The Consett iron company limited: a case study in Victorian business history

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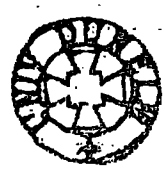
ABSTRACT

This thesis describes and analyses the progress and development of ironmaking at Consett between 1840-1940. The main body of the thesis is however devoted to the period 1864-1914, and examines the hypothesis that there was a failure in entrepreneurial ability in the late Victorian economy.

Chapter I provides the background to the foundation of large scale iron-making at Consett, and also illustrates the risks involved in creating large enterprises in an age of unlimited liability. Chapter II deals with the capitalisation of the Consett Iron Company, Limited, between 1864-1914. The financial performance of the Company can then be examined with regard to the structure of ownership and the extent of the Company's capitalisation. As Consett was an integrated concern from the outset, its development has been treated through the examination of inputs, culminating in the final output of iron and steel.

Chapter III therefore describes the Company's search for iron ore supplies through the period, examining the reasons for shifts in location from which ore was supplied, and also highlighting the comparative failure of the Company's management to secure a new source during the Edwardian decade.

Chapters IV and V deal with the firm's coal-mining activities. The former traces the growth of demand and the Company's foresight in acquiring large new coal tracts. Chapter V then examines the problems on the supply side created by the conflict between the industry's naturally diminishing returns and the quality of management and labour effort.



Chapter VI, VII and VIII look at the iron and steel producing activities. The first simply traces the changing technology, from a qualitative viewpoint. The impact of this Chapter is heightened by the quantitative evidence on the changing real costs of iron and steel manufacture, which are presented in Appendix G.1. Chapter VII examines the demand for the Company's iron and steel products, and the methods for marketing them. Chapter VIII concludes the main body of the thesis by enquiring into the Company's labour relations, and also the structure, training and personalities of the management.

Finally Chapter IX examines the fortunes of the Company during the Great War and the difficult inter-war years. This exercise helps to emphasise the decline in managerial vigour which took place during the Edwardian era.

THE CONSETT IRON COMPANY, LIMITED: A CASE STUDY IN VICTORIAN BUSINESS HISTORY

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Thesis submitted for the
Degree of Master of Philosophy
1973

ACKNOWLEDGEMENTS

I would like to thank all those people who contributed their knowledge of the local archives that I have used, a service that has economized greatly upon my own time. In addition a special thanks is due to my supervisor, Dr. D. Bythell, for his patience in reading and criticising the text. A similar debt is also owed to Dr. R.H. Britnell.

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INTRODUCTION

For many decades, economists and historians have been fascinated by the causes of the retardation of industrial growth in the late Victorian and Edwardian periods. This debate has centred upon the entrepreneur for sometime, for it is he who originates and directs the vital input of industrial growth, enterprise.(1) This input, we are led to believe, was uncommonly scarce in Britain after the 1870's, in contrast to its relative abundance in Germany and the United States.(2)

In the late 19th Century and in Britain herself at an earlier period the scarcity of enterprise dampened the propensity to innovate, and so the rate of technical progress slowed down, and the real costs of production began to level off. The climacteric for the growth of productivity has been established either in the 1870's or the 1890's;(3) both may be correct. D.J. Coppock shows that a period of sustained productivity growth preceded the 1870's, whereupon productivity growth in Britain began to slow down.(4) However, his evidence does not contradict that of Phelps Brown and Handfield-Jones who observed a further break in the 1890's, when productivity growth and real income per capita stagnated.(5)

Can this decline in the rate at which productivity was growing be necessarily traced back to the men in command, the entrepreneurs? In the

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(1) D.H. Aldcroft, "The Entrepreneur and the British Economy, 1870-1914," Economic History Review, 2nd Ser. XVII (1964-65), pp. 113-134.

(2) Ibid., pp., 134-35.

