 years, with two subsequent treaties each of 12 years, and management was by means of periodic

[144] Henderson (1975, p.35).
[145] Henderson (1975, p.36).
[146] Henderson (1975, pp.34, pp.36-37).
[147] Henderson (1967b, p.18).
[148] Henderson (1975, p.37).

Zollverein congresses;[149] this is dealt with further below. Over subsequent years the life of the *Zollverein* was extended until 1886[150] during which time the three Hanseatic ports of Lubeck, Hamburg and Bremen gave up their economic independence in the 1880s.[151] The conclusion to be reached here is that given the requirement for recurrent revalidation, the *Zollverein*, unlike the *Verein*, should not be considered a permanent institution. In fact it calls into question whether the *Zollverein* can be called an institution at all, because Ploeckl[152] comments that: "the *Zollverein* was not really an agency, it was an agreement between sovereign governments, who agreed to implement certain policies in their own customs administration. There was maybe a small office that co-ordinated monetary flows…and statistics but that was purely technical and had no policy role… It is also visible in another role, namely that trade agreements with other countries could be negotiated by individual states (rather than the *Zollverein*) and then be ratified by the member states." Nevertheless, the evidence which follows will produce the conclusion that the *Zollverein* was a *de facto* institution, albeit one which was loosely constructed and held together in an unorthodox manner by treaties. Further, its fabric was strengthened by its member states all being geographically juxtaposed and its members, in the main, of the same ethnic origin sharing language and culture.

Fischer,[153] in examining the legal structure and administrative aspects of the *Zollverein*, reports that it was the first time that sovereign states had joined together bound by treaties to form a customs union. Altogether some 130 treaties, both bi-lateral and multi-lateral, were signed. While the treaties themselves appear complex in their detail, in practice they seem to have been simple in application, probably because each of the parties desired financial improvements and the anticipated revenues would constitute the main source of income for members of the *Zollverein.* This was in an age before the many taxes levied by governments today became available to their treasuries.

[149] Henderson (1967b, p.18).
[150] Henderson (1967b, p.26).
[151] Henderson (1939, Reprint 2013, p.342); Fischer (1960, p.70).
[152] Ploeckl correspondence with Flood, August-September 2018.
[153] Fischer (1960, pp.67-71).

Initially[154] the larger states, Prussia, Baden and Württemberg, had wanted to form a joint customs administration but this was blocked by smaller states. As a compromise all the states then agreed to: re-structure their customs administrations on the Prussian model; deploy civil servants, called *Kontrollbeamte,* to central customs offices to carry out reciprocal audits on other states to monitor compliance with treaties. To give the civil servants focus they were directed to work in the interests of the whole *Zollverein*. Kreutzmann identifies this as "the first important step towards administrative integration". As a result they acquired specialist knowledge in support of General Conference decisions, and extensions to treaties, becoming a *de facto* elite "who developed a feeling of collective identity." In the process, although seconded civil servants were under instructions from their own governments they frequently argued against the wishes of their ministers; some, for example Biersack, were disciplined for their trouble. Therefore, it can be said that the civil service was a key element in holding the *Zollverein* together through turbulent times.

The *Zollverein*, which initially was an inter-governmental association, developed over its lifetime into a supra-national organisation.[155] That is, it progressed from an inter-governmental organisation of sovereign states "which merely committed to abide by particular standards" to one whereby "they gave away their sovereignty in particular areas of policy and subjected themselves to the legislative and judicial power of the shared organs."[156]

As regards the management of the *Zollverein*, "the executive body was the annual general congress. This could sit for over six months and alternated its venue between member states' capitals; delegates were bound by instructions. With the exception of some small states who could delegate their vote to a larger state, each state had one vote. Unanimity in the decision making process was mandated for each decision. This veto power…was not abolished before the foundation of the North German Confederation (and after 1871 the customs administration was transferred to the federal authority)."[157]

[154] The quotations in this paragraph come from Kreutzmann (2013a, pp.194-195).
[155] Kreutzmann (2013a, pp.190-194).
[156] Kreutzmann (2013a, p.192).
[157] Fischer (1960, p.78).

Kreutzmann[158] describes the General Conference's business process: "the General Conference set the customs tariff; decided the settlement and accounting for common customs revenues; considered proposals to amend regulations; considered complaints from member states. Most importantly, its decisions regarding common customs legislation had immediate effect in member states. This led to the historian Huber judging the General Conference as a 'genuine legislative organ of the *Zollverein* that created supra-territorial law'."

The characteristic of unanimity, which facilitates successful institutions, prevailed in the *Zollverein's* formative years and lasted until 1867. This bears comparison with the *Verein*[159] and Fischer's assessment brings to mind a work by Aoki et al*, The Firm as a Nexus of Treaties.*[160] The *Zollverein* was such a nexus of treaties.

In comparison, the *Verein* had an Executive Board whose role was fulfilled by one of its railway administration members being voted by the membership of the association to manage its business affairs for a term of two years.[161] That the same few administrations were voted into office repeatedly does not detract from the process. This executive body was supported by an administrative bureau staffed by permanent employees and by committees responsible for given topics. [162] Each committee was chaired by a different railway administration but was comprised of members from other railway administrations. Initially, the General Assembly[163] met twice each year, but from 1864 meetings occurred biannually; in 1873 this returned to twice yearly and from 1886 reverted to once every two years. At the outset, each railway administration had one vote. This changed subsequently based on a member's length of track.[164] Each member held a veto and decisions had to be accepted

[158] Kreutzmann (2013a, p.195).
[159] *Festschrift* (1896). *Verfassung*, pp.12-13
[160] Putterman (1991). Review of Aoki et al (1990).
[161] *Festschrift* (1896). *Einleitung*, p.XIV.
[162] *Festschrift* (1896). *Verfassung*, p.7.
[163] *Festschrift* (1896). *Verfassung*, p.9
[164] *Festschrift* (1896). *Verfassung*, p.12: states: "Originally each administration held one vote… [in 1849 Austria demanded two votes]… A committee proposed votes be allocated proportional to each member's line length. The exact formula changed several times."

unanimously within eight weeks. However, from 1875 decisions of the General Assembly took effect provided nine tenths of the membership approved them within eight weeks. The exceptions were amendments to the Articles of Association and tariffs. In 1876 some additional exceptions were approved. Altogether, this was a very democratic process.[165]

It is useful to compare the personalities involved in establishing the *Zollverein* with the leading dignatories of the *Verein* (given in Chapter 4) and the leading characters in the *Verein der Techniker* (in Chapter 6). Henderson singles out leading Prussians, who over a period from the first treaty (1819) until the last (1885), helped re-shape the German economy and influenced the coming together of the German states culminating in the unification in 1871. These were: Maassen, Motz, Eichhorn, Kühne, Philipsborn, Pommer-Esche and Delbrück, who he describes as "men of ability, character and courage." These men were principals who had stood fast and "kept on track" through many years of political turmoil and challenge. Consequently, he considered "the *Zollverein* to be the contribution of the Prussian civil service to the founding of the German Empire".[166]

For his part, Kreutzmann gives a more balanced picture and includes non-Prussians. He referred to this group as *die Bürokratische Funktionselite* (the elite of functionaries) of the German *Zollverein*: Bever, a civil servant from Bavaria; Braun, Minister President of Nassau; Behr, Finance Minister of Saxony as well as Weinlig, and later Friesen, Interior Ministers of Saxony. But he also notes that a number of non-Prussian key personalities were either pupils of Prussian principals (e.g. Thon, civil servant, Saxony, of Motz) or had been sponsored by them (e.g Biersack,[167] civil servant from Hesse, appointed as Director of Customs for Frankfurt). As regards the Prussians themselves, Kreutzmann identifies Maassen, Motz (the principal of Thon and Kühne), Kühne (the principal of Delbrück) and Delbrück himself as those who played a notable part in safeguarding and developing the *Zollverein*. This is not a

[165] *Festschrift* (1896). *Verfassung*, pp.12-13.
[166] Henderson (1939, Reprint 2013, pp.336, pp.342-343).
[167] Dumke in Lee (1991, p.89): Biersack is particularly remembered for writing (in 1850) that "the favourable financial results of the *Zollverein* should be seen as one of its most important and secure bonds."

complete list, of course, but they are certainly among the leading players. What is striking is that it appears as a relay race with the baton being passed from one to the other amongst the elite of functionaries from around 1818 until 1876.

It is instructive to know who the elites were because it gives a better understanding of, and greater credibility to, the *Zollverein*. As seen, the *Zollverein* did not have its own civil servants, just those assigned by their own state governments to *Zollverein*-related duties and who, through working together became specialists who saw themselves as an elite. Having identified them, Kreutzmann [168] explores what influences shaped their beliefs and motivations. He identifies the period between 1806 and 1813 as being of the utmost significance. This followed the period of reflection in Prussia after its defeat by Napoleon at Jena in 1806. Among the reforms which followed was a programme of social and economic change which had reverberations throughout Germany. To recall some of these: 1807 saw the *Bauernbefreiung* (abolition of serfdom), the introduction of revised legislation relating to the local government and commercial practice, and the abolition of guild powers which had profound effect by promoting private enterprise. These reforms were to have far-reaching societal consequences because the civil servants and the leading politicians he referred to as "the functionaries" identified with the spirit of the times and with dedication drove these reforms forward. Perhaps more importantly, they inculcated in their subordinates the same enthusiasm for these liberal beliefs and they carried the baton as far as the 1870s. That Kreutzmann has identified this period in this way, and explained its significance in terms of its influence on nineteenth century German history, marks out his writings from those of other historians.

Fischer[169] recounts that Prussia paid most of its partners the revenues which it had itself collected and that "it gained its political power mainly through financial sacrifices". It will be remembered that Henderson[170] reported that the *Zollverein* established a single tariff set by Prussia, the proceeds of which were shared proportionally according to the members' populations. When these two

[168] Kreutzmann (2013b, p.154).
[169] Fischer (1960, p.80).
[170] Henderson (1975, p.34, pp.36-37).

statements are compared, it is reasonable to infer that Prussia operated a special payments regime to induce compliance with its plans. This interpretation gains credibility when Fischer[171] recounts that over time Prussia's motivation changed: "Prussia originally founded the *Zollverein* to meet her own needs, but now used it as an instrument for her German policy".

If further evidence was needed about the attractiveness of the financial arrangements, during the seven weeks of the Prussian-Austrian war in 1866, the remittance to Berlin of duties collected by all the individual states, and the subsequent payment of funds back to states, continued without interruption.[172] That meant that member states of the *Zollverein* which sided with Austria against Prussia in the war, as well as Prussia itself, continued to honour their treaties during the war; trade between warring *Zollverein* treaty partners was not disrupted.

Despite all this, it would be wrong to imagine that the setting-up and running of the *Zollverein* was a straightforward affair. Fischer[173] strives to explain the effort that was required over an extended period to construct institutions and instruments, and to negotiate, in order to bring this venture to life (and notwithstanding the war, to maintain it in existence). Fischer sees this as political integration by economic means.

Later, Fischer[174] observes that "The *Zollverein* of 1834-1867 has long been considered chiefly as the pioneer of national unity, as the forerunner of Bismarck's Reich…Thus Prussia's efforts and struggle for a customs-union were viewed almost entirely under the aspect of political events in nineteenth century Germany." In the light of Fischer's other comments this should be seen as an explanation of why, after the event, such perceptions existed in the historiography.

In a similar vein, Blackbourn[175] looks at the *Zollverein* in the context of politics, as a power struggle between Prussia and Austria. Of particular interest is his

[171] Fischer (1960, pp.82-83).
[172] Fischer (1960, pp.69-70).
[173] Fischer (1960, p.65).
[174] Fischer (1960, p.65).
[175] Blackbourn (2003, p.179, pp.183-184, p.188).

exploration of the idea of “a third Germany”, or “trias” between Prussia, the smaller German states, and Austria. This was an aspiration of some of the smaller states who preferred to retain their autonomy in a stronger Confederation. As such, it was seen as a way forward which would have allayed their fears about the primacy of either Austria or Prussia, and of being deprived of a meaningful voice in their own affairs. It is doubtful this could have worked; Great Power politics suggests not.

Blackbourn[176] relates how in its quest for primacy Prussia engineered the confrontation with Austria which resulted in Austria’s subsequent defeat by Prussia at the battle of Königgrätz in 1866. Blackbourn[177] identifies Königgrätz as “the decisive moment in what we call German unification: a German civil war that led to the partition of Germany and the expulsion of Austria.” That Blackbourn expresses this event in such profound and succinct terms marks him out from other historians. For clarification, this meant that Austria was not only removed from interfering in the *Zollverein*, of which it was not a member, but it was effectively expelled from the German Confederation of which it was a member, thus leaving Prussia as the dominant power in Germany. Nevertheless, Austria remained a member of the German *Verein* which at first sight seems odd; Mitchell[178] gives the clue when he says that “Austrian tracks before 1870 provided German territories with their only direct access to the Mediterranean via Trieste.” Under the circumstances, it is not unreasonable to draw the conclusion that the Prussian government communicated the desirability of Austria’s continued membership of the *Verein* to the *Verein’s* executive board.

The Austro-Prussian War (1866) resulted in the founding of the North German Confederation under Prussia’s leadership thereby effectively replacing the German Confederation and the diet in Frankfurt am Main. At the same time the *Zollverein* dissolved but was quickly re-established by Prussia. Henderson[179] reports how the restored *Zollverein* (sometimes referred to as the second *Zollverein*) played an important role repairing relationships between the

[176] Blackbourn (2003, pp.183-184, p.188).
[177] Blackbourn (2003, p.184).
[178] Mitchell (2000, p.40).
[179] Henderson (1939, Reprint 2013, pp.341-343).

representatives of the north and of the south of the country who met in the customs parliament. Thus the parliament served as a bridge between erstwhile antagonists and hastened the resolution of differences. Henderson tells us that the parliament became known as Prussia's customs empire[180] and was the forerunner of the German *Reichstag*.

Paradoxically, as noted earlier, Blackbourn [181] thought that "nationalist historians…ascribed too great a role to the *Zollverein*". What Blackbourn had in mind is not clear, but if he was thinking about Henderson's[182] comment about the *Zollverein* and the railways being fundamental to Germany's industrial success, he had a point: the evidence[183] shows it was the ***Verein*** in its routine business which began turning the *Zollverein's* aspirations into reality through, for example, its major contribution to the *Allgemeines Deutsches Handelsgesetzbuch* (German Commercial Code) of 1859 and the Customs Act of 1869.

For his part Tipton[184] is dismissive of the *Zollverein*: "The establishment of the *Zollverein* was of little importance, if the brevity of its treatment in local histories is a reliable negative indicator". Clark[185] also had reservations, believing that effects of the *Zollverein* were less economically successful than originally believed in that it did little to shift the balance of the economy from the land to industry; that is, investment in industry showed no special increase because of the *Zollverein's* involvement and as a consequence agriculture remained predominant. This assessment is questionable; it might be more accurate to say that the industrial sector expanded significantly such that it challenged the importance of agriculture to the economy. But this was an ever-changing picture as the century progressed. This is illustrated by statistics concerning the value of products and their impacts on the economy: locomotives and sugar being particularly good examples of import substitution and subsequent valuable flows of exports. To put Clark's observation into context, it was not

[180] Henderson uses the term *Preußisches Zollkaisertum* perhaps not realising that this was seen as a derogatory term.
[181] Blackbourn (2003, p.140).
[182] Henderson (1975, p.52).
[183] *Festschrift* (1896). *Schlusswort*, p.415.
[184] Tipton (1976, p.77, p.38, p.28).
[185] Clark (2006, p.394).

until the 1880s that agriculture started to fall from its erstwhile predominant position dropping from employing 49 percent of the workforce to 35 percent in 1907.[186]

Another great critic of the *Zollverein*, as much else, was Mitchell.[187] It will be remembered that Mitchell, while recognising that the *Zollverein* "was to gain unquestionable significance in promoting inter-state commerce by lowering tariff rates", highlighted the fact that "Prussian predominance within the Customs Union in many regards weakened it because the fear of *Verpreussung*, that is an excess of economic control by Berlin, dissuaded the other German states from committing their rail networks to supervision from the *Zollverein*." Consequently he saw that "the complementary deficiencies of the German Bund and the *Zollverein* largely explain the creation in 1847 of the Association of German Railway Administrations" – the *Verein*.

Henderson maintained that it was "the *Zollverein* and the railways together [that] set Germany on the road to industrial success".[188] Pierenkemper and Tilly similarly accorded the *Zollverein* a place of great importance in pre-unification Germany noting that "incomplete though it was, the *Zollverein* served as a substitute for a nation-state during the early phase of German industrialisation".[189]

Of particular interest for comparison with the *Verein* is that Fischer[190] draws attention to the different transport situations which existed when the *Zollverein* was founded in 1834: transport was primarily horse-drawn; but when the last adhesions to the *Zollverein* occured in 1885 a national railway network was in place. It is known from Henderson, and Pierenkemper and Tilly, amongst others, that this was instrumental in the transition of Germany from being an agricultural economy to one which was a leading industrial power.[191]

[186] Blackbourn (1998, p.188, p.313).
[187] Mitchell (2000, pp.40-42).
[188] Henderson (1939, Reprint 2013, pp.337-340); Henderson (1975, p.52).
[189] Pierenkemper and Tilly (2005, p.9).
[190] Fischer (1960, p.66).
[191] Henderson (1975); Pierenkemper and Tilly (2005).

It has been noted that Henderson[192] attributed much of the initial progress towards industrial expansion in Germany to improved communications and the *Zollverein.* Carr [193] summarised the importance of the railways for communications thus: "Railways, as well as the introduction of the telegraph, facilitated the collection and distribution of news." Carr connected this with the rise of journalism and the growing availability of newspapers and periodicals resulting from the reduced cost of printing, and the railways collecting and distributing this newsprint.

The historiography (also) portrays the railways as a communications revolution, and thereby as ***the*** knowledge diffusion technology during the Industrial Revolution.[194] These observations were about the exchange of word of mouth information now that ordinary citizens could travel with ease outside of their own locality, what Kopper [195] calls "spatial mobility". Continuing the communications theme, Henderson [196] specifically reports that "in the 1860s…under the North German Confederation a unified postal administration was established…and extended over the whole of the country a few years later." Ploeckl[197] considers, inter alia, the beneficial impact of the mail as a medium of communication on commercial performance and the economy in Germany, but curiously does not mention how the mail was carried. By the mid-nineteenth century the railways were almost certainly the principal carrier of mail between the major towns and cities where clusters of industry were to be found. It is certain that the battle von der Heydt won with the railways over their initial reluctance to run night trains contributed to the effective flow of mail; this facilitated communication particularly for business and government.

Kreutzmann [198] addresses how some in the liberal movement viewed the *Zollverein*. They believed that the *Zollverein* could be a useful instrument for overcoming particularism and thereby progress the campaign for a united Germany. By contrast, other liberals viewed this as the antithesis of liberalism

[192] Henderson (1939, Reprint 2013, pp.337-338).
[193] Carr (1991, p.28).
[194] Mokyr (2002) cited by Hornung (2012, p.8).
[195] Kopper (2015, p.224).
[196] Henderson (1939, Reprint 2013, p.327).
[197] Ploeckl (2015) Working Paper 2015-12.
[198] Kreutzmann (2013a, p.199, p.201).

because it would by-pass state parliaments, where they existed, to approve taxes. The reason was that customs duties would be set first in treaties then adjusted by General Conferences. This topic is of interest in terms of the *Verein* because its constituent railway administration members were, as explained earlier, supportive of particularism.

In summary it can be said that the *Zollverein*: initially, was primarily a treaty organisation of sovereign states for trade purposes; became a political institution, but an institution which required recurrent re-validation; did not have permanent staff until 1867, although prior to that time it had a measure of administrative integration by means of *Kontrollbeamte* (auditors); did not have a committee structure; managed by means of annual congresses; until 1867 gave effect to its decisions only after the unanimous approval of its members in conferences, and thereafter via majority voting in its conferences; possessed a genuine legislative organ that created supra-territorial law; operated at two levels (inter-governmental and later supra-national); and was a voice for the standardisation of currency, weights, measures, and legal and commercial practice; "served as a substitute for a nation-state during the early phase of German industrialisation".[199]

The *Verein*

The emergence of the *Verein* and providing evidence to support the hypothesis that it was a political institution have already been addressed in the thesis. This section, therefore, serves to further highlight the similarities and difference between the *Zollverein* and the *Verein* and makes a judgement as to whether the *Verein* can be considered as the successor to the Zollverein in the commercial field.

Initially what is striking is that the executive managements of both bodies were men of the highest professional calibre and status in government, the civil service and business. As regards the *Zollverein*, its members were exclusively German whereas the *Verein's* comprised a number of European nationalities, although they were predominantly German.

[199] Pierenkemper and Tilly (2005, p.9).

Given the number of railway companies in public ownership, the presence of civil servants in the management of the *Verein* was to be expected, but the number of directors who were either serving or former top level government officials was not. Dunlavy[200] cites the case of Councillor Mellin as an example of the reciprocal flow of officials between the railways and government. Apart from the fact that the *Verein* satisfied the criteria for an institution, this level of public service involvement and the inevitable influence of government culture without doubt made the *Verein* a political institution. By contrast, Ploeckl questions whether the *Zollverein* can be called an institution at all when he comments that "the *Zollverein* was not really an agency, it was an agreement between sovereign governments, who agreed to implement certain policies in their own customs administration."[201]

The distinctive executive management of the *Verein* doubtless facilitated a *de facto* network at the highest level with, and between, the civil service and government. Despite the paucity of empirical material, logic permits reasonable inference that this network must have facilitated many conversations, proposals and trade-offs between the *Verein* and the *Zollverein*, and between the *Verein* and (other) government bodies, to reach mutually acceptable accommodations. Brophy[202] referred to this as a "juste milieu" or middle way.

As regards a constitution of some description, the similarity between the *Verein* and the *Zollverein* was that the *Verein* had a constitution in the form of Articles of Association which might be considered roughly analogous to the *Zollverein's* nexus of treaties. Further, notwithstanding arguments to the contrary, each met the criteria for being classed as an institution.

Some historiography which covers only a limited period, for example that of Dunlavy, recounts that the *Verein* had no permanent staff. This is not correct; from an early date it had both permanent staff and structure (via its committees).[203] This gave force to agreement between members that the railways should aim to operate as a unified network "in such a way that unitary

[200] Dunlavy (1994, p.165).
[201] Ploeckl correspondence with Flood, August-September 2018.
[202] Brophy (1998, p.135 et seq.).
[203] Dunlavy (1990, p.138); *Festschrift* (1896). *Verfassung*, p.7, p.10.

administration and joint operation can actually be implemented."[204] By contrast the *Zollverein* had neither committee structure nor permanent staff, save those few *Kontrollbeamte* who acted as auditors.

A key feature of both institutions was in requiring unanimity of decisions. This applied at the the beginning but over the years the voting procedures of each the *Verein* and the *Zollverein* were modified for the sake of getting things done and not being blocked by smaller, less important members. However, a major difference lay in the power given to the *Zollverein's* General Conference. Here decisions on such things as customs tariffs "had immediate effect creating supra-territorial law; as such the General Conference was deemed to be a genuine legislative organ."[205]

As for bureaux employed by the *Verein* and the *Zollverein*: very quickly the *Verein* devised arrangements for conducting business between members including a procedure for exchanging tickets, a tribunal to deal with disputes and later a General Accounting Office or Clearing House[206] for processing payments between members because payments were received in many currencies. As regards the receipt and payment of monies, these functions appear to have been discharged for the *Zollverein* by the Prussian civil service, although Ploeckl thought that "maybe (the *Zollverein* had) a small office that co-ordinated monetary flows…and statistics but that was purely technical and had no policy role."[207]

Concerning legislation, it is instructive to consider two major issues involving both the *Verein* and the *Zollverein*. The *Zollverein's* interest in commercial matters centred principally on tariffs (customs duties) and associated financial reporting. However, it is most unlikely that it was unaware of the work done in 1848-1849 by the Pauluskirche parliament, and subsequently by the Prussian civil service, to produce a commercial code for application across the whole of Germany. This was because one of the leading civil servants involved in the

[204] *Festschrift* (1896). *Einleitung*.
[205] Kreutzman (2013a, p.195) citing the historian Huber.
[206] *Festschrift* (1896). *Verfassung*.
[207] Fischer (1960 p.70); and Ploeckl correspondence with Flood, August-September 2018.

Zollverein, Pommer-Esche,[208] held the post of Prussian Minister of Commerce in 1848 and subsequently was the Prussian Director-General of Taxes. Apart from the topics mentioned, the *Zollverein's* interest in commercial matters appears to have been limited to efforts to get agreement of equivalence on currency. Otherwise, its performance seems disappointing on such things as standardisation of weights and measures. It had both the structure and opportunity to actually effect change on these issues, first through its *Zollverein* General Congress meetings and, after 1866, the so-called Prussian Customs parliament which is sometimes referred to as the second *Zollverein.*

By contrast, from the outset owing to the demands of business, the *Verein* had no choice other than to address directly such issues as weights, measures and currency, and to come up with workable business solutions. This was long before these matters were formalised by the North German Confederation and then extended to the whole of Germany. It also had to become involved in the commercial and administrative aspects of transporting freight and interfacing with the customs authorities on customs duty requirements. As regards the former, one outcome was the *Verein's* contribution to the German Commercial Code of 1859; as for the latter, the *Verein* had a significant input to the Customs Act of 1869; this is covered below.

Although customs tariffs were very much the concern of the *Zollverein*, this matter was complicated by free traders and protectionists with diametrically opposed agenda, and vested interests, seeking to influence outcomes. In addition, the terms and conditions of governing treaties between Prussia and the states of the *Zollverein* had to be taken onto account when trade arrangements with foreign countries impacted Germany's economy and adjustments were necessary.

As already indicated, it would be a mistake to believe that only the *Zollverein* had an interest in customs duties. It is known that in the first years of the *Verein* a committee was established, the Committee for the Customs Treatment of Goods carried by Rail, to compose regulations concerning the treatment of

[208] Henderson (1939, Reprint 2013, pp.244-245).

goods and effects on the German railways in relation to customs duties.[209] In 1850, the Rhenish Railway Corporation was nominated by the *Verein* to act on its behalf in this matter with German state governments. These meetings continued over many years and necessitated further proposals to be submitted. Latterly, during the period 1865-1869, the Prussian Minister for Trade and Finance and the Confederal Customs Council (replaced by the Prussian Customs parliament in which representatives of most German states sat after the 1866 war with Austria) negotiated customs arrangements. The source records that "Many of the Union's [the *Verein's*] points were taken into consideration, especially in the drafting of the new Customs Act of 1869." This is a good example of the *Verein's* domain knowledge influencing government on an important business matter and shows how the *Verein's* input was complementary to that of the *Zollverein*.

From the historical record it can be reasonably inferred that the *Verein* was a leader in the commercial use of statistics; this is one reason it may have been able to make a valuable contribution to the drafting of the Customs Act.[210] From 1846 it engaged in the collection of information relating to its members' income and outgoings and this was presented in 1849. A committee was then formed charged with designing a proforma for a more sophisticated collection of data covering all aspects of railway operations which on completion was to be issued to each of the *Verein's* member administrations; these were first issued in 1851. The obvious value of statistics caused them to be further developed and refined as circumstances demanded. For example, statistics were collected on the rising incidence of locomotive axle failures which resulted in serious accidents. The *Verein* collected data on such incidents which it published in 1857. As a result it can be inferred that corrective measures were taken because the number of component failures reduced in subsequent years.[211]

The record[212] shows that "in 1863 the International Statistical Congress at Berlin addressed the movement of goods by rail. Subsequently, the Royal Prussian Minister for Trade instructed the Board of the Prussian Eastern

[209] *Rückblick* (1871, p.10).
[210] *Rückblick* (1871, pp.10-12).
[211] Helmholtz and Staby (1930, part II, p.319).
[212] *Rückblick* (1871, pp.10-12).

Railway to apply to the Union [the *Verein*] to introduce railway statistics." It is not clear to what this instruction specifically referred given the *Verein* had already been publishing statistics on all aspects of the railways' operations since 1850. Perhaps it meant the said railway should apply to the *Verein* to be included in this activity. Later, in 1870, as the processing of certain statistics had remained a matter for individual railway administrations, the historiography indicates that a committee of the *Verein* decided further standardisation was required. This was to include data on railway personnel sickness, invalidity and mortality "as a way for ensuring pension funds were appropriately financed."

While the evidence supports the view that the *Verein* and the *Zollverein* were complementary, the idea that the *Verein* took over from the *Zollverein* in terms of its main commercial responsibilities is unrealistic. Once the smoke of its political agenda is swept away, the *Zollverein's* commercial work can be clearly seen. This can be summarised as the agreement of customs tariffs, which ensured a continuous and healthy flow of revenue to member states equitably distributed, and the devising of associated supranational government administrative arrangements, particularly in the accounting and economic fields. These arrangements helped lay the foundations of the future German empire.

As for the *Verein,* it was forced by circumstance to devise commercial, contractual and administrative regulations for all aspects of railway business. These were used by the railways in their dealings with customers and stakeholders. Therefore, it is logical to conclude that these procedures and processes must have found their way into the business practices of these parties at a time when the railway was on its way to becoming one of the largest businesses in the world and its customers were to be found across all sectors of the German economy. Certainly there is evidence that it produced proformae for reporting purposes,[213] but the procedural instructions which normally accompany such forms have not been discovered. For example, an

[213] German Commercial Code (*Allgemeines Deutsches Handelsgesetzbuch, Viertes Buch, Fünfter Titel, von dem Frachtgeschäft*): (1) Regarding the Bill of Lading: Art 415 determined the legal relationship between the Carrier and the Consignee; (2) Regarding the Consignment Note: Arts. 391, 402, 403, 405, 406 -these Articles contained further terms and conditons. / *Rückblick* (1871, pp.17-18).

examination of the relevant articles [214] in the *Allgemeines Deutsches Handelsgesetzbuch* (German Commercial Code) did not reveal the necessary evidence.

It is interesting to note that the *Verein* took time to consider what was happening in neighbouring countries, particularly Great Britain which was still the leading railway country. This indicates an acknowledgement on the part of the *Verein* that Germany was still in catch-up mode. An insight into this is gleaned from a report in the *Verein's* newspaper ZVDEV Nr.2 in 1867[215] which described the structure, operation and profitability of railways in Great Britain and their effect on the economy. It noted that the structure differed considerably from France in that lines branched out from all the major cities not just London, whereas in France all lines flowed from Paris. It also noted that, unlike the Continent, most railways in Great Britain were double-tracked and its stations had good facilities which made them more expensive to build. As regards economic effect, it observed that competition from the railways had forced down canal-borne freight traffic prices by 40 per cent, had facilitated the movement of labour and had greatly stimulated exports. On a separate issue, the newspaper was especially interested in the construction of the London underground. To what extent this may have influenced the *Verein's* policies and action going forward has not been ascertained, but this was still early days for the railways in Germany and it is likely that such information would have proved of value.

In conclusion, while the *Verein* was not the successor to the *Zollverein* in commercial matters it was because the purpose of each organisation was quite different. The *Zollverein* was a civil service construct, initially established to facilitate trade between the states of Germany by eliminating tariff barriers between them, but which evolved into a political organisation. In comparison, the *Verein* was first and foremost a commercial organisation established to support and represent the railway company administrations which constituted its membership. However, the *Verein* may be said to have given life to many of

[214] German Commercial Code. (*Allgemeines Deutsches Handelsgesetzbuch, Viertes Buch, Fünfter Titel, von dem Frachtgeschäft*): Articles particularly referring to the railway freight business: Arts 422-431.
[215] Staatsbibliothek, Berlin. Nr. 4Nz 13615-7. 1867. ZVDEV Nr.2.

the *Zollverein's* aspirations through its daily routine business. In this manner, as seen, it was able to make a valuable contribution to the *Allgemeines Deutsches Handelsgesetzbuch* of 1859[216] and the Customs Act of 1869. Furthermore, the *Verein* initiated the secondary railway system and capitalised on its international role. Both these aspects are examined in the next chapter. That the *Verein's* activities produced significant commercial and economic benefits for Germany is undeniable but has, in the main, gone unrecognised.

The next chapter moves to a different theme, the changing fortunes of the *Verein*, and introduces the *General Konferenz* as the successor to the *Verein* in Germany. It also unravels the conundrum about the REA being founded as the *Verein's* official successor. This development captures the *Verein's* decline, yet in another way it can be seen as the start of a new era because of its involvement in wider European matters. However, first the *Verein's* initiative regarding the Secondary Railway system in Germany is examined.

[216] *Festschrift* (1896). *Schlusswort*, p.409: It was said "the (*Verein's*) influence peaked when it intervened in Germany's commercial legislation."

Chapter 8

The Changing Fortunes of the *Verein* after the Unification in 1871

In the absence of a governmental national railway authority in Germany until 1873, the *Verein's* ascent as the non-statutory railway authority in Germany has been demonstrated. It achieved this firstly by establishing itself as both a trade association and a political institution, then by growing in influence as a leading commercial organisation in the German economy. At the same time it established itself as a railway centre of technical excellence in continental Europe. This latter aspect, its international as opposed to its national role, is considered in this chapter. From the outset "the railways might be viewed as the mortar of national unification",[1] but it was the *Verein* which gave them form, structure and influence.

The German railway system in its first phase was completed during the 1850s by which time its structures and regulations were largely in place.[2] After that time the development of the railways consisted largely of replacing original track with more robust lines to carry higher-powered locomotives and heavier rolling stock, and the laying down of new double-tracked lines. While this latter activity was welcomed, particularly by the military for the rapid transportation of troops, its prime purpose was to improve safety and efficiency in support of the extra volume of freight generated by the new industries in the second half of the century. In these matters the *Verein* was a participant through the activities of its technical arm, the *Verein der Techniker,* and through its constituent member railway administrations.

It was noted earlier that the *Verein* had made a valuable contribution to the *Allgemeines Deutsches Handelsgesetzbuch* (German Commercial Code) of 1859, but elsewhere the historiography reports that "the [*Verein's*] influence peaked when it intervened in Germany's commercial legislation."[3] This is a most surprising assessment which this chapter will demonstrate is misjudged.

[1] Mitchell (2000, p.39).
[2] Schot et al (2011, p.274).
[3] *Festschrift* (1896). *Schlusswort*, p.409.

In a similar vein, it will be remembered that Mitchell, among others, saw the unification of Germany in 1871, and the subsequent launch of the REA in 1873, as key events sounding the death knell of the *Verein*. By comparison, it will be remembered that this thesis identified the date when the *Verein's* power first began to wane as 1866. Yet, as will be seen, the decline was gradual and the *Verein* remained an influential force in German railway affairs for many decades thereafter.

1866 was a critical juncture for the *Verein* because, after Prussia's victory in the war against Austria, the North German Confederation led by Prussia was formed. This took charge of railway matters in the confederation's jurisdiction and displaced the *Verein* from its dominant position, although it remained pre-eminent in railway engineering matters. More importantly, Austria was expelled from the German Confederation, thus confirming Prussia's hegemony; but Austrian member companies were not expelled from the *Verein*. This fact appears to have raised serious questions for the military about the *Verein's* trustworthiness owing to its international membership.[4] Kaiser and Schot[5] report that by 1871 the *Verein* comprised 82[6] companies (of which 50 were German, 26 Austro-Hungarian, 3 Dutch, 2 Belgian, and 1 Russian (the Warsaw-St.Petersburg line)[7] with a track distance across Germany of 21,471 kilometres.[8] The consequences of these two issues started the slide in the *Verein's* fortunes. Yet there was an ambiguity here that should be noted: namely that it suited Germany's interests prior to the opening of St Gotthard tunnel to have access to the Mediterranean Sea via the (then) Austrian port of Trieste. This probably explains why the Prussian government did not press for Austrian members to be expelled from the *Verein.*

The Emergence of the *General Konferenz*

[4] Mitchell (2000, p.123): These fears were subsequently confirmed when the *Verein* refused "to supply the REA with statistical data on the grounds that the *Verein* was an international organization that must avoid suspicion of favoritism toward Germany."
[5] Kaiser and Schot (2014, pp.122-123).
[6] Figures quoted by historians vary. Henderson (1967b, p.47) reports "over sixty independent railway administrations in Germany (in 1871)." This discrepancy probably results from not including the state owned lines.
[7] Bradford (1907) also names Bosnia and Romania.
[8] See Appendix B.