(3) D.J. Coppock, "The Climacteric of the 1890's A Critical Note," The Manchester School, XXIV (1956) pp. 1-29; E.H. Phelps Brown and S.J. Handfield-Jones, "The Climacteric of the 1890's : A Study in the expanding Economy," Oxford Economic Papers, New Series IV (1952), pp. 266-307.

(4) D.J. Coppock, op.cit., p.7.

(5) E.H. Phelps Brown and S.J. Handfield-Jones, op.cit., p.271.

case of the iron and steel industry some writers clearly think so. Professor Duncan Burn claims that:

> "The British makers were less well equipped than their rivals to judge the commercial prospects of innovations while they were in an experimental stage, or to forecast the trend of technical change and therefore to be prepared for it."(6)

Burnham and Hoskins have been much more explicit in their criticism of entrepreneurship:

> "If a business deteriorates it is of no use blaming anyone except those at the top, and if an industry declines relatively faster than unfavourable external and uncontrollable factors lead one to expect, the weakness can only be attributable to those who are in control of its activities."(7)

However, this critical view of the entrepreneur in iron and steel has of late been under attack. D.N. McCloskey concludes his examination into the entrepreneurial performance of the Victorians thus:

> "Late Victorian entrepreneurs in iron and steel did not fail. By any cogent measure of performance, in fact they did very well indeed."(8)

In a similar vein, though not absolving the entrepreneur from 'stupidities or failing,' Peter Temin asserts, "there is little reason to give prominence to the inadequacies of British industry or industrialists in

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(6) D. Burn, The Economic History of Steelmaking, (Cambridge, 1961) p.297.

(7) T.H. Burnham and G.O. Hoskins, Iron and Steel in Britain, 1870-1930, (London, 1943) p.271.

(8) D.N. McCloskey, Economic Maturity and Entrepreneurial Decline : British Iron and Steel 1870-1913. (Unpublished Ph.D Thesis University of Chicago, 1970) p.142.

an explanation of the fortunes of the British steel industry.(9) Temin argues that the demise suffered by Britain was a consequence of slowly growing markets, compared with Germany and the U.S.A.(10)

Thus on the one hand there is a school arguing that the relative decline in the British steel industry was induced by the inadequacies of the management, whilst the rival school maintains that externalities imposed such limitations upon the growth of the industry that the scope for innovation was severely curtailed. The opinions of the former have been liberally absorbed as an example of entrepreneurial degeneracy in the documentation of the evidence against the Victorian businessman.(11)

Interpretations of the coal industry's performance in the same period are equally diverse. The years after the middle of the 1880's saw a steady decline in labour productivity in British coal-mining. In an extractive industry diminishing returns are only to be expected at some stage. However, Professor A.J. Taylor has argued that the extent of the decline cannot be explained by unfavourable geological conditions alone. Coal-mining too suffered from the malaise of conservatism amongst its leadership, and an overall lack of vision:

> "Failure to take full advantage of the economies of scale both at the entrepreneurial and operational level reduced the industry's overall efficiency and in so doing also restricted its competitive

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(9) P. Temin, "The Relative Decline of the British Steel Industry, 1880-1913," in Industrialization in Two Systems, Edited by H. Rosovsky (New York, 1966) p.155.

(10) Ibid. p.141.

(11) D.S. Landes, "Technological Change and Development in Western Europe, 1750-1914," The Cambridge Economic History, VI (Cambridge, 1965) p. 563; D.J. Coppock, op.cit. p.27.

capacity in relation to a German rival who not only saw the advantages of integration but was quick to make use of them".(12)

Once more D.N. McCloskey has provided a counter-blow, since the differences in resource endowment between the U.S.A. and Britain could easily explain the difference in labour productivity. He concludes that:

> "The case for a failure of masters and men in British coal-mining before 1913, in short, is vulnerable to a most damaging criticism; there was clearly no failure of productivity."(13)

This contest in the interpretation of historical data remains unresolved. Against the entrepreneur there is an extensive qualitative literature, both contemporary and historical,(14) whilst in his support there are both the quantitative and qualitative studies in the style of McCloskey and Charles Wilson.(15)

The present study will attempt to bring together a qualitative description of management, and the decisions it made, with a measurement of the performance of the Company as a result of these decisions. The object

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(12) A.J. Taylor, "The Coal Industry," in The Development of British Industry and Foreign Competition 1875-1914, Edited by D.H. Aldcroft (London, 1968) pp. 67-68.