An added factor in the *Verein's* growing isolation may have been the Prussian government's irritation that the *Verein* was making little progress regarding the agreement of railway tariffs across its German membership. The Prussian government conveniently ignored its own culpability in this. At this point, in 1868, two Prussian[9] railway companies, the central and north-western, formed a *Tarifverband* and agreed a simplified classification of tariffs.[10] This thesis claims that this agreement formed the genesis of the emergent *General Konferenz* (General Conference of German Railways) which developed into an imperial sponsored body via its proxy the Prussian government.[11] This was a loose association of German only railway companies (which by definition excluded the *Verein*) and which together with the establishment of the REA, in 1873, displaced the *Verein* in so far as purely German railway matters were concerned.

Although the *General Konferenz* was mainly concerned with tariffs and fees (see Chapter 7) its remit included operating regulations[12] which hitherto had been the exclusive domain of the *Verein*.

Delegating responsibility for operating regulations to the *General Konferenz* was, doubtless, a legacy from the North German Confederation. However, this cannot be taken as limiting the application of these regulations solely to that former territory after the unification. The *Verein* had also been excluded from the joint military-civilian line commissions in favour of the REA which interfaced with the military. Therefore, it is logical to assume that the *General Konferenz*, the REA and the military, three imperial bodies, would have worked in concert to formulate operating regulations for Germany as a whole. Seen against the Prussian generated paranoia in Germany about a future attack by France or Russia and the militarisation of certain lines this is entirely credible.

A series of additional developments served to further reduce the *Verein's* authority: its entries in the German Commercial Code were adopted by the Imperial government which meant it lost control of them. Then, in 1871, a law

[9] The Fremdling and Knieps (2011) paper which cites these companies is specifically about the Prussian railway system. Hence, these companies were without doubt Prussian.
[10] Fremdling and Knieps (2011, p.142).
[11] Bradford (1907, p.74).
[12] Meyer (1897, p.96).

was passed whereby the Imperial government was made liable for any operational risk concerning the railways.[13] Again this shifted the focus from the *Verein* to the government, leeching power from it. Similarly, it was further dis-empowered by the adoption of its regulations and procedures into the Berne Convention. [14] Later, following the Berne treaty, the Prussian Railway Administration chart[15] (section III Imperial and International advisory bodies) indicated that the *Verein's* role was limited to considering international traffic questions under the Berne treaty.

Thereafter, although the *Verein* was largely limited to technical and engineering outputs, it would continue to exert influence to the extent that in 1879, von Maybach, "as Prussian Minister of Public Works…took increasing umbrage at the *Verein's* constant pestering about railway standards and norms."[16]

On the positive side, in 1878, the Imperial government gratefully adopted the *Verein's* proposal for a secondary railway system which was ushered in after the Lines of Secondary Importance bill passed into law. This was in the period of the so-called "Great Depression", 1874-1894, although it is debatable whether the launch of the secondary railway system prevented it from getting worse. This is addressed later in the chapter. At this point, suffice it to say that Mitchell[17] challenged the sobriquet of the "Great Depression", and even the alternative of the "Great Deflation", and evidenced this by quoting the total of German investments made in the periods between 1850-1895: from 1850-1870 2.3 billion marks (£135.29 thousand million); from 1871-1873 2.8 billion marks (£164.70 thousand million); and from 1874-1895 2.4 billion marks (£120 thousand million).[18]

Around the same time, the Imperial government tacitly supported the *Verein's* leadership role for German involvement in trans-European railway regulatory

[13] It is assumed that this removed a huge burden from railway companies in that such risks previously had been insured against. Paradoxically from 1871 "railway companies were made legally liable for their passengers' safety and health" (Schivelbusch 1986, p.134).
[14] *Festschrift* (1896). *Schlusswort*, p.415.
[15] Bradford (1907, p.77).
[16] Mitchell (2000, p.128).
[17] Mitchell (2000, pp.142-143).
[18] Note the different rates used for mark conversions- see Appendix C.

issues led by the Swiss.[19] Together these factors once again raised the *Verein's* profile. This latter activity characterised the change in the *Verein's* status: for many, because of its multi-national membership, it came to be seen primarily as a German-led international railway organisation although it still retained its position, and maintained a strong professional reputation, as the *de facto* railway technical authority in Germany. Perhaps Lommers's[20] rhetorical question: "The *Verein Deutscher Eisenbahnverwaltungen*, an association without a nation?" was overstated.

Despite its gradually waning importance in German affairs, the Imperial government was conscious of the debt it owed to the *Verein* for having overseen the construction of an integrated and functioning railway network in the years before the unification. This is shown[21] by a conversation between von Maybach (the Prussian railways minister and a former Head of the REA) and Bismarck when, in April 1879, Maybach praised the *Verein* for "[performing] admirably to encourage some necessary technological uniformity in the past." On this point, it might be noted that whereas in certain other developed countries "the need for standardisation drove mergers, e.g. the creation of six private railways in France",[22] in Germany this had been avoided through the activities of the *Verein*. It is arguable whether this was a good thing given that, by the time of the unification, fifty railway companies out of a total of eighty two members of the *Verein* were German.[23]

From an early date Mitchell[24] had written off the *Verein* with the comment: "the future irrelevance [of the *Verein*] had already been sealed by national unification." This was to ignore the *Verein's* position as a storehouse and living source of technical and engineering knowledge. Working behind the scenes, the *Verein's* technical arm, the *Verein der Techniker,* continued to monitor the reliability of railway supplies (recording the results statistically) and to test new articles and products, publicising such activities and inviting comments. From

[19] Mitchell (2000, p.128).
[20] Lommers. http://www.inventingeurope.eu/exhibit3tour1item3. Accessed 21 October 2014.
[21] Mitchell (2000, p.128).
[22] *Festschrift* (1896). *Schlusswort*, p.410.
[23] Kaiser and Schot (2014, pp.122-123).
[24] Mitchell (2000, p.139).

evidence previously presented, the conclusion can be drawn that where a sea-change occurred, such as in metallurgy, the *Verein der Techniker* became actively engaged in supporting the re-qualification and re-certifying processes of materials and articles.

In parallel, although the *Verein* (and *Verein der Techniker)* continued to issue procedures and amendments thereto, these were adopted by government and government sponsored authorities which diluted the *Verein's* influence.[25]

Nonetheless, the *Verein* continued to play an important role including recognising best practice in the railway industry. An example is the combined adhesion cog wheel railway trialed in 1885 for use in mountainous regions. Its designer, Roman Abt, was awarded the *Verein's* principal prize for what became known as "the Abt System".[26] This is but one example where *Verein* used the prize system to recognise and disseminate knowledge more widely. Another example of a prize awarded was Brosius and Koch's handbook *Locomotivführer* (Locomotive driver), [27] a wide-ranging technical manual covering many aspects of railway operations. Of especial note is the fact that "prizes…may be awarded to engineers of any nationality, so informing the Union's members about progress elsewhere."[28]

At the same time that it was recognising best practice, the *Verein* was itself engaged in pushing the frontiers of science through its involvement in the development of electric powered locomotive technology. The historiography, although somewhat patchy, describes how matters progressed.[29] Around 1903 the Prussian Ministry of Public Works and the Prussian State Railway commenced running trials on a test line with German manufacturers including AEG (*Allgemeine Elektricität Gesellschaft).* Not surprisingly, these research and development trials appear to have lasted over many years but the historiography consulted does not give a detailed account of them. However, at some point the ministry decided to use the mono-phase current (*Einphasenwechselstroms*), 10 Kv at 15 Hz, as a voltage for the engines

[25] *Festschrift* (1896). *Schlusswort*, p.415.
[26] Kühne and Reiners (2010, pp.38-39).
[27] Brosius and Koch (1899).
[28] *Festschrift* (1896). *Schlusswort*, p.413.
[29] Kühne and Reiners (2010, pp.52-53).

because no problems were experienced carrying the power from the power station to the locomotive by means of simple overhead power lines. (In the early days, transmitting electrical power over distances was a problem to be overcome). The ministry was then uncertain what lines to electrify and proposed the Altona to Kiel route, but this was blocked by the Prussian Ministry of War which had the power of veto. In due course Magdeburg-Halle-Leipzig, a distance of 154 kilometres, was chosen because there were large supplies of lignite (brown coal) en route at Bittefeld. This was to be the location of a new, yet to be built, power station fuelled by lignite to power the line. Finally, in 1909, the Prussian *Landtag* (Parliament) approved the electrification of the line at a cost of 25.9 million marks (£1.29 million) including 6.47 million marks (£323,500) for electric locomotives. By 1911 trains were regularly using the first section, Dessau to Bittefeld. The historiography indicates that the *Verein* was active in the development of this new electric power technology. In April 1911, a meeting of its Technical Committee recommended the introduction of a standard power system for long distance railway lines, namely: 15 Kv voltage at 16.66 Hz. Following this the design of electric rolling stock, the height of overhead cables and the operation of electric trains was agreed between Prussia, Bavaria and Baden, and soon afterwards by Austria, Switzerland, Norway and Sweden. Notwithstanding earlier inventions of the weldless steel wheel by Krupp, and improved steering gear by the inventor Edmund Heusinger[30] (a leading member of the *Verein*), if there had been any doubt before, these innovations demonstrated that Germany had become a world leader in railway technology.

Primary sources provide proof that the *Verein* continued in force well into the decades at the turn of the century. These include *Operational Regulations of the Verein* effective from 1st March 1890.[31] Also, a full set of updated conditions for the construction and use of operational equipment on main railways and the *Nebenbahnen*[32] (also known as *Sekundärbahnen,* namely*,* lines of secondary importance and governed by the Act of 1878) was compiled

[30] Kühne and Reiners (2010, pp.18-19).
[31] Staatsbibliothek, Berlin. Nz 34237-1890. *Betriebs Reglement des Vereins...Gultig vom 1 März 1890*.
[32] Meyer (1897, p.82).

at the technical meeting held in Amsterdam 3rd-5th September 1908.[33] This latter regulation was issued to promote reciprocal traffic between the two types of lines with specific reference to technical equipment and to increase operational safety. The document is important because, again, it shows that the *Verein* was viable both in Germany and in its international role all through the nineteenth and into the twentieth century. In the former case, it gives a definition of *Nebenbahnen* which clarifies a point of confusion for many historians, viz: "*Nebenbahnen* are to be defined as full gauge railways serving public traffic on to which locomotives of the main railways can transfer but which the speed of 15 kilometres per hour may not be exceeded and for which as appropriate to the lower speed and the simpler operations less onerous provisions may apply." In the latter case, the Dutch location of this meeting *(die Versammlung vom 3-5 September 1908 zu Amsterda*m) attests to the *Verein's* internationalism.

Another example which demonstrates the continuing influence of the *Verein* is an article with diagrams by Strahl, *Die Anstrengung der Dampflokomotiven* (*The Output of Steam Locomotives*), published in the *Organ* in 1908.[34] This gives the most favourable speed at the maximum power for different locomotives. These two variables (speed and maximum power) are calculated using a method set out by Strahl. The formulae proposed by Strahl were intended for modern locomotives and quote empirical values. For older locomotives, the formulae have to be adjusted because they had shorter boilers and pipes which meant they were less efficient in exploiting the heat from the firebox. Strahl cited a pipe factor: the longer the pipe the more efficient the outcome and closer to his formula for the efficiency of an engine.[35] Clearly there had to be a maximum potential for this, a tipping point, and this reflected the state of knowledge at the time. The diffusion of technical information in the way described helped to promote a reliable and efficient railway system and thereby contributed to the smooth running of the economy.

[33] Staatsbibliothek, Berlin. Nz 36010/57. *Technische Beziehung über den Bau und Betriebrichtigungen der Haupt und Nebenbahn…den Beschlüssen der Versammlung vom 3-5 September 1908 zu Amsterdam.*
[34] *Organ für die Fortschritte des Eisenbahnwesens in Techniker Beziehung* (1908, p.43).
[35] Helmholtz and Staby (1930, *Vorbemerkung*, page VI).

As regards the Amsterdam meeting, almost from the beginning the *Verein* was an international organisation. Its constitution allowed for this and an examination of the lists of its early membership (previously cited) reveals the names of railways outside Germany's borders.

Taking each in turn, the *Verein's* constitution,[36] as amended from 1858, stated that membership was open to administrations domiciled in territories ruled by governments that were members of the German Confederation, for example, Holland which shared a monarchy with Luxembourg. In recognition of changes to the political boundaries in Europe further amendments followed in 1864 and 1867; these opened membership to railways formerly within the German Confederation or ruled by a government of the Confederation. Later, from 1871 this was expanded to the German Empire and the Austro-Hungarian monarchy, and in 1873 Luxembourg was added, as was The Netherlands in 1880.

Details of early members[37] joining the *Verein* during 1847 include railways beyond Germany's borders in Austria (the Vienna-Gloggnitz Railway), in Prussian-occupied Poland (the Stargard-Posen Railway and the Cracow-Upper Silesian Railway), and in The Netherlands (the Aachen-Maastricht Railway). The date-point, 1847, indicates either German ownership of the railways, or domicile in a German Confederation territory, or a territory ruled by a German Confederation member. In any event at least one of the termini of each of these railways was outside Germany proper.

It was seen earlier that by 1850 Germany already had an extensive railway network[38] with lines to Antwerp, Basle, Cracow, Prague and Vienna.

Subsequently, a more ambitious railway project involving Germany would be embarked upon, the St Gotthard Tunnel. This will be considered later in the chapter.

In the same way that the railways within Germany drew the country together and enabled the potential of the *Zollverein* to be realised, the railways emanating from Germany, which became the *de facto* rail hub, fostered the

[36] *Festschrift* (1896). *Verfassung*, pp.4-5.
[37] *Festschrift* (1896). *Einleitung*, pp. XIV-XV.
[38] Henderson (1967b, p.20).

development of trade and commerce because of its position straddling north central Europe.

Despite its German roots and the preponderance of its membership being German, the *Verein* was conscious of the need to demonstrate that it valued its multi-national character. To this end, its leading figures[39] included non-German nationals, and many of its General Assemblies[40] were held outside of Germany, for example, in Amsterdam, Budapest, Salzburg, Trieste and Vienna.

Another striking feature of the *Verein* was that many of its leading figures, both German and non-German, were senior professionals in their own fields: in mechanical engineering, civil engineering, financial accounting or law, and held government positions and, or, sat on railway company boards. In some cases they moved between the civil service and the railways during their careers. This constituted a powerful and influential network at the highest level across Europe. As such, it was trusted by governments probably because the reputations of these individuals were established before joining the *Verein.* Kaiser and Schot's[41] comment that "it [the *Verein*] managed to introduce, without diplomatic interference, many rules to ensure harmonization across borders" reflects this trust.

The rules in question have been cited in a previous chapter but may be summarised as: "technical standards to ensure the uniformity of wagons, roadbeds, stations, loading and unloading, signalling systems, and schedules across borders…also regulations for the mutual use and exchange of wagons so that loading and unloading of goods would be unnecessary when trains passed borders."[42]

It is easy to see why such arrangements would be attractive to railway companies and why there was a voluntary adoption of these regulations. The resulting drive for standardisation facilitated inter-operability, increased the speed and efficiency of railway companies' operations for freight through-traffic. Further, it simplified the availability of spares for repairs, and repairs

[39] *Festschrift* (1896). *Bildnisse* (XXVII-XXXIX).
[40] *Festschrift* (1896). *Nachweisung*.
[41] Kaiser and Schot (2014, p.123, Fig. 4.3).
[42] Kaiser and Schot (2014, pp.123-124).

themselves, wherever the need arose in a network stretching hundreds of miles. As a consequence, non-German countries benefited from rapid access to the German market, while for Germany it gave connection, through Austria, to Trieste - its only port of access to the Mediterranean Sea until the St Gotthard Tunnel became available in 1882.

Altogether, the *Verein* developed, and kept on developing, because it was a community of interest.[43] This served the rapid transport needs of its multi-national members and was led by experienced administrators supported by technical specialists. However, as stated earlier, the dilution of the *Verein's* German identity, when viewed through the lens of German military security, caused it to be regarded with some reservation by the Imperial government.

Kaiser and Schot,[44] in their examination of the role of technology as an agent of change in European history, consider how new technologies enabled transnational connections, resulted in consequential regulation, and often occasioned an unpublicised integration across Europe. It is clear that the *Verein,* through its constituent members, delivered these outcomes. As an important player in this evolution, Kaiser and Schot identify the *Verein* as one of the early building blocks of Europe.

The St Gotthard Tunnel Project

It has been seen how the *Verein* produced and promulgated its guidelines and procedures at a time when there was neither a central government railway authority in Germany, nor a European railway authority. The wider adoption of these regulations is now considered. How did this come about? Until 1867 the Swiss had not been very interested in railways but in that year two railway tunnels opened, neither of which passed through its territory: the Mont Cenis and Brenner Pass. These proceeded to syphon-off overland trans-Alpine traffic which underpinned Swiss prosperity. This became the motivation for Switzerland's interest in constructing the St Gotthard Tunnel.[45]

[43] Kaiser and Schot (2014, p.128).
[44] Kaiser and Schot (2014).
[45] Faith (1990, p.63).

The tripartite treaty between Italy, Switzerland and Germany to build the St Gotthard Tunnel was signed in 1870 after several years of negotiation. Construction of the tunnel, financed by all three countries, commenced in 1872 and was completed in 1882.[46] Remarkably, the German Imperial government expected its own federal states which might directly benefit from this project to contribute. Archive papers[47] show that German railway companies agreed to pay a total of 11,934,000 Swiss Francs (£473,571) while the balance of Germany's share, SF 8,066,000 (£320,079) was to be paid by the Imperial government. This made a grand total of SF 20,000,000 (£793,650) committed to be paid to Switzerland by Germany. What is less publicised is that Germany played a significant part in building the St Gotthard Railway. Gerwig,[48] head of the technical department of the Grand Duchy of Baden State Railways, and a member of the *Verein's* executive, was appointed head of construction.

As the total construction costs amounted to SF 156,000,000 (£6,190,476) Germany's fractional contribution was trivial for such a huge economic benefit.[49] Mitchell expressed it thus: "Since the opening of the Suez Canal, no single engineering feat had such a decisive impact."[50] However, the need for harmonising railway regulations between France and Italy on the one hand and Germany and its adherents on the other arose as an issue.

Kaiser and Schot explain that Switzerland called initial meetings of international railway authorities in Berne, Switzerland, in 1878 and subsequently in 1886.[51] This was because Switzerland, at the centre of Europe, feared that the growth in railway traffic, not least as a result of the (expected) opening of the St Gotthard tunnel and the running of the new line in 1882, could be jeopardised by differences in freight regulations between countries particularly France and Italy as compared to Germany.

Naturally, the Swiss government was concerned that difficulties connected with freight regulations might hinder the early recovery of Switzerland's significant

[46] Kaiser and Schot (2014, p.131).
[47] Geheimes Staatsarchiv Preußische Kulturbesitz, Berlin. I.HA.Rep 93E Nr.3291/1
[48] *Festschrift* (1896). *Bildnisse*, pp.XXXV plate 7.
[49] Geheimes Staatsarchiv Preußische Kulturbesitz, Berlin. I.HA.Rep 93E Nr.3291/1.
[50] Mitchell (2000, p.146).
[51] Kaiser and Schot (2014, pp.131-133).

share of the project cost. Consequently, the Swiss were motivated to act as a neutral mediator. As for Germany, Bismarck was content for the *Verein* to be involved because of the potentially beneficial commercial implications for Germany.[52] For their part, in due course, the Swiss proved adept at brokering a collaborative agreement which was signed as the *Convention on the International Traffic of Goods by Rail*, also called the *Berne Convention*, in 1890.

Meyer reported that the convention was signed by Austria, Belgium, France, Germany, Holland, Hungary, Italy, Luxembourg, Russia and Switzerland, and was applicable to an area of some three million square miles and two hundred and sixty million people. Also, a central bureau based in Berne was established, organized and supervised by the Swiss *Bundesrat* to monitor and manage the implementation of the convention's articles. In addition, any violation of the convention punished in the courts of one signatory would be recognised and upheld in the courts of another, unless the decision conflicted with its own laws. Meyer drew attention to the remarkable situation whereby "states so diverse had voluntarily made themselves amenable to a common code of law under these circumstances…[and by which]…the great power and many-sided influence of railroads, and the healthy development of closer international relations [was evident]."[53] The *Festschrift* records that it was the *Verein's Regulations for Passenger and Goods Traffic* which became the foundation of this protocol.[54]

Later, von Maybach, the Prussian Minister of Public Works responsible for railways, "attributed the high standard of railway technology across the whole European railway network to the Association's [the *Verein's*] work."[55] That the *Verein* was able to accomplish so much initially in its own sphere of influence, then persuade other European countries to adopt the greater part of its procedures and practices for mutual benefit, was an outstanding achievement. That this included France through the good offices of the Swiss, via the Berne Convention, was testimony to its remarkable effectiveness. It will be noted that

[52] Mitchell (2000, p.128).
[53] Meyer (1897, pp.98-100).
[54] *Festschrift* (1896). *Einleitung*, p.XVII and *Schlusswort*, p.411.
[55] *Festschrift* (1896). *Bau, Betrieb und Betriebsmittel*, p.45.

this was achieved long after the unification date, 1871, when the *Verein* was supposed to have "died".

Regionalism

Banzawa[56] quoted Yamada (2001) who observed that had Bismarck's plans for nationalisation of the railways been successful it would likely have been detrimental to Germany's regional industrialisation. However, this has to be taken in context. Bismarck saw from an early date that Germany needed a railway network. There were two main reasons for this: the potential of the *Zollverein* could not be realised without serviceable transport links between the principal towns and cities; the military must be able to move rapidly. As Prussia had already seen the military advantage of using the railways in 1846 to move its army from a garrison in Bohemia to Cracow to put down a rebellion of Polish nationalists,[57] and had similarly responded to a plea from Baden in 1848 to help quell civil insurrection, Bismarck saw that a national main line system, not a regional specific system, was the priority and would satisfy these requirements. In the early days of railways this was entirely logical.

For their part, entrepreneurs were interested in financing such a system provided there was good prospect of returns on capital being delivered in a timely manner.[58] This was the case where railway construction could be completed quickly (especially where the railways would serve areas of population growth), or where government would guarantee dividends in the event the railway company was unable to pay these at the due date. As a result, early railway building was largely a straight line on a map affair. By definition this aimed at avoiding areas where the terrain presented civil engineering challenges or were not heavily populated. These considerations favoured the area north of the River Main as opposed to the southern area of Germany with its undulating topography and lower population density. More importantly, the south lacked the huge coal fields of the Saarland, Rhine-Westphalia, and Silesia that bridged northern Germany from west to east.

[56] Banzawa (2012).
[57] Wolmar (2012, p.18). This was presumably in support of Austria because Bohemia was in Austria, and Cracow was in Austrian-occupied Poland, at that time.
[58] Richard (2012, p.95). Richard reports that "as soon as the hoped for rapid profits vanished, many capitalists refused to go on financing the capital already subscribed."

These would fuel Germany's industrial revolution, but only if the coal could be extracted and moved in vast quantities, and this was wholly dependent on the railways. Even where water-borne transport was involved, the initial movement of coal from the pit-heads to the barges required a railway, as did unloading at the destination.

At this point it is necessary to register the fact that Hornung[59] and Gutberlet[60] differed from one another. Hornung, writing specifically about Prussia, reported that "until the 1860s…lines were mostly built in a linear way." Gutberlet wrote that "most early railroads…followed the traditional trade routes along Germany's major rivers…[and]…As a result…attracted mainly passenger traffic because reloading between railroad cars…and barges proved too expensive for long distance cargo." Gutberlet's (adopted) assessments may have validity for Germany in so far as rulers of the independent states were concerned. Here, the granting of charters may have been dependent on allaying their fears about trade diversion from traditional trade routes which passed through their territories; this can be considered as a manifestation of particularism. Certainly, Hornung's assessments remain valid for Prussia because they utilised official nineteenth century data super-imposed on old railway maps of Prussia, in order to draw conclusions. Although both of these situations clearly prevailed in different states at the outset, there is no doubt that by the 1850s the skills of the civil engineers constructing the railways had dramatically improved such to allow at least dispensing with the "straight line on a map" option. This was evidenced not only by overcoming major bridging challenges, but by the construction of the Geislinger Steiger and the Göltzschtal Brücke. The former was the first mountain railway line in Germany. This had a rising gradient of 135 metres over 6 kms and formed part of the Stuttgart to Ulm line; as such it carried heavy traffic. The latter was, at the time, the biggest brick-built bridge in the world: 574 metres long, and 78 metres high built by the Saxon-Bavarian Railway Company.[61]

[59] Hornung (2012, p.2).
[60] Gutberlet (2013a, p.4) citing Heinze and Kill (1988).
[61] Kühne and Reiners (2010, pp.20-22).

The importance of coal can only be understood if it is seen in the context of exploiting the potential of evolving technology for the benefit of industry. Coal replaced charcoal and through a process called the "puddling process" (introduced in Great Britain before 1800 but refined over many decades) made the production of bar iron from pig iron possible. Then in the 1850s coke from coal was used to fire a more efficient furnace, using the Bessemer process, to mass produce steel from pig iron. Around the early 1800s, the innovation of steam as a source of power (other than for propelling locomotives) was introduced. This too was dependent on coal for one of its raw materials. Each of these developments, "puddling", the Bessemer process, and steam power, was a British invented leap forward through technology and their introduction into Germany constituted a transfer of technology. Steam could only be generated by coal or coke-fired plant and immediately dispensed with the need for water-driven energy. That is not to say that water was no longer required, but it released manufacturers from being tied to fast flowing rivers which drove primitive water wheels to generate power. As a consequence, there was an incentive to (re)locate manufacturing plants adjacent to coalfields, or close to railway lines that could deliver coal speedily and cheaply. Inevitably, this demand attracted labour for the mines with the resulting need for accommodation and stores, thus leading to the formation of new towns and new markets. In turn this led to agglomeration and economies of scale with attendant commercial benefit. Good examples include Essen and Bochum on the Ruhr coal-field.

In this connection, the historiography[62] addresses the issue of what Herrigel calls "autarkic" and "decentralised" (that is "non-autarkic") industry and its distribution across Germany. Autarkic industry was viewed as coal mining, iron and steel, chemicals and electrical engineering; that is, industries engaged in predominantly heavy engineering supported by the new joint-stock company (industrial) banks. Non-autarkic business comprised small and medium firms producing consumer goods, or specialised engineering companies. These were dependent on finance from regional or co-operative banks, and on supply

[62] Apart from the final reference in this paragraph, the quotations are from Pollard (1997, pp.1781-1783) reviewing Herrigel (1996).

chains for components in order to produce their products. The location of each, the autarkic and the non-autarkic categories of industry, showed a marked regional distribution. Autarkic firms could be found in the Ruhr and Silesia whereas the non-autarkic ones were found in Baden, Württemberg and Saxony. It is immediately clear that the reason for this split in terms of industry type and location was proximity to a major coal-field (the former) or distance from a major coal-field (the latter). However, this was not the only reason. Herrigel maintained that "traditional regions could not tolerate major innovations and were therefore avoided by the new industries." Pollard strongly disputed such a conclusion citing the steel producing city of Sheffield, England, as "a leading centre of the old and pioneer of the new." Nevertheless, there are grounds for alleging that certain areas of Germany were avoided by entrepreneurs. Parts of the south are a case in point; here the guilds continued to wield considerable restrictive power until as late as 1864.[63]

While Tipton[64] emphasised the importance of the railways giving access to coal in nineteenth century Germany for the growth of industry, he also highlighted that approval for a new line was a political decision. To illustrate these points he relates the case of Poensgen a manufacturing company in the Eifel region. This lies south of Aachen in the north-west of Germany and west of the River Rhine. Despite petitioning the Prussian government for a railway line over many years (Poensgen himself was a friend of the Prussian railways minister von der Heydt), no direct government action was taken. The absence of a railway linking the Eifel with the coalfields of the Ruhr (which lies east of the River Rhine) finally caused Poensgen to re-locate to Düsseldorf. The continued failure of government to respond to requests for a line, although there is evidence it tried to delegate action to the Rhenish Railway Corporation, ultimately led to a serious decline of manufacturing in the Eifel. The main conclusion to be drawn from this is that proximity to a continuous supply of cheap fuel, namely coal, was a major factor determining whether or not industry, particularly metal manufacturing and heavy industry, flourished in the regions.

[63] Gutberlet (2013b, p.2); Tipton (1976, pp.79-80).
[64] Tipton (1976, pp.79-80).

As regards the failure of Poensgen to persuade the government to build a railway in the Eifel region, the problem was essentially political. This area together with Westphalia and the Rhineland (the western provinces), prior to being governed directly from Berlin (as a result of being transferred to Prussia by the Congress of Vienna), had already enjoyed significant self-government. Consequently, it did not take kindly to the involvement of a new interventionist government. Further, it lay on a major coalfield and embraced the burgeoning Ruhr industrial area which it wished to exploit to the full. Its officials were strongly liberal in terms of business and included such entrepreneurs as the Cologne businessman David Hansemann. By contrast, their opposite numbers in Berlin were conservative, often land-owning *Junkers,* and were seen as favouring the more agricultural east while hampering the aspirations of the west. A comment attributed to the Prussian treasury minister gives credence to grievances of the western provinces: "industry [is] a 'cancerous sore' on the body politic and is therefore to be discouraged whenever possible."[65] Tipton summarised it like this: "The common theme of the debates between the western provinces and the Prussian government was the distribution of political and social power".[66]

The Poensgen example is particularly instructive because it arose in the north-west of Germany which was thriving industrially compared to the south. This forces a re-appraisal of broad-brush perceptions of what was happening at this time in the German regions. It also indicates the incidence of heterogeneity within regions themselves. This is borne out by a close reading of the historiography which reveals a mosaic of differences within regions. The causes were complex and included unsupportive government (as seen in the Poensgen case), the power of institutions (which hindered progess in the south), and social class (a clash of attitudes between the governing elites and the business classes across the country). Each of these issues affected decision making and could have profound impact because each region was both a *de facto* political and an economic entity.

[65] Tipton (1976, p.69).
[66] Tipton (1976, p.71).

The north, western and central regions of Germany were a mix of agrarian and industrial economies. These regions, apart from the Eifel in the north-west, were well served by the railways. Broadly speaking, in the west the economy was predominantly industrial as illustrated by the huge coal reserves in the Ruhr basin and the Saarland. This coal fuelled the agglomeration of industry which ran kilometre after kilometre embracing the rapidly growing towns of Duisburg, Essen, and Bochum, and on as far as the ancient city of Dortmund. In the industrial towns the main outputs were iron, steel and metal products and companies like Krupp of Essen became world famous. Nonetheless, Rhineland-Westphalia remained one of the three main textile producing regions, the others being central and eastern Germany, and the three southern states.[67]

In central areas the picture was changing.[68] While textiles were the biggest industry, its cottons were having difficulty competing with other regions and the production of textiles was declining. It was timely, therefore, that soon the cultivation of sugar beet transformed the economics of farming and also began to have considerable impact on the national economy. “The new combination of industrial with agricultural enterprise was the key element in the continuing development of central Germany. The cultivation of sugar beet benefited agriculture generally…and provided increased animal feed in addition to the beet itself…[Such was the demand that by]…1857 there were one hundred and sixteen sugar factories in Prussian Saxony alone.”[69] This generated a demand for locally manufactured agricultural machinery across the sugar beet growing areas. In addition, agriculture generated the manufacture of metal products and food processing. Hence, this region was fortunate in that its dependence on coal not only was limited but that a new source of wealth, the processing of sugar beet, became active.

In the east, the Prussian capital Berlin lay at the centre of Brandenburg and its lands in the north-east and the east, namely Pomerania, East and West Prussia and Posen. Berlin was a principal hub of the German railway system

[67] Henderson (1975, p.61).
[68] Tipton (1976, p.62).
[69] Prussian Saxony, formerly part of the Kingdom of Saxony, was ceded to Prussia at the Congress of Vienna in 1815.

(others being Cologne and Munich) and as such would have had major railway workshops. Berlin boasted many thriving small engineering businesses like the locomotive builder Borsig, but across the region other industries, particularly textiles, provided employment for as many as 395,000 in 1861.[70] The flatness of its eastern territories facilitated agriculture and from the 1850s it was served by the *Ostbahn* (Eastern railway). Initially this had been built in response to the *Junkers'* demand for a line to move troops rapidly to the Russian border which lay adjacent to their lands. However, its use for commercial purposes soon became apparent and was a catalyst for improving farming methods. These were financed by daily deliveries of produce to Berlin and the growing industrial areas of the west.

South of Brandenburg lay Silesia with its massive coal reserves. In the earlier part of the century it had produced greater quantities of coal than the Ruhr, but later the positions were reversed. Nevertheless, Silesia had an advantage in that it was rich in other minerals including iron and zinc. In Silesia, where there was coal there was iron close-by, and both these could be easily mined because the deposits were near the surface in thick, even strata.[71] As a result of the intense mining, and a thriving textile industry,[72] a light engineering industry existed to support both. Breslau was Silesia's principal city, the seventh largest in Germany, a commercial centre and a route centre proximate to the borders with Russian-occupied Poland, and to Austria-Hungary.

Saxony, which lay between Prussia and Bavaria, sat at what turned out to be a major cross-roads of German rail traffic. Its chief line was the Leipzig-Dresden line. Later a line from Hof (just south of Dresden the capital of Saxony but in Bavaria) was built and ran to Augsburg also in Bavaria. This took on great importance and is mentioned later in connection with the Ulm incident. Although initially Saxony's lines were predominantly privately owned, over time they came more under state control and, from 1859, its workers were placed on the same footing as postal workers and wore uniforms.[73]

[70] Tipton (1976, p.54).
[71] Henderson (1975, p.136).
[72] Henderson (1975, p.61).
[73] Mitchell (2000, p.44).

Saxony was one of the main textile producing areas in Germany,[74] and was the most important factor in making Saxony an "industrial region".[75] However, employment fluctuated over the decades and cotton spinning was susceptible to changes in tariffs and internal competition from other German regions particularly Alsace after 1873. Cotton then started to give way to the production of high grade woollens. As a result of the *Zollverein's* tacit encouragement of regional specialisation, and with no shortage of skilled operatives, Saxony emerged as a leading producer of woven woollens. However, in a changing market the manufacture of clothing then came to the fore. Textiles were not Saxony's only employment for it also produced metal products and supported the railways. These activities were facilitated by a pool of skilled labour, its coal basin at Zwickau and iron mines at Schwarzenburg.[76]

Yet, the historiography[77] indicates a political dimension. This was driven by the Saxon government's realisation that its businessmen, mainly artisans from close-knit local communities, were slow to embrace technology, for example steam power, and were parochial in their outlook compared to their peers in Rhineland-Westphalia. There, new businesses had been set up by aspirational scions of commercial and banking families. Consequently, the government encouraged entrepreneurs from outside Saxony to improve the competitiveness of the region. However, this had limited benefit given the negativity of the communities to this initiative. The interesting point here is that, in Saxony the government was seeking to help, while in the western provinces of Prussia businessmen believed the government in Berlin was acting against its interests.

In the south and south-west regions, which stretched from Bavaria through Württemberg and Baden up to Alsace-Lorraine,[78] the issues were different. The chief concentrations of population were at some distance from the major coalfields (apart from Alsace-Lorraine) and agriculture predominated. Further,

[74] Henderson (1975, p.61).
[75] Tipton (1976, p.49).
[76] Tipton (1976, pp.50-51).
[77] Tipton (1976, p.52).
[78] Alsace-Lorraine was French until 1871 and was quite different from the rest of this area. It is only referenced because it was part of a German geographical region for record purposes after that date.

this region was less densely populated than the north and (again apart from Alsace-Lorraine) had a chequered history in attracting and encouraging investment in the railways.