(13) D.N. McCloskey, "International differences in productivity? Coal and Steel in America and Britain before World War I," in Essays on a Mature Economy: Britain after 1840, Edited by D.N. McCloskey (London, 1971) p.295.

(14) A. Shadwell, Industrial Efficiency : A Comparative Study of Industrial Life in England, Germany and America, (London, 1909): A.L. Levine, Industrial Retardation in Britain, 1880-1914, (London, 1967).

(15) C. Wilson, "Economy and Society in Late Victorian England," Economic History Review, 2nd Ser. XVIII (1965).

of study is the Consett Iron Company, an integrated coal, coke, iron and steel producer. The Company rose out of the ruins of the Northumberland and Durham District Bank, and the Derwent Iron Company, in 1864. The following years were of unbroken prosperity for the owners of the concern.

> "In the first half century of its history, the company always made a profit and never paid a dividend below 7½ per cent, and then only in the early years 1867-69; dividends of 33⅓, 40, 50 or even 60 per cent were not uncommon, while the average dividend over the period 1864 to 1914 was about 23½ per cent."(16)

The ownership was from the outset broad, and although certain families provided a succession of Directors, the Company could never be described as family controlled.

Though profitability is of paramount importance to the shareholder, it does not necessarily provide a good indicator of industrial and economic efficiency in the utilization of resources. It has therefore been necessary to adopt some other measuring rods of performance. For coal-mining, the average product of labour between 1896-1914 has been used in conjunction with information on geological conditions in the pits, and the rates pa id to the miners. In light of this the rate of adoption of new techniques is examined. On the iron and steel side, a measure of the real costs of production is used to see how these changed over time. This is supported by a descriptive account of the developments in the iron and steel works.

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(16) H.W. Richardson and J.M. Bass, "The Profitability of the Consett Iron Company Before 1914," Business History, VII, (1965) p.72.

However certain factors defy quantification, particularly the relationship of management with suppliers, employees and customers. The company owed much of its success to the ability shown by its managers in negotiating supplies and in adopting and maintaining a sound sales policy.

As a further test of a firm's success, it is important to remember that a possible source of the exceptional profitability was may be monopoly power. The Market in which Consett operated will be examined to ascertain whether the Company had either monopoly or monopsony power. If such power existed it would have contributed to profitability, whilst detering innovation and technical improvement.

The study follows the Company through by way of inputs, that is first looking at the sources and nature of capitalisation, the supply of iron ore, coal, coke &c., and culminating in the examination of iron and steel production, markets and labour.

Though one cannot extend any conclusions drawn in a single firm study to an industry as a whole, certain limited generalizations might safely be made. Firstly, it is possible to rank productive operations at Consett amongst the best-practice techniques available, at least up to 1900. Thus the entrepreneurial vigour of the Company's management kept the firm at the forefront during the expansionary years of the open-hearth process. As Consett was the largest producer of steel for the shipbuilding industry, this weights its contribution of entrepreneurial talent to this sector of the steel industry, quite heavily. Secondly, some of the problems encountered by Consett were common to all steel producers, particularly labour relations and the supply of iron ore. Therefore, as in many instances the producers acted in concert Consett's success or failure in tackling such problems, probably fairly reflects the success and failure of other interested steel producers.

However, there were particular problems, possibly unique to Consett, such as the question of location and space for expansion. This is the simplest case of the past heritage constraining the options open to a company at any moment of time in the future. The study of the development of other iron and steel companies might well show that they too suffered similar problems.