Baden lay at the southern end of the River Rhine, the busiest trade route from The Netherlands to Switzerland, and on its western borders it was proximate to France.This location enabled Baden to capitalise on the flow of lucrative commerce through its inland port at Mannheim. It also pointed to the railways being state controlled. However Baden's desire to be a profitable early adopter of railways was bedevilled firstly by its decision not to use the emerging standard 1.435 metre track gauge being introduced elsewhere in Germany, then secondly by the delay in the building of the Mannheim-Basle railway; both cases were reported previously. Finally, by 1854 all main routes were in operation.[79]

Württemberg lay between Baden to the west and Bavaria to the east. Mainly a wooded and mountainous area, Württemberg's economy was largely dependent on agriculture and textiles. At first, its state government was not enthusiastic about railways but changed its mind and had an operational service in place by 1854.[80] However, its hopes for capitalising on this by negotiating easements for its railways were frustrated. In the short term, neither was a connection to Baden's railway serving the Rhine corridor trade route achieved, nor was access via Ulm to the port of Friedrichshafen on Lake Constance (described later) agreed with Bavaria. Either would have boosted Württemberg's economy. Finally, a deal was done in 1850 with Baden, and with Bavaria 1861 although this did not have full effect until 1873.[81]

Bavaria was the strongest of the southern states and the counter-balance to Prussia in German affairs. It jealously guarded its independence of action but this was often interpreted as exemplifying *kleinstaaterei.* In other words it sought the selfish pursuit of its own interest to the detriment of a greater good. An example was its refusal to allow the line from Augsburg to Ulm to be built. This would have connected Bavaria's capital, Munich, with Württemberg's

[79] Kech (1911, p.18).
[80] Kech (1911, p.18).
[81] Mitchell (2000, pp.46-49).

capital, Stuttgart. This refusal in turn frustrated a proposed railway link between Paris and Vienna. This was motivated by Bavaria's fear that south-bound rail freight traffic from Hof on the border of Saxony through Augsburg to Bavaria's port of Lindau on Lake Constance would have been jeopardised if a short cut using Württemberg's tracks over Ulm to the port of Friedrichshafen, also on the lake, became available. The line from Hof to Lindau was 566 kms and had been constructed between 1843-1853; it was a prize to be protected.[82] Consequently, this saga continued over many years and "Bavaria's policy was…[seen as]…particularism incarnate."[83]

At this point the historiography has to be challenged. A close scrutiny of the railway maps of the period (see Appendices) show that the Hof-Lindau line at Nördlingen already connected with Ulm by 1860 without any major detour. South of Ulm the line connects with Friedrichshaven on Lake Constance; but this has to be deduced by taking into account the maps for railways at the end of 1850 and 1860.[84] Thus the problem about not allowing a connection between Ulm and Augsburg for the reasons stated is puzzling.

Despite the first railway in Germany having been built between Nuremberg and Fürth in Bavaria in 1835, in a declaration ten years later the Bavarian Minister President Karl von Abel declared that "the government would under no circumstances allow railways –'whose owners can, up to a point, dominate the country's entire commercial and passenger traffic'– to be run by private companies."[85] Yet circumstances conspired such that the government did reluctantly welcome investors. However, a number of projects failed through under-estimation of the costs involved and fledgling railway companies had their charters withdrawn. The ensuing loss to investors frightened others away. This left only one viable private line, Munich to Augsburg. The government then fell back on its initial preference to run a state railway system and, seeing the

[82] Kech (1911, p.21).
[83] Mitchell (2000, pp.45-47).
[84] Kobschätzky (1971).
[85] Henderson (1975, p.48).

profits that could be made in the long term, moved to a state owned system which was completed by 1874.[86]

In much of the historiography the southern states are portrayed as being stuck in the eighteenth century. The low population density and distance from coalfields have been noted as negative factors against attracting and encouraging industry. Another important factor was that, unlike elsewhere in Germany, in Bavaria and Württemberg the vestiges of the guild system prevailed in manufacturing until 1848 and 1864 respectively.[87] The guilds controlled employment and trade relating to manufacturing, and to this legacy can be attributed some measure of responsibility for the economic stagnation of the southern states. Elsewhere[88] in the historiography the main causes are identified in the "divisions among the ruling elites of the southern states [which] often hampered development…[and where]…central governments were unwilling to see initiative displayed by local communities in any sphere of action." Equally, those communities were hostile to government regulation and did not welcome new enterprise by strangers to their area. Consequently, at that time, an absence of natural resources, increased transport costs to haul coal from a distance, regressive governments and institutions, and a society riven by class and self-interest, all conspired to create an environment inimical for business to flourish. Nevertheless, athough manufacturing took second place to agriculture across the southern area,[89] textiles were strong in the three southern states.[90] The fact that there were cloth and yarn exchanges in Stuttgart and in Augsburg reflected the region's position as an important producer of woollen textiles.[91]

The Secondary Railway System

It was noted earlier that in 1869, prior to the unification, the *Verein* had examined the possibility of using redundant railway lines and fittings, as well as rolling stock, still having useful life remaining, for the construction and operation

[86] Kech (1911, pp.20-24).
[87] Gutberlet (2013b, p.2).
[88] Tipton (1976, pp.59-60).
[89] Tipton (1976, pp.57-58).
[90] Henderson (1975, p.61).
[91] Gutberlet (2013a, p.5).

of a secondary railway system. The *Verein der Techniker* followed up in 1876 with the publication of *Gründzuge für die Gestaltung der Sekundären Eisenbahnen* (Fundamental Principles for the Design of a Secondary Railway)[92] which detailed the design requirements for such a system. Yet, it took some time and an economic slump in Germany before any interest in its possibilities was shown by government. Finally, Bismarck was persuaded to the idea and was instrumental in bringing into law the Secondary Railway Act (1878). This law included restrictions on speed that had significant operational and safety implications.

It is important to note this date, 1878, because there is a disconnect in the historiography. Gutberlet[93] indicates that prior to this but, "after 1861 railroad construction shifted from laying new trunk lines to building branches that connected smaller towns to the network. By 1875 a dense web of railways reached all district capitals and many smaller towns." This is interesting, but may well be overstated, given the size of Germany and the cost of building branch lines to the same standard as main lines; this was the requirement at that time. Indeed, another source indicates that once the main lines had been completed investors were reluctant to sink further capital in lines which had little prospect of delivering profit.[94] Yet another report states that before 1870 there were few regional networks or linkage between them.[95] Hence, it was governments within the federation which were attracted to the idea of secondary railways because their construction and operating costs were much reduced. Attracted by reduced operation costs, Saxony took advantage of this in the 1880s and downgraded 500 kilometres of track to secondary status.[96]

That there was considerable demand for these lines is illustrated by the formation of the Bachstein Company. As will be remembered, around 1879 this firm offered a central management service for secondary railway lines introduced by the Act of 1878. This provided a railway design and build service

[92] Staatsbibliothek, Berlin. Nz 15808.
[93] Gutberlet (2013a, p.4).
[94] Mitchell (2000, p.44).
[95] Mitchell (2000, pp.54-55).
[96] Ziegler (1996, p.355).

with a full supporting package: recruitment of labour, payroll, contracting, accounting, procurement and legal services.[97]

While the historiography refers to the secondary railway system, few facts are presented to allow mapping the distribution of such railways, or to describing their economic effect. Given the size of the task, which would involve researching all the state archives, this must be considered as a separate project. However, an indication of their impact can be gleaned from the case of the Wilkau-Wilzschhaus railway constructed in Saxony between 1881 and 1893. This was well after the main railway network had been built in Germany and, hence, it is reasonable to consider this as a valid example of the secondary railway system because of the date of its coming into service. This railway generated a cluster of industry, some "eleven new factories that produced metal goods, machine tools, paper, and chemicals". [98] The historiography also indicates that Wilkau was part of a coal belt. This in itself is interesting because Saxony was not a major coal producing region, yet in this case it benefited from being on a coal seam. Thus, not only did it have cheap coal, but it could recruit trained engineers from the mines. A further benefit was that secondary railways were able to set tariffs for an initial period of eight years after coming into operation.[99] Such price stability would have been an immense commercial boon. It is clear that, together, these advantages would have allowed the new industries to compete successfully against established manufacturers elsewhere even "squeezing manufacturers in other regions out of the market…Ziegler discusses the destruction of old manufacturing centers and rising imbalances between regions as part of the transport revolution in Germany."[100]

Still, there was another facet to this. Paradoxically, recent research[101] strongly indicates that, in the second half of the nineteenth century, better access to markets resulting from the arrival of the railways "had a negative impact on manufacturing growth in regions with below median per capita manufacturing

[97] Kühne & Reiners (2010, pp.30-31).
[98] Gutberlet (2013a, p.6) citing Ziegler (1996).
[99] Meyer (1897, p.85).
[100] Ziegler (1996) cited by Gutberlet (2013a, p.6).
[101] Gutberlet (2013a, pp.1-2).

employment, but for regions above this mark the impact was positive. This [meant] that the railroad boom did not support the dispersion of industry but instead contributed to the geographic concentration of industrialization." Nonetheless, the research admits of a complex picture: manufacturers could still have been attracted to such regions because of their low costs if such costs, together with low rail transportation costs back to distant markets in the industrialised areas, allowed for profitable business. Under the circumstances, the Wilkau-Wilzschhaus case fits into this latter category.

There is no doubt that the secondary railway system created employment across the country by the construction and maintenance of lines and the maintenance of rolling stock. It would also have stimulated agriculture and generated associated light industry, not least railway workshops which acted as *de facto* training centres for engineers. It is reasonable to conclude that agriculture especially benefited because secondary lines, acting as feeder lines to the main railway network, would have allowed perishable produce to access markets in distant towns and cities for the first time.

The *Verein's* proposal for a secondary railway system had far-reaching implications economically and commercially. Altogether, the prima facie evidence supports the claim that the secondary railway system revitalised the regions, stimulated the national economy and thereby helped to alleviate the effects of the economic slump from the time of its introduction in 1878.

The major chapters now completed, the next section concludes by comparing what was supposed at the beginning of the project, the hypotheses, with the reality found. The section also identifies the original contribution to scholarship which is encompassed within this thesis.

Conclusion

- The *Verein's* contribution to Nineteenth Century Germany

This section summarises the reasons why the *Verein's* achievements and influence merit further consideration and a place of importance in the historiography of nineteenth century Germany.

Mitchell[1] refers to the importance economic historians attached to the railways in Germany when he observed that "railway engines provided the elemental force of Germany's extraordinary growth in the nineteenth century…[providing the]…take-off from an agricultural to an industrial society." To put this into perspective, railway locomotives were deployed in continuously growing numbers after their introduction into Germany in 1835. However, unless there were good relations between companies, important information on operating problems, mechanical and otherwise, was not going to be shared for mutual benefit. Worse still, there would be little prospect of crossing over onto one another's lines if track gauge and rolling stock dimensions were all different. This would have been a commercially limiting situation with little justification for sunk costs resulting in minimal prospect of growth, of profitability, or return on capital employed.

Initially, co-operation such as the Dresden-Leipzig Railway acting as a school of learning for its neighbour the Leipzig-Magdeburg Railway was a prime example of good practice. Similarly helpful was the Prussian government's decision to standardise on the British 1.435 metre track gauge, and its efforts in the 1840s to get the Prussian railway companies to improve their performance technically. Nonetheless, it was insufficient to avert bad practice like Baden Railway's choice of a different track gauge from its neighbours, or railways trying to negotiate issues with government on a one to one basis.

After some ten years of operating practice, the Prussian railways gradually came to the realisation that it was better to join together in a permanent union (that is, an association) to pool information and to present a united face to

[1] Mitchell (2000, p.54).

government in negotiations. Ultimately this led to the founding of the *Verein,* a constitution based society. This not only promulgated regulations and procedures for the guidance of its members and customers, but also established a clearing house for its members' receipts and payments.

That the *Verein* engendered good relations amongst its members because of its early policy of unanimity (later majority voting) in decision making, and the provision of an arbitration service to resolve disputes, is less well known; this resulted in a well-oiled institutional machine. What was more obvious and led to the railways, the *Verein's* constituent members, being recognised as a leading sector was the way that the railways catylised industry, generated both backward and forward linkages, aided the regeneration of agriculture, provided for the rapid transit of freight in bulk regardless of the weather, enabled the movement of labour and provided employment wherever track was laid down. In addition the railways, for the first time, provided affordable transport for the masses and travel between states. This promoted better communications and assisted in regional differences being better accommodated, or as described in the historiography "smoothed out". In a connected matter, Segal[2] makes an interesting point in his paper about spatial-political perceptions resulting from the German railway cartography of the period: "new maps…came to overshadow other national and political signs…railways were a cause of de-territorialization for regions and states and for the vision of a unified Germany."

Despite the railways' friction with the Prussian government which had been evident in the years prior to the *Verein's* formation, later when its technical arm the *Verein der Techniker* was set up as semi-autonomous body, Henze of the Royal Prussian State Railways was able to inform the inaugural assembly of that society, on 25th February 1850, that the Prussian Minister of Public Works had "taken note of the assembly's work with great interest and wished to show a sign of his recognition." This took the form of an invitation to the engineers present to travel on a special excursion train from Berlin to Gorlitz and Bunzlau "to inspect the magnificent structures on that railway."[3]

[2] Segal, *Imago Mundi*, (2016, pp.46-61).
[3] *Rückblick…in Technischer Beziehung* (1900, p.63).

From the beginning the railways generated huge employment in a new railway construction industry and in the railway companies themselves. However, the impact was more widely felt as a result of backward linkages from "the railways' demand for inputs…[which]…influenced the sales, profits, production, and, ultimately, investment in those branches of the economy which supplied such inputs."[4] Such demands produced backward linkages[5] for coal, iron, and steel, stimulating production massively by factors x8, x14, x54 respectively over the period 1850-1857.[6] This translated into the "railways absorbing over one-third of German iron output in the 1850s, and thus, indirectly, more than 4 per cent of coal mining production."[7] These figures closely mirror those of Great Britain in the late 1840s.[8] Around the same time, 1842-1853, the expanding requirement for locomotives by German railway companies put pressure on, and provided opportunity for, German engineering firms to adapt to meet that demand, that is by backward linkage from the railway companies. This gave rise to a new rolling stock manufacturing industry with double benefit through import substitution. Taking one example, this is evidenced by the steady move away by Prussian railway companies from the purchase of foreign locomotives to German built ones.[9]

Forward linkages[10] resulting from the railways also had impact. These were "investments in capacity which were undertaken due to the transportation improvements brought about by railways". These emanated from improvements relating to technical, and organisational issues (for example, the standardisation of rolling stock, equipment, processes and procedures promoted by the *Verein*) and the resulting savings passed onto the customer. This was usually by means of reduced prices under the pressure of competition.

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[4] Pierenkemper and Tilly (2005, p.61).
[5] Backward and forward linkages: Backward linkages: channels through which material, information and money flow between a company (or organisation) and its suppliers and create a network of economic interdependence. /Forward linkage: a distribution chain connecting a producer or supplier with the customer. Source: http://www.businessdictionary.com/definition/backward -linkages. ~forward-linkages. Accessed 10 April 2019.
[6] Blackbourn (1998, p.178).
[7] Pierenkemper and Tilly (2005, p.63).
[8] Aldcroft (1991).
[9] Pierenkemper and Tilly (2005, pp.61-62 Table 16).
[10] Pierenkemper and Tilly (2005, p.65).

In the latter part of the century when the chemical and shipbuilding industries emerged, their demand for a continuous flow of raw material could only be met by the railways in the quantities required. As for the chemical dye producers, equally their dyestuffs could only be moved quickly by rail to the waiting textile industry which was geographically scattered around the country. This picture gives credence to the belief that the railway was the technology which shaped growth during the industrial revolutions in Germany. Pierenkemper and Tilly[11] reported that "economic historians have assigned railways a crucial role in German industrialisation. They were a leading sector."

Yet, there was more than this. The railways were enabled by the technical and administrative inputs and co-ordination of the *Verein*, and more often than not they themselves agreed tariffs. Through the freight transportation service the railways provided, the *Zollverein* was empowered by its aspirations being turned into reality. No longer were wagons bogged down in muddy roads frustrating the free flow of trade and commerce as foreseen and designed by the *Zollverein* treaties, but regardless of the weather they moved their freight and passengers steadily along. Henderson[12] captured the essence of it when he observed that "the *Zollverein* and the railways together set Germany on the road to industrial success."

The *Festschrift* assessed the *Verein's* impact thus: "The Union [the *Verein*]…has contributed significantly to the healthy economic development of our polity, the strengthening of our domestic policy making and our ability to defend ourselves externally, as well as the consolidation of international economic and political relations across the territory of the Central European states."[13] In a similar vein, Kaiser and Schot wrote: "To many non-Germans, it was felt that the *Verein* had been an important instrument for establishing a powerful Germany."[14]

[11] Pierenkemper & Tilly (2005, p.58).
[12] Henderson (1975, p.52).
[13] *Festschrift* (1896). *Einleitung*, p.XVIII.
[14] Kaiser and Schot (2014, p.138).

Consequently, the question arises as to what extent nineteenth century Germany could have progressed without the standardised railway system the *Verein* created, or at least a delay to its general introduction?

This requires a stepped answer. This thesis has reported the inadequacy of the roads and waterways in Germany at the beginning of the railway age; Prussia particularly lacked the government finance to build and maintain them. It was different in the south of the country where government funds were available. But it soon became clear that railways were capital intensive enterprises on a continuing basis which demanded multiple sources of funding.

Apart from this and the absence of indigenous technology and a manufacturing industry to produce the rails and locomotives, the outstanding negative feature was the absence of a single statutory authority to regulate an emergent railway industry. This was a critical requirement because of the fragmentation of the country into 38 independent states. By a series of events, namely, borrowing the technology, the arrival of new investors and later industrial banking, the majority of these problems were overcome by the 1850s. But from 1847, it was the *Verein* that filled the all-important railway co-ordinating authority role, although in a non-statutory capacity and purely on the basis of a voluntary society of railway administrations. Yet this association commanded the tacit support of governments both within, and outside, Germany's borders. Railway companies also saw that their best chances for success arose from following the leadership the *Verein* provided.

It is inconceivable that had the problems listed above not been resolved in a reasonable timescale, outside countries would not have become more involved than they already had. The British laid down the first railways in Germany, Nuremburg to Fürth, and Dresden to Leipzig, and provided funding from the London markets into the Prussian coffers. The French, arguably, introduced industrial banking. These initiatives would most certainly have developed further because of the lucrative business opportunities they presented.

Hence, the real question here is about the *Verein*. Would a unified and effective railway system have developed at that time without the *Verein*? The thesis reveals a possible answer to this: the *Zollverein* could have fulfilled this role

had it not been for the other German states' trepidation about Prussia's ambitions. It was the *de facto* leader of the *Zollverein* and the states feared their railway funds would be appropriated into a communal budget managed by Prussia.

Against these considerations the *Verein* was a perfect and timely solution. Its inputs as the *de facto* co-ordinating and non-statutory regulatory authority for the railways enabled the railways to become a leading sector in the German economy, and in turn to act as an enabler for other sectors to fulfil their roles effectively. At the same time the *Verein's* gift for forming co-operative relationships across boundaries expedited the economic health of north central Europe through the surge in trade and commerce underpinned by the railways. It might also be claimed that this extended to assisting Italy's industrial revolution once the St Gotthard Tunnel was opened and raw materials from Germany sped their way to Turin and Milan.

In the Introduction, the question of inference in the thesis was raised. It was recognised that, given the limitations of the source material, a challenge might reasonably be made concerning many of the broader conclusions about the operation and impact of the *Verein* being derived by inference from the nature of the organisation. A response, with examples, was offered to support what may be viewed as amongst the principal inferences. Other inferences in the thesis arose through reading the historiography, further informed by the writer's experience of working in the United Kingdom civil service and later working in manufacturing industry. Nevertheless, it is acknowledged that, should relevant new evidence come to light, historians in the future may be able to provide more substance to the arguments put forward in this thesis.

The Original Hypotheses -Outcomes

At the outset of this research it was believed that the *Verein* was more than a trade association. A number of hypotheses were mooted to demonstrate this. The following commentary reviews these against the conclusions reached.

It was believed that the *Verein*, acting with and through its railway administration members, was:

Independent of government. The evidence does not support this hypothesis. The fact that many of the *Verein's* member railway administrations were owned and operated by state governments made this impossible. Further, it made sense for the railways to have a close relationship with government especially as many of the *Verein's* executive management included serving and former civil servants. However, in the early days (the 1840s) this proved elusive because the relationship was marred by the conflict in Prussia between the leading private railway companies and the government over the strictures of the Railway Law (1838). This got no better with the arrival of a new Prussian railways minister, von der Heydt, who was "double hatted" as the Minister of Commerce. Von der Heydt saw the railways' first duty was to serve the public good, not shareholders. He used the law (or threat of it), to force the railways to reduce their freight charges (the imposition of the ein pfennig tariff) and to provide better services for business (running night trains). Von der Heydt's initatives demonstrably improved the business performance of the railways. This showed a degree of dependency on government in the period before the *Verein's* inputs raised the railways' management performance. Over the next decades, entrepreneurs who had invested in the railways made efforts to compromise with government and find a middle way for mutual benefit. The construction of the railway network overseen by the *Verein* was considered as helping the government to forge the structural continuities that marked post (1848) revolutionary German history. This appraisal has focused on Prussia, but what happened in Prussia, the most populated German state with the most railways, set the scene for what happened elsewhere in Germany.

The centre of railway engineering excellence and a technology leader. The evidence supports this hypothesis. The *Verein* was primarily an engineering body and at its core was the *Verein der Techniker*. This worked solely to the instructions of the *Verein* and was engaged in both the science and mechanics of engineering specific to the railways. Such activity was often in consultation with rolling stock manufacturers and their suppliers, for example, Borsig and Krupp. At a time when railways were pushing the limits of technology, the *Verein der Techniker* involved itself in the evolving sciences of steam, oil lubrication and metallurgy. Its findings, whether on routine or

scientific matters, were reported to the *Verein,* thence to the *Verein's* general assemblies. Subsequently these reports would find their way into the *Verein's* publications. There is no evidence to suggest that there was a comparable organisation to the *Verein der Techniker* in the regions of the *Verein's* membership centred on Germany. As such, because of its domain knowledge, expertise and research activities, it was recognised as a centre of excellence and a technology leader. The *Verein der Techniker* can be likened to the back-room of a tailor's shop and the *Verein* its shop window. The *Verein der Techniker's* special value to the *Verein* was that it enabled the *Verein* to survive the changing political environment. Hence, after the REA was founded as the official Imperial railway authority in 1873, thus displacing the *Verein* which had acted only in an unofficial capacity, the *Verein* was able to continue because its status as the railway centre of engineering excellence was maintained.

The *de facto* non-statutory railway authority in Germany. The evidence supports this hypothesis until 1873 when the REA (Imperial Railway Office) was established. Thus for a period of twenty six years the *Verein* discharged this role via a membership which accepted its guidance on a voluntary basis. How did this come about? From the early days it was seen by German railway companies that, in the absence of any governmental body to control the railways, some kind of association was necessary to share knowledge and operating experience, and to issue technical and administrative procedural notes for guidance. Also, to present a united face on behalf of railway administrations to government(s). Out of this came the *Verein* in 1847 and the recognition of the need for unity and standardisation. Not only railway companies but governments saw the sense in having such a body and gave tacit support to the *Verein* to act as a non-statutory railway authority. However, the *Verein* did not have a free hand but was constrained by its constitution wherein the key feature in its formative years was the need for unanimity in decision making. This gave comfort to its members, especially governments, that no decisions would be imposed upon them. Subsequently, after the railway network and its main features were substantially in place, decision by majority voting was introduced.

The co-ordinating authority behind the most important strategic element of modern Germany's national infrastructure, namely a standardised railway network, and as such the lead in the transport revolution. The evidence supports this hypothesis. It was apparent from the 1840s when railway companies first wanted to cross into one another's territories that railway track and rolling stock must be compatible. Notwithstanding earlier efforts by the Prussian government, it was not until the *Verein* was formed that standardisation was taken seriously and technical guidance documents issued after consulting with such bodies as the Association of Architects, regarding aspects of building the railways, and with rolling stock manufacturers. This enabled the construction of a standardised, inter-operable railway system which proceeded apace until by 1860 the railway network in Germany was substantially completed (see map at Appendix). As such this railway system, built and operated under the guidance of the *Verein*, to the latest technological standards represented the most important strategic element of modern Germany's national infrastructure. Unlike road haulage or waterborne transport it was not affected by the weather. This inherent reliability, together with its speed differential gave it a critical advantage over its competitors. This transformed the cost of freight transportation and logistics and thereby costs associated with trade; this resulted in significant social savings calculated to be 5 per cent of Germany's GDP in the 1890s. This was the start of the transport revolution which the railways led until the advent of the motor vehicle (by Karl Benz) in 1885. Even then the railways vied with the motor vehicle for the lead position because the first electric locomotive was built in Germany circa 1879, although one did not come into service until circa 1911 between Dessau and Bittefeld.

The catalyst and indispensable support for Germany's two industrial revolutions. The evidence supports this hypothesis. Economic history focuses mainly on the catalytic effect of the railways by jump-starting the first industrial revolution in Germany. For the first time coal, lignite and iron mines were able to mine to their maximum output because the railways were able to move these minerals in vast quantities regardless of the weather to their customers. This allowed for reduction in tariffs which rippled back into the economy. The

railways were not just suppliers of transport services but customers whose demand-driven backward linkages, for track bed ballast, iron rails, ties, wooden sleepers, bricks etc., for locomotives and rolling stock, and for labour stimulated existing industries and created new ones. This created a network of economic interdependence and re-vitalised the economy, not least by import substitution. Forward linkages, such as increased investment in industry, which emanated from cost savings passed into the economy as a result improvements in the railways similarly generated economic growth. Later, with the second industrial revolution came the new industries of chemicals, dyestuffs and shipbuilding. From then onwards, vast tonnage of coal, salt and steel needed to be moved. This represented a step change in volumes and weights and could only be transported because, by then, the tracks were more robust and the locomotives more powerful. Without the railways these industries could not have developed.

More akin to a commercial head office of a corporation with far reaching commercial effect. The evidence supports this hypothesis. As the railways expanded there was a need for the administrative procedures which underpinned the business to be compatible. This meant especially that railway to customer interfaces, railway to railway payments and receipts, railway to government interfaces had to be as standardised as possible. Further, it was desirable for the law under which the railways operated to be common for all. It must not be forgotten that at that time there were no common standards for weights and measures, or distances, no common law, no common commercial law, no common currency and no common language in Germany. While the *Zollverein* had pondered on these issues it had made little progress beyond collecting taxes from members and dividing the proceeds (to a formula) back to them. Therefore, its proposals must be considered aspirational. By comparison there was an immediacy about the *Verein's* members' business. This forced the *Verein* to devise procedures and arrangements to allow financial and commercial transactions between member companies, with customers and with suppliers. Also, the *Verein* influenced government on such matters as the German Commercial Code and customs duty provisions, and by compiling, using and making available reliable statistics was an early provider of such

information. Altogether, it is apparent that these procedures must have spilled over into the mainstream of business to the benefit of the economy.

A *de facto* political institution as well as a trade association. The evidence supports this hypothesis. In terms of "new institutional economics", the *Verein* demonstrably satisfied the requirements for an institution (as described by Dunlavy and North) in that it consisted of rules, compliance procedures, and had an ordered distribution of power. Further, it provided a stable structure and friendly environment within which human interaction took place and facilitated the realisation of co-operative solutions. In this way the *Verein,* by means of its technical, operational, administrative and financial procedures reduced economic uncertainty. As political science recognises that institutions inherently have a political dimension and reduce economic uncertainty, the *Verein* was certainly a political institution.

An unanticipated counter-balance to the *Zollverein*. The evidence supports this hypothesis. Although not a recurring issue, the record reveals that the *Verein* on occasion was forced to publicly confront the *Zollverein* on its protectionist stance. One example cited in the *Verein's* newspaper, ZVDEV, in 1861 reported the *Verein* as objecting to rates proposed by the *Zollverein* because they were inimical to the economy.

A major force in driving the use of the German language. The evidence supports this hypothesis. Over many years, resulting from military conflicts and peace settlements, German states, particularly Prussia, had acquired land and people from other powers. These populations were not German speaking and were slow to assimilate. The coming of the railways in Germany brought the German language more immediately into their communities. If they wished to avail themselves, or their businesses, of the railways they had to be able to read and speak German because the *Verein* and its constituent railway administration members only used German. In this way the *Verein* was a major force in diffusing the German language in German lands. This acted as a "glue" in the nation building process, an enabler in what Childers referred to as the transformation of Germany from a *Kulturvolk* (cultural nation) into a *Staatsvolk* (nation state).

An international body which raised the profile and awareness of Germany as a world power. The evidence supports this hypothesis. The *Verein* exercised *de facto* geo-political power through influencing railway administrations in neighbouring countries to adopt its regulatory practices and, or, inter-face arrangements. This increased Germany's influence in Europe and eventually led to the Berne International Convention on European trans-national railway freight traffic.

The Study as an Original Contribution to Knowledge

This study constitutes an original contribution to knowledge in the following ways:

A clear account based on evidence that the *Verein* was the *de facto* non-statutory railway authority in Germany until the establishment of the REA in 1873; A clearly presented case that the essence of the *Verein's* continuing power and influence was the agency of its technical arm, the *Verein der Techniker* as a centre of railway technical excellence and research; A clearly presented case that the *Verein* was a poltical institution as well as a trade association; A new interpretation that it was the *Verein* in a co-ordinating role, working through the *Verein der Techniker* and the *Verein's* railway administration members, that was responsible, as the enabler, for the establishment of Germany's most important modern strategic infra-structure, namely a standardised, inter-operational railway network; An explanation why the *Verein* was the indispensable support for Germany's second industrial revolution; Reasons why the *Verein* should be considered a pioneering commercial body which facilitated good business practice across Germany and beyond; Reasons why the *Verein* should be considered the principal facilitator of adoption of the German language across "German lands"; Reasons for identifying 1866 as the year the *Verein's* power and influence started to wane; the clear identification of the *General Konferenz* as the *de facto* successor to the *Verein* in Germany**.**

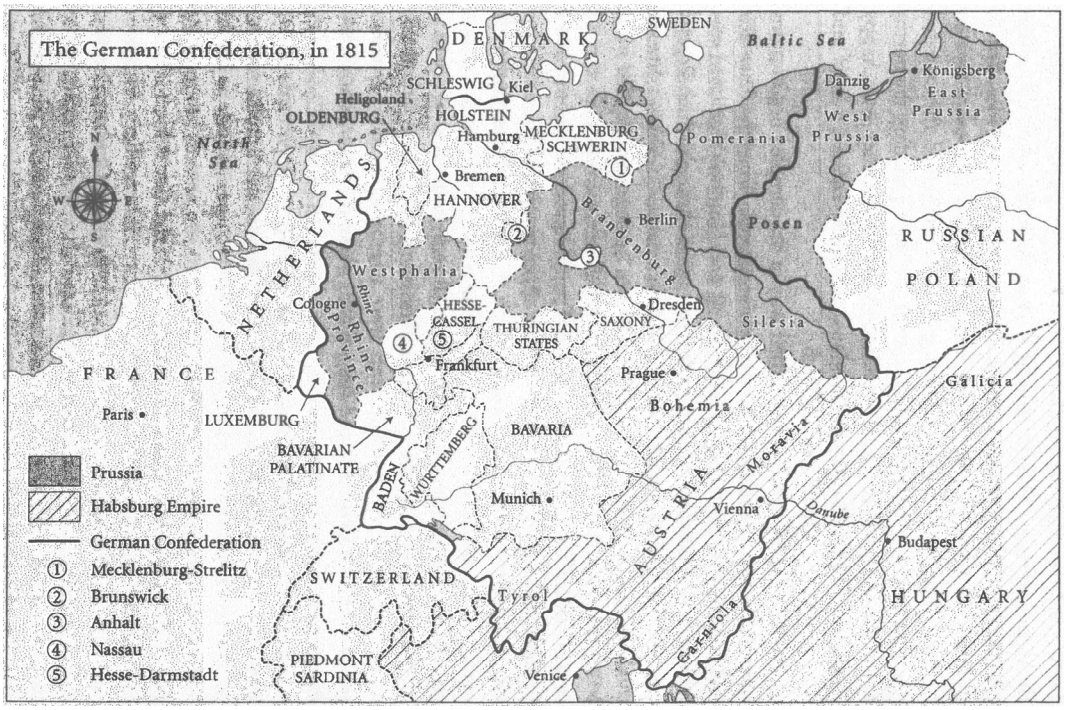
The evidence presented in this thesis re-evaluates the *Verein's* place in the ascent of nineteenth century Germany as a leading industrial, trading and commercial power. Without the *Verein* and its contribution it is unlikely that

Germany would have achieved these heights. It is clear that the *Verein* was certainly more than a trade association!