In the final Chapter IX there is a certain amount of implicit comparison, in so far as the development up to 1914 can be seen in a clearer perspective. Though the interwar years proved most difficult for the Company, they induced a new approach to business. The shrinkage of traditional markets meant the Company had to adopt a more positive approach to the disposal of its products. Prior to 1914 marketing had remained a low intensity operation, geared primarily to the smooth functioning of existing markets, rather than to the creation of new ones.

In surveying the overall performance in all these ways, it is clear that the Consett Iron Company exhibited evidence of a climacteric in its own development in the late 1890's, though it is not possible to say much about the 1870's. However, it is unlikely that there was much growth in productivity in the twenty years preceding 1870 because of the uncertainty with which the ironworks operated during that period.

It is hoped that this study will illustrate that the Victorian entrepreneur was not necessarily the ill-qualified amateur that he has been painted; and that contemporary and retrospective criticism have done a grave disservice to the endeavour and ability of these businessmen. The decline in the rates of real growth in all industrial nations after 1900 probably supports Temin's hypothesis that the development and growth of the market determines the quality of entrepreneurship, and also Habakkuk's observation: "Great generals are not

made in time of peace; great entrepreneurs are not made in non-expanding industries."(17)

(17) P. Temin, op.cit., p.155; H.J. Habukkuk, American and British Technology in the 19th Century, (Cambridge, 1962) p.212.

CHAPTER 1

THE ORIGIN OF THE CONSETT IRON COMPANY 1840 - 1864

1. Introduction

During the period between 1830 - 1870, the ironmasters of Great Britain were able to exploit rapidly developing markets, both at home and abroad, in the refreshing atmosphere of free-trade. Production of pig iron in Britain rose from just under one million tons (per annum) to slightly over five million.(1) The growth of these years followed closely the demand created by the booms in railway construction throughout the world. However, it was not a period without its own special problems: there were marked depressions in each decade, usually caused by the over optimism of the ironmasters.(2) Entrepreneurs had to cope with the increase in the scale of operations caused by expanding output and the advances of technology.

The latter difficulty of organising the larger scale of enterprises was not limited to the ironmasters; the railways, the source from which so much of their business originated, also faced the problem of raising large amounts of capital for the construction of railway networks. The railway companies were instrumental in the founding of Joint Stock companies in the 1830's and 1840's and were to some extent followed by the Welsh ironmasters in the 1840's.(3) However, despite this trend in South Wales, the partnership remained the

(1) A. Birch, The Economic History of the British Iron and Steel Industry, 1784 - 1879 (London, 1967) Appendix I.

(2) Ibid., pp. 220 - 222; J.R.T. Hughes, Fluctuations in Trade, Industry and Finance (Oxford, 1960) pp. 154 - 171.

(3) A. Birch, op.cit., pp. 201 - 204.

preferred form of organisation in the iron-trade because it avoided some of the hazards of remote ownership, which still existed before the adoption of limited liability in 1856.

At the beginning of the 1840's the North-East region was an insignificant producer of pig iron, but during the ensuing decade the ironstone resources of Cleveland were opened out and by 1865 the region accounted for 21% of the nation's annual production of pig iron.(4) Though the main development took place on Tees-side, one of the earliest ventures was undertaken in North-West Durham, at Consett. The early history of modern iron-making at Consett illustrates some of the enthusiasm of the early Victorian entrepreneurs, and also the dangers which could befall the over-ambitious.

The entrepreneur was naturally anxious to expand his operations to exploit the rising tide of demand, but this confronted him with the dilemma of how best to raise the necessary capital for investment in blast furnaces, puddling furnaces and mills: he had in effect three choices. He could plough back current profits, but this was more suited to long term growth and was not geared to very rapid expansion. Secondly a partnership could be formed, extended or even converted to the Joint Stock principle; this necessitated either the absorption of a few very wealthy persons, or the acceptance of the difficulties attending remote ownership in an age of unlimited liability. Finally the entrepreneur could borrow the necessary funds, the main problem in this case being that interest payments would constitute a cost on the finished product. The founders of the ironworks at Consett chose

(4) J.R.T. Hughes, op.cit., p.155. In 1847 the region produced 5% of a national output of 2 million tons of pig iron; in 1865 this had risen to 21% of 5,819,000 tons.

the latter, and this chapter is devoted largely to an examination of the calamity wrought upon both borrowers and lenders.