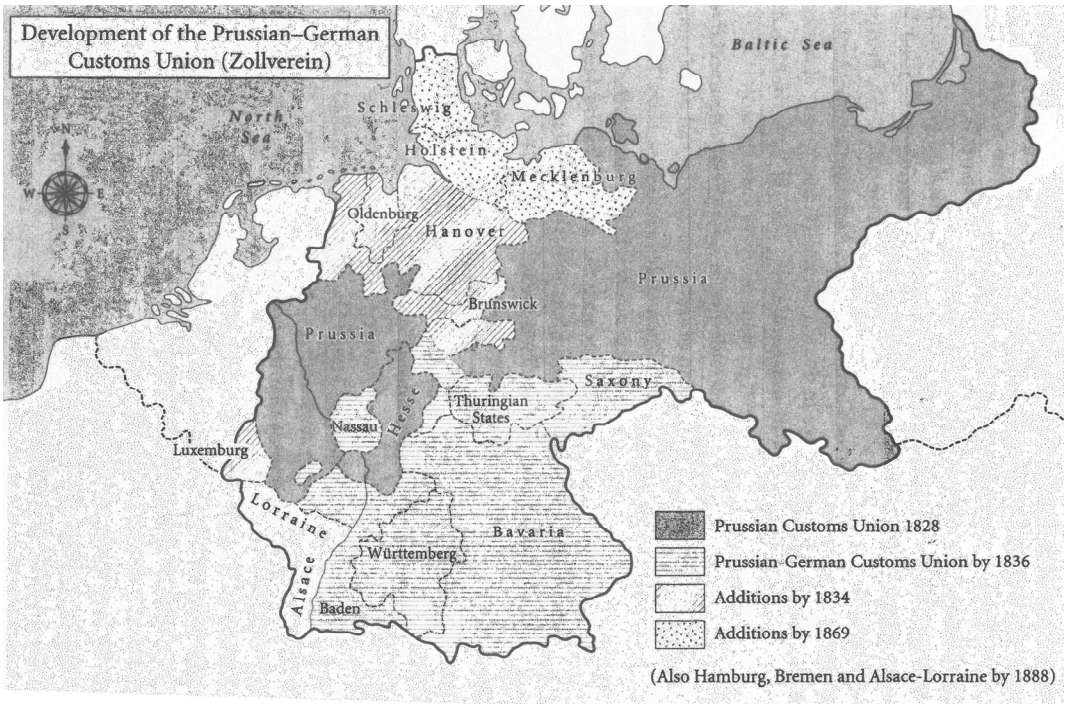
Appendices

Appendix A

Maps

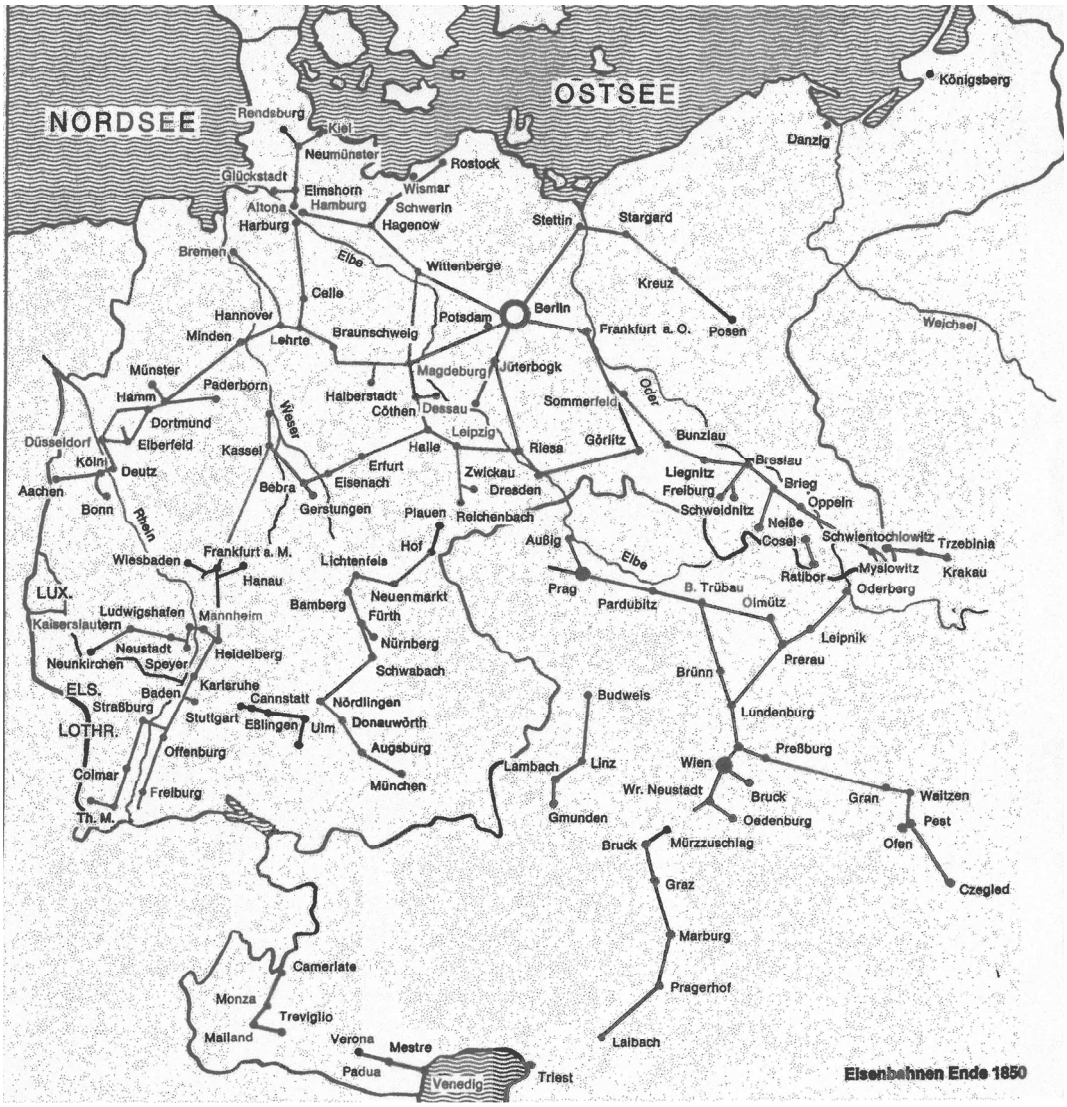


The German Confederation in 1815*

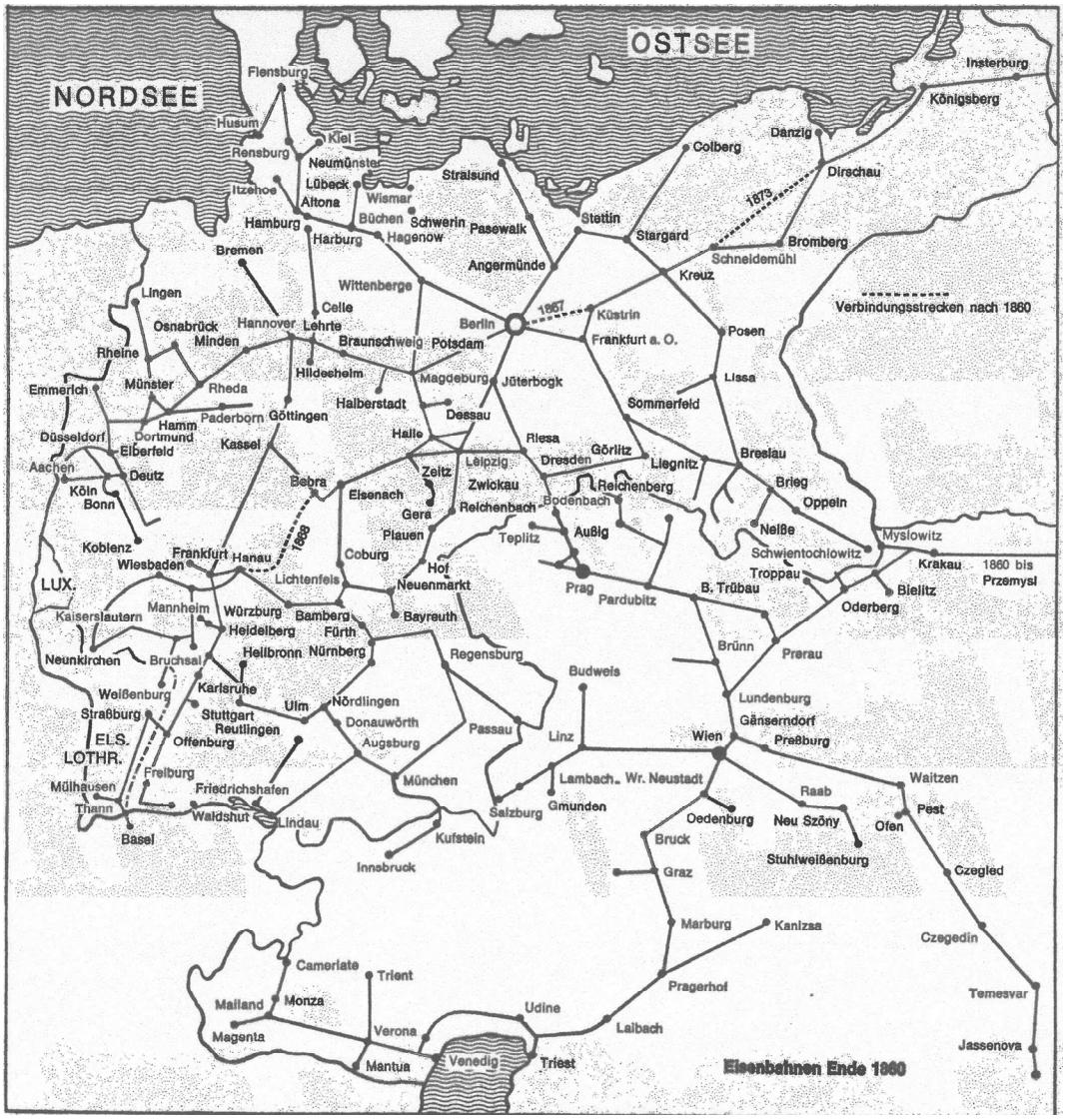


Development of the Prussian-German Customs Union (*Zollverein*)*

* Copyright material from Christopher Clark's *Iron Kingdom* (2006). Used under restriction by kind permission of Penguin Press, London.



Railway tracks in Germany at the end of 1850**



Railway tracks in Germany at the end of 1860**

** Permission to use copyright material applied for. Source: Hans Kobschätzky's *Streckenatlas der deutschen Eisenbahnen 1835-1892* (1975) Alba Buchverlag, Düsseldorf.

Appendix B

Length of Railway Line Open (in kilometres)[1]

	Germany			Prussia	
	Single track (i.e. route-kms)	( )[2]	Of which double-track	Single track (i.e. route-kms)	Of which double-track
1835	6	(6)			
1836	6	(6)			
1837	20	(21)			
1838	141	(140)		34	
1839	242	(240)		69	
1840	462	(469)	117	185	
1841	677	(683)	135	395	18
1842	922	(931)	248	588	113
1843	1310	(1311)	264	815	136
1844	1758	(1752)	264	924	136
1845	2151	(2143)	286	1106	158
1846	3291	(3281)	426	1972	188
1847	4317	(4306)	650	2424	320
1848	5002	(4989)	1139	2718	567
1849	5458	(5443)	1229	2880	632
1850	5875	(5856)	1248	2967	635
1851	6162	(6143)	1334	3153	731
1852	6649	(6605)	1394	3487	735
1853	7177	(7147)	1557	3697	803
1854	7608	(7571)	1808	3697	992
1855	7862	(7826)	-	3822	1040
1856	8672	(8617)	-	4373	1184
1857	9055	(8991)	-	4652	1426
1858	9721	(9650)	2873	4901	1550
1859	10648	(10593)	-	5452	1600
1860	11157	(11089)	-	5762	1742
1861	11567	(11497)	-	5951	1800
1862	12150	(12048)	-	6113	1821
1863	12773	(12651)	3710	6416	1960
1864	13240	(13114)	4048	6560	2110
1865	14034	(13900)	4400	6895	2265
1866	14941	(14787)	4618	7133	2418

For the avoidance of doubt: 'single track' = 'route kilometres' and from this total figure a proportion was of a greater capacity, thus 'double track'. The two columns are **not** to be added together to provide a grand total.

a From 1872 with Alsace-Lorraine. Fremdling (1975) Table 20.

b From 1868 with the territories annexed in 1866. Fremdling (1975) Table 20.

[1] Except for figures in brackets (see below), figures are from Fremdling (1975) Table 20 *Die Streckenlänge deutscher und preußischer Eisenbahnen.* Fremdling's figures stop in 1879 the year railways in Prussia were taken into public ownership.

[2] Figures in brackets are (comparable) single track (i.e route kilometre) figures for Germany from Mitchell, B.R. (1998) Part F1 p.673 and p.676. Mitchell does not provide figures for double track in Germany or figures for Prussia.

	Germany			Prussia	
	Single track (i.e. route-kms)	( )	Of which double-track	Single track (i.e. route-kms)	Of which double-track
1867	15793	(15679)	4929	7425	2640
1868	16442	(16316)	5275	10125[b]	3645[b]
1869	17322	(17215)	5673	10457	3796
1870	18810	(18876)[3]	5959	11460	4067
1871	20405	(21471)	6337	12474	4377
1872	22522[a]	(22426)	7454[a]	13632	4971
1873	23853	(23890)	8061	14461	5398
1874	25495	(25487)	8290	15493	5575
1875	27931	(27970)	9152	16940	6358
1876	29088	(29305)	9186	17556	6391
1877	30288	(30718)	9476	18346	6514
1878	31337	(31471)	9601	18974	6634
1879	33094	(33250)	9782	20134	6795
1880		(33838)			
1881		(34381)			
1882		(35081)			
1883		(35993)			
1884		(36780)			
1885		(37571)			
1886		(38525)			
1887		(39785)			
1888		(40827)			
1889		(41793)			
1890		(42869)			
1891		(43424)			
1892		(44177)			
1893		(44340)			
1894		(45462)			
1895		(46500)			
1896		(47433)			
1897		(48449)			
1898		(49830)			
1899		(50702)			
1900		(51678)			
1901		(52933)			
1902		(53843)			
1903		(54775)			
1904		(55817)			
1905		(56739)			
1906		(57584)			
1907		(58291)			
1908		(59241)			
1909		(60389)			
1910		(61209)			
1911		(61978)			
1912		(62734)			

[3] Impact of territorial changes: further explanations are to be found in the Introduction to Mitchell, B.R. (1998).

	Germany			Prussia	
	Single track (i.e. route-kms)	( )	Of which double-track	Single track (i.e. route-kms)	Of which double-track
1913		(63378) (61159)[4]			
1914		(61749)			

[4] Excludes narrow gauge from 1913 to 1917.

Appendix C

Notes on Currencies

1. The following is an extract from Henderson (1975) Author's Note:

"The following list shows the approximate value of the currencies referred to in this book, [which covers the period 1834-1914], giving in each case the number of units equivalent to one pound sterling:

Thaler (Prussian): 6 ½
Florin or Gulden (Austrian): 12
Mark banco (Hamburg): 13
Mark current (Hamburg): 17
Mark (gold standard): 20" *

*The gold standard was introduced in Germany after the unification by the Currency Law of 1873 (Henderson (1975) p.159).

In the absence of definitive information on date points for conversions prior to 1873, the economic periods used by Mitchell* have been used to form a rough guide. Hence, in this thesis the Mark banco (Hamburg) rate has been used up to 1849; thereafter for the period 1850-1872 the Mark current (Hamburg) rate. Then from 1873 onwards the Mark (gold standard) rate.
*Mitchell (2000) pp 142-143.

2. With reference to the Swiss francs to the pound sterling calculations in this thesis: The exchange rate was advised as 25.2 Swiss francs for one British pound (apart from minor deviations due to transaction costs) in 1882 (and as a matter of fact since 1860). Source: Professor Dr Ernst Baltensperger, University of Berne. Correspondence Flood/ Baltensperger 30-31 October 2019.

3. With reference made to the gulden, guilders and florins in this thesis: The English translation of the German word *der Gulden* is guilder or florin. Source: The Concise Oxford German Dictionary (2009). Consequently, gulden, guilder and florin are inter-changeable terms.

The gulden circulated in southern Germany…[and Austria]…whereas the thaler circulated in Prussia and many northern German states. In 1838 the Dresden Coinage Treaty linked the thaler with the gulden by means of silver at a fixed

rate.This converted at 14 thalers for 24.5 gulden. Source: Pierenkemper and Tilly (2005, p.35).

4. Where sums converted to £s have been derived from sums expressed in billions, the conversions have used British not US billions, that is, where £1 billion was £1,000,000,000,000 (1+12 zeros).

Bibliography

Primary Sources:

Allgemeine deutsche Biographie. 1875 et seq. Leipzig and Berlin, Münchener DigitalisierungsZentrum, Digitale Bibliothek. https://www.digitale-sammlungen.de/index.html accessed 21st March 2019.

Allgemeines Deutsches Handelsgesetzbuch. (1861). Würzburg, Druck und Verlag der Stahel'schen Buch und Kunsthandlung.

Die Deutschen Eisenbahnen in Ihrer Entwicklung 1835-1935. (1935). Berlin, Deutsche Reichsbahn.

Festschrift über die Thätigkeit des Vereins Deutscher Eisenbahn-Verwaltungen in den Ersten 50 Jahren Seines Bestehens 1846-1896. (1896). Berlin, Druck der Nauck'shen Buchdruckerei.

Hundert Jahre deutschen Eisenbahnen. Jubiläumschrift zum Hundertjährigen Bestehen der deutschen Eisenbahnen. (1935), Berlin, Deutsche Reichsbahn.

Rückblick auf Gründung und Wirksamkeit des Vereins Deutscher Eisenbahn-Verwaltungen (1871). Berlin, Druck der Nauck'schen Buchdruckerei.

Rückblick auf die Thätigkeit des Vereins Deutscher Eisenbahn-Verwaltungen in Technischer Beziehung 1850-1900. (1900). Berlin, Druck von Felgentreff & Co.

Primary source material covering the period 1835-1900 was examined and in some cases authorised copies taken during a visit to the Deutsche Bahn Bibliothek-Archiv, Nürnberg, namely:

Organ für die Fortschritte des Eisenbahnwesens in technischer Beziehung; Verein Tages-Ordnung; Protokolle; Zeitungen der Verein Deutscher Eisenbahn-Verwaltungen;

Secondary Sources:

Aldcroft, D.H. (1991). 'The Railway Age'. *The Economic History Society*, Refresh 13 (pamphlet).

Anastasiadou, I. (2004). 'Building Europe on Rails. Working Document No 5. August 2004', *Delft University of Technology, The Netherlands.*

Andersson-Skog, L. and Krantz, O. (eds) (1999). *Institutions in the Transport and Communications Industries –State and Private Actors in the Making of*

Institutional Patterns,1850-1990. Canton, Massachusetts, USA, Science History Publications.

Bagwell, P.S. (1968). *The Railway Clearing House in the British Economy 1842-1922.* London, George Allen & Unwin Ltd.

Banzawa, A. (2012) 'What caused the failure of nationalisation of the railway system in Germany? : Malfunction of the German Imperial Railway Office (*Reichseisenbahnamt*) in the 1870s and 1880s'. Discussion Paper 12-18. *OSIPP,* Osaka University, Japan.

Bartky, I.R. (1989). 'The Adoption of Standard Time'*. Technology and Culture,* **30**, pp.25-56.

Blackbourn, D. (1998). *The Long Nineteenth Century. A History of Germany, 1780-1918.* New York, Oxford University Press Inc.

Blackbourn, D. (2003). *History of Germany, 1780-1918. The Long Nineteenth Century.* Second Edition. Malden, MA, Blackwell Publishing Ltd.

Bradford, E.S. (1907). 'Prussian Railway Administration', *Annals of the American Academy of Political and Social Science,* **29**, pp. 66-78.

Brophy, J.M. (1998). *Capitalism, Politics and Railroads in Prussia 1830-1870*. Columbus: Ohio State University Press.

Brose, E.D. (1991). Review of 'New Profession, Old Order: Engineers and German Society, 1815-1914' by K. Gispen (1991). *The American Historical Review,* **96** (3), pp. 897-898.

Brosius, J. and Koch, R. (1899). *Lokomotivführer III. Abteilung Der Fahrdienst*. Wiesbaden, Verlags J.F.Bergmann.

Bühler, D. (1991). *Die Entstehung der allgemeinen Vertragsschluß-Vorschriften im Allgemeinen Deutschen Handelsgesetzbuch (ADHGB) von 1861*.Frankfurt am Main, Peter Lang.

Carr, W. (1991). *A History of Germany 1815-1990.* London, Edward Arnold.

Chandler, A.D. Jr., (1965) 'The Railroads: Pioneers in Modern Corporate Management', *The Business History Review,* **39** (1), pp. 16-40.

Childers, T. (1990). Review of 'German History 1770-1866' by J.J. Sheehan (1989). Article in the New York Times, 11th November 1990.

Clark, C. (2006). *Iron Kingdom-The Rise and Downfall of Prussia, 1600-1947*. London, Allen Lane.

Cohn, G. (1893). 'The Railway Policy of Prussia', *Journal of Political Economy*, **1** (2), pp.179-192.

Craig, G.A. (1983) *The Germans*. New York, Meridian: Penguin Books, USA Inc.

Crawford, R. (1862). 'The Railway System of Germany'. Minutes of the Proceedings, **22**, (1863). London, The Institute of Civil Engineers. http://www.icevirtuallibrary.com/content/article/10.1680/imotp.1863. Sourced 04/09/2012

Creveld van, M. (1977). *Supplying War-Logistics from Wallenstein to Patton*. Cambridge University Press.

Demuth, F. (1932). German Trade Associations. *The Journal of Business of the University of Chicago,* **5** (4), Part 1, pp.307-320.

Demuth, F. (1933). German Trade Associations. *The Journal of Business of the University of Chicago*, **6** (1), Part 2, pp.55-61.

Dunlavy, C.A. (1990). 'Organizing Railroad Interests: The Creation of National Railroad Associations in the United States and Prussia', *Business and Economic History,* Second Series, Volume Nineteen.

Dunlavy, C.A. (1991). 'Mirror Images: Political Structure and Early Railroad Policy in the United States and Prussia'. *Studies in American Political Development 5,* 1-35. Cambridge University Press.

Dunlavy, C.A. (1994). *Politics and Industrialization -Early Railroads in the United States and Prussia.* Princeton, NJ, Princeton University Press.

Dunlavy, C.A. (2000). Review of 'Capitalism, Politics and Railroads in Prussia 1830-1870' by J.M. Brophy (1998). *The American Historical Review*, **105** (2), pp. 631-632.

Enzyklopädie des Eisenbahnwesens. (1923). Zehnter Band. Berlin and Vienna, Urban and Schwarzenberg.

Evans, R.J. (1997). *Rereading German History 1800-1996*. London, Routledge.

Faith, N. (1990). *The World the Railways Made*. London, The Bodley Head.

Faulenbach, B. (1982). 'Die Preußischen Bergassessoren im Ruhrbergbau. Unternehmermentalität zwischen Obrigkeitsstaat und Privatindustrie' In: Vierhaus, R. *Mentalitäten und Lebensverhältnisse Beispiele aus der Sozialgeschichte der Neuzeit.* pp.225-244. Göttingen, Vandenhoeck & Ruprecht.

Fischer, W. (1960). 'The German Zollverein. A Case Study in Customs Union'. **XIII** *Kyklos: internationale Zeitschrift für Sozialwissenschaften*. Bern, A. Francke and Oxford, Blackwell Publishing.

Fischer, W. (1961). 'Der Deutsche Zollverein, die Europäische Wirtschaftsgemeinschaft und die Freihandelszone.' Europa-Archiv Folge 5 /1961.

Flume, J. W. (2014). 'Law and Commerce: The Evolution of Codified Business Law in Europe'. *Comparative Legal History*, 2:1, 45-83, DOI 10.5235/2049677X.2.1.45

Fogel, R. W. (1964). *Railroads and American Economic Growth: Essays in Econometric History.* Baltimore and London, The John Hopkins Press. (Paperback edn 1970).

Fogel, R. W. (1979). Notes on the Social Saving Controversy. *Journal of Economic History, 39*(1), 1-54. Retrieved from www.jstor.org/stable/2118909

Fremdling, R. (1975). *Eisenbahnen und deutsches Wirtschaftswachstum 1840-1879. Ein Beitrag zur Entwicklungstheorie und zur Theorie der Infrastruktur.* Dortmund, Gesellschaft für Westfälische Wirtschaftsgeschichte E. V.

Fremdling, R. (1977). 'Railroads and German Economic Growth- A leading sector analysis with comparison to the USA and Great Britain'. *Journal of Economic History,* **37** (3), pp. 583-604.

Fremdling, R. and Knieps, G. (2011). 'Competition, regulation and nationalization: The Prussian railway system in the nineteenth century'. *Scandinavian Economic History Review*, **41** (2), pp.129-154.

Gall, L. and Pohl, M. (1999). *Die Eisenbahn in Deutschland von den Anfängen bis zur Gegenwart*. München, C. H. Beck Verlag.

Gourvish, T.R. (1980). *Railways and the British Economy 1830-1914*. London, The Macmillan Press.

Gutberlet, T. (2013a). 'Railroads and the Regional Concentration of Industry in Germany 1846 to 1882'. *University of Arizona.* Working Paper.

Gutberlet, T. (2013b). 'Mechanization, transportation, and the location of Industry in Germany 1846 to 1907'. *University of Arizona.* Working Paper.

Gutberlet, T. (2013c). 'Railroads and the Regional Concentration of Industry in Germany 1861 to 1882'. (Preliminary Draft) *Rensselaer Polytechnic Institute.*

Hawke, G.R. (1970). *Railways and Economic Growth in England and Wales*. Oxford, Clarendon Press.

Helmholtz, R. von and Staby, W. (1930) *Der Entwicklung der Lokomotive*. Band I. Munich, Verlag von R. Oldenbourg.

Henderson, W.O. (1939) edn 2013. *The Zollverein*. Cambridge University Press.

Henderson, W.O. (1967a). *The State and the Industrial Revolution in Prussia 1740-1870*. Liverpool University Press.

Henderson, W.O. (1967b). *The Industrial Revolution on the Continent – Germany, France, Russia- 1800-1914*. London, Frank Cass & Co Ltd

Henderson, W.O. (1975). *The Rise of German Industrial Power 1834-1914.* London, Maurice Temple Smith Ltd.

Herrigel, G. (1996). *The Sources of German Industrial Power*. New York, Cambridge University Press.

Hornung, E. (2012). 'Railroads and Micro-regional Growth in Prussia'. Ifo Working Paper No.127 March 2012. *Leibniz Institute for Economic Research,* University of Munich.

Hornung, E. (2014). 'Railroads and Growth in Prussia'. *Journal of the European Economic Association,* **13** (4), pp.699-736.

James, H. (2012). Review of 'Krupp: A History of the Legendary German Firm' by T.W. Guinnane. *EH.NET.*

Johnson, E.R. (1900). 'The Principles of Governmental Regulation of Railways'. *Political Science Quarterly*, **15** (1), pp.37-49.

Kaiser, W. and Schot, J. (2014). *Writing the Rules for Europe*. Basingstoke, Palgrave Macmillan.

Kay, J. (1995) *The Foundations of Corporate Success*. Oxford, Oxford University Press.

Kech, E. (1911). *Geschichte der deutschen Eisenbahnpolitik*. Leipzig, G.J. Göschen'sche Verlagshandlung.

King, D.J.S. (1991). 'The Ideology Behind a Business Activity: The Case of the Nürnberg-Fürth Railway'. *Business and Economic History,* Second Series, Volume Twenty.

Kitchen, M. (1978). *The Political Economy of Germany 1815-1914*. London, Croom Helm.

Klee, W. (1982). *Preußische Eisenbahngeschichte*. Stuttgart, Verlag Kohlhammer, W.

Köbler, G. (year not stated). *Allgemeines Deutsches Handelsgesetzbuch 1861.* Index and recital of Articles. Drawn down from www.koeblergerhard.de > Fontes >AllgemeinesDeutschesHandelsgesetzbuch 1861.htm. Last accessed 25/11/2019.

Kobschätzky, H. (1971). *Streckenatlas der deutschen Eisenbahnen 1835-1892.* Düsseldorf, Alba Buchverlag.

Kocka, J. (1987) 'Eisenbahnverwaltungen in der Industriellen Revolution: deutsch-amerikanische Vergleiche'. *ECONSTOR Leibniz-Informationzentrum Wirtschaft,* pp. 259-277. Stuttgart, Franz Steiner Verlag.

Kopper, C. (2015). 'Transport and Communication'. *Bonn, Bundeszentrale für politische Bildung,* pp. 224-235. (Thomas Rahlf (Ed.)). Accessed 01/02/2019 http://www.deutschland-in-daten.de/en/transport-and-communication

Kreutzmann, M. (2013a). 'Der Deutsche Zollverein von 1834: von der intergouvernementalen Staatenverbindung zur suprastaatlichen Organisation?' *ZGEI Zeitschrift für die Geschichte der Europäische Integration.* pp.189-206. https://nomoslibrary.de (sourced 15 July 2017).

Kreutzmann, M. (2013b). 'Die bürokratische Funktionselite des Deutschen Zollvereins und ihre Rolle für die deutsche Nationsbildung 1818-1884'. *Jahrbuch zur Liberalismus-Forschung*. Baden-Baden, Nomos Verlagsgesellschaft.

Kühne, K-J and Reiners, J. (2010). *Fahrt Frei-100 Ereignisse aus 175 Jahren deutscher Eisenbahngeschichte.* Stuttgart, Transpress Verlag.

Lee, W.R. (ed.) (1991). *German Industry and German Industrialisation-Essays.* London, Routledge.

Leunig. T. (2010). 'Social Savings'. LSE Research Online version. http://eprints.lse.ac.uk/30135/

Lommers, S. (2000). 'An Association without a Nation? The Verein Deutscher Eisenbahnverwaltungen'. *http://www.inventingeurope.eu/exhibit3tour1item3/*

MacGregor, N. (2014). *Germany: Memories of a Nation*. London, Allen Lane.

McMahon, A.W. and Dittmar, W.R. (1939). 'Autonomous Public Enterprise-The German Railways'. *Political Science Quarterly,* **54** (4), pp. 481-513.

McMeachin, S. (2010). *The Berlin-Baghdad Express-the Ottoman Empire and Germany's bid for World Power 1898-1918.* London, Allen Lane.

March, J.G. and Olsen, J.P. (1984). 'The New Institutionalism: Organizational Factors in Political Life'. *The American Political Science Review*, **78** (3), pp.734-749.

Meyer, B.H. (1897). 'The Administration of Prussian Railroads. With Special Reference to the Adjustment of Railway Rates'. *The Annals of the American Academy of Political and Social Science*, **10**, pp.77-111.

Mitchell, A. (1996) Review of '*Politics and Industrialization: Early Railroads in the United States and Prussia*' by C.A. Dunlavy (1994). *Central European History,* **29** (2), pp.243-247.

Mitchell, A. (2000). *The Great Train Race: Railways and the Franco-German Rivalry, 1815-1914.* New York, Berghahn Books.

Mitchell, A. (2001a). Review of '*Die Eisenbahn in Deutschland von den Anfängen bis zur Gegenwart*' by L. Gall and M. Pohl (1999). *Central European History*, **34** (2), pp.252-255.

Mitchell, A. (2001b). Review of '*The Most Valuable Asset of the Reich*', by A.C. Mierzejewski (1999). *Central European History*, **34** (4), pp.586-589.

Mitchell, B.R., (1998). *International Historical Statistics, Europe 1750-1993.* Fourth Edition. London and Basingstoke, Macmillan Reference Ltd, 1998.

Mommsen, W.J. (1994). Review of '*German History 1770-1866*' by J.J. Sheehan, (1989). *The Journal of Modern History* **66** (2), pp.431-433.

North, D.C. (1996). *Institutions, Institutional Change and Economic Performance.* Cambridge University Press.

Norton, R. (1915). 'The Man of Peace – Kaiser Wilhelm II'. Oxford Pamphlets, 1914-1915. **64.** Oxford University Press. Digitising sponsor: University of Alberta.

O'Brien, P. (ed.) (1983). *Railways and the Economic Development of Western Europe, 1830-1914.* London, The MacMillan Press.

Pierenkemper, T. and Tilley, R.H. (2005). *The German Economy During the Nineteenth Century*. New York, Berghahn.

Pinson, K.S. (1954). *Modern Germany: Its History and Civilisation*. New York, Macmillan.

Ploeckl, F. (2010). 'The Zollverein and the Formation of a Customs Union' *Discussion Papers in Economic and Social History No. 24.* University of Oxford.

Ploeckl, F. (2015). 'It's All in the Mail: The Economic Geography of the German Empire'. Working Paper No. 2015-12. The University of Adelaide.

Plum, W. (1974). *German Trade Promotion in the First Half of the Nineteenth Century.* Bonn-Bad Godesberg, Friedrich Ebert Stiftung.

Pollard, S. (1997). Review of '*The Sources of German Industrial Power*' by G. Herrigel (1996). *American Journal of Sociology,* **102** (6), pp.1781-1783.

Pratt, E.A., (1915). *The Rise of Rail-Power in War and Conquest, 1833-1914.* London, P.S. King & Son.

Puffert, D.J., (2009). *Tracks Across Continents, Paths Through History. The Economic Dynamics of Standardization in Railway Gauge.* Chicago, The University of Chicago Press.

Putterman, L. (1991). Review of Aoki, M., Williamson, O.E. and Gustafsson, B. (eds) (1990). 'The Firm as a Nexus of Treaties'. *Journal of Economic Literature,* Vol. XXIX, pp.1202-1204 Sept. 1991.

Richard, J. (2012). 'The Victory of the Prussian Railway "Dynamic" Accounting Over the Public Finance and Patrimonial Accounting Models (1838-1884): An Early Illustration'. *The Accounting Historians Journal*. **39** (1), pp.91-126.

Roth, R. (2005). *Das Jahrhundert der Eisenbahn. Der Heerschaft über Raum und Zeit 1800-1914.* Ostfildern, Thorbecke Jan Verlag.

Schmidt, A. (1991). Review of '*Railway Imperialism*' by Davis, C.B., Wilburn, K.E. Jr., and Robinson, R.E. (1991) *The Journal of Economic History*, **52** (3), pp.750-751.

Schot, J., Butler, H., and I. Anastasiadou. (2011). "The dynamics of transnational railway governance in Europe during the long nineteenth century". *History and Technology* **27** (3), pp. 265-289.

Segal, Z, (2016). 'Regionalism and Nationalism in the Railway Cartography of Mid-Nineteenth Century Germany'. *Imago Mundi* **68** (1), pp.46-6.

Sheehan, J.J. (1989). *German History 1770-1866*. Oxford, Clarendon Press.

Shivelbusch, W. (1986). *The Railway Journey -The Industrialization of Time and Space*. Leamington Spa, Berg.

Snell, J.B. (1971). *Mechanical Engineering: Railways*. London, Longman Group Ltd.

Sobel, D. (1998). *Longitude*. London, Fourth Estate.

Spencer, E. (1998) Review of '*Capitalism, Politics and Railroads in Prussia, 1830-1870*' by J.M. Brophy (1998). *The Business History Review*, **72** (4), pp.649-651.

Sperber, J (1999). Review of '*Capitalism, Politics and Railroads in Prussia, 1830-1870*' by J.M. Brophy (1998). *The Journal of Economic History*, **59** (2), pp.513-514.

Sterne, S. (1887) 'Curious Phases of the Railway Question in Europe'. *The Quarterly Journal of Economics*, **1** (4), pp.453-468.

Süß, H. (2002). *Deutsche Schreibschrift –Lesen und Schreiben Lernen*. München, Droemersche Verlagsanstalt Th. Knaur Nachf. GmbH & Co, KG.

Tatsachen über Deutschland. (2010). Frankfurt am Main, Societäts-Verlag.

Taussig, F.W. (1894). 'Recent Discussions on Railway Management in Prussia'. *The Quarterly Journal of Economics*, **9** (1), pp.77-87.

Taylor, A.J.P. (1993). *From Napoleon to the Second International- Essays on Nineteenth Century Europe.* London, Hamish Hamilton.

Tilly, R. (1980). *Kapital, Staat und sozialer Protest in der deutschen Industrialisierung.* Göttingen, Vandenhoeck & Ruprecht.

Tilly, R. (2000). Review of '*Capitalism, Politics and Railroads in Prussia, 1830-1870*' by J.M. Brophy (1998). *The Journal of Modern History*, **72** (2) pp.560-561.

Tipton, F.B. Jr. (1976). *Regional Variations in the Economic Development of Germany During the Nineteenth Century*. Middletown, CT, Wesleyan University Press.

Tipton, F.B. Jr (2000). Review of '*Capitalism, Politics and Railroads in Prussia, 1830-1870*' by J.M. Brophy (1998). *Central European History* **33** (2), pp.279-281.

Tipton, F.B. Jr (2003). *A History of Modern Germany since 1815*. London, Continuum.

Tode, S., Engel, S. and Beate, J. (2012). *175 Jahre Borsig –Technik für eine Welt im Wandel.* Hamburg, Verlag Hanseatischer Merkur.

University of Oxford. Bodleian Library Notes for Guidance on German Archives. https://libguides.bodleian.ox.ac.uk/german-archives Accessed 2012.

van Horn Melton, J. (1991). Review of '*German History 1770-1866*' by J.J. Sheehan (1989). *The American Historical Review*, **96** (5), pp.1565-1567.

Verein Deutscher Eisenbahn-Verwaltungen. *Deutsche Eisenbahn-Statistik für das Betriebs-Jahr 1851-1877.* (2015) Nürnberg, DB Museum-Archiv.

Wagenblass, H. (1973). *Der Eisenbahnbau und das Wachstum der deutschen Eisen und Maschinenbauindustrie 1835 bis 1860.* Stuttgart, Gustav Fischer Verlag.

Wagner, A. (1902). 'The Public Debt of Prussia'. *The North American Review*, **175** (548), pp.136-144.

Watson, P. (2010). *The German Genius.* London, Simon and Schuster.

Weber, Baron M.M. von (1870). *Die Schulung der Eisenbahnen.* Quoted in Pratt Ch iv -Project Gutenberg download November 2013.

Wiener, M.J. (1985). *English Culture and the Decline of the Industrial Spirit, 1850-1980.* Harmondsworth, Middx, Penguin Books Ltd.

Winder, S. (2010). *Germania.* London, Picador.

Wolmar, C. (2012). *Engines of War*. London, Atlantic Books Ltd.

Zegarra, L.P. (2012). 'Transportation Costs and the Social Savings of Railroads in Latin America'. Business School Working Paper series No 2012-09-0005, *University of Peru.*

Ziegler, D. (1996) *Eisenbahnen und Staat in Zeitalter der Industrialisierung*. Stuttgart, Franz Steiner Verlag.

Zussman, A. (2008). 'The Rise of German Protectionism in the 1870s: A Macroeconomic Perspective'. Hebrew University.