In 1840 Consett was no more than a couple of isolated houses on the wild moorland of North-West Durham. In that year, however, a partnership was formed to exploit the minerals of the district for iron-making. The following year, 1841, the partnership styled itself the Derwent Iron Company and within five years grew into the second largest iron-making concern in the kingdom, being surpassed only by Dowlais. The Derwent Iron Company however became "famous only for its size (with eighteen blast furnaces the largest ironworks in England) and for its inability to make a profit."(5)

2. The Derwent Iron Company, 1841-1857

The industrial and commercial activity of the North-East was much influenced by the local Quaker community, and the foundation of an ironworks at Consett was no exception. This was appropriate, for near by Shotley Bridge had been one of the earliest strongholds of Quaker activity in the North, and it is believed that the first Quaker Meeting House in England was built there.(6) Even though the members of the Society of Friends were dispersed more widely throughout the County by the mid-nineteenth century, much of the property in the vicinity of Shotley Bridge was still owned by them. One family that had remained prominent in the locality was the Richardsons. Jonathan.

(5) H.W. Richardson and J.M. Bass, "The Profitability of theConsett Iron Company before 1914, " Business History,VII,(1965).

(6) W. Fordyce, The History and Antiquities of the County Palatine of Durham (Newcastle, 1857, 2 vols.) II, p.700.

Richardson had developed Shotley Bridge as a Spa,(7) and later played a central role in the emergence of the Derwent Iron Company.

It was the existence of a Spa which brought William Richardson of Sunderland to the area, for reasons of his health, in the autumn of 1839.(8) During his visit he became friendly with a local cartwright, John Nicholson, who was also an amateur mineralogist . Nicholson showed some samples of ironstone, found "on the blue heaps at Consett"(9), to William Richardson. At this point there is some confusion about which of the Richardsons Nicholson approached. The writer of the Victoria County History opted for Jonathan Richardson, but only upon hearsay evidence. More probable seems to be the account presented in the Durham Chronicle in 1858.(10) In that account it was William Richardson who received the samples from Nicholson, and carried out preliminary examinations in the area. He then called upon Robert Wilson of Newcastle to undertake a further inspection of the mineral deposits. On the strength of their findings it was decided to make more exhaustive tests on the deposits, in order to ascertain whether they would be viable as the basis for an industrial concern. Test shafts were sunk and samples of ore analysed, probably by the Quaker ironmasters in Sunderland.

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(7) Ibid.

(8) Durham Chronicle, 2 July, 1858.

(9) The Victoria History of the Counties of England: A History of Durham (London, 1907, 2 vols.) II, p.291. Hereafter cited as V.C.H.

(10) Durham Chronicle, 2 July 1858.

The analysis proved satisfactory, for shortly after four gentlemen, including three Quakers of whom no more is recorded,(11) formed a partnership to smelt the ironstone at Consett. The initial capital was £10,000. Once again an element of confusion is introduced by Lowthian Bell's account of the formation of the company. He claimed that the owners of the Redesdale Ironworks, Messrs. Bigge, Cargill and Johnson, had their attention diverted to the resources at Shotley Bridge.(12) However, it is unlikely that this trio were responsible for the initial investment, though they did merge their interests with the Consett partners in 1841 to form the Derwent Iron Company.(13)

The four original partners seem to have quickly appreciated that the location was not ideal for the production of pig iron alone. A greater advantage was possible by the addition of forges and mills. The reason for this was that coal was the relatively cheap input, and thus, the further the metal was refined, the greater would be the possible profit, since the products' value would be increased without any substantial addition to cost.

The extension of the plant to include puddling and finishing mills required a considerable infusion of new capital, more than the original partners could afford. It was this which induced the merger of interest between Consett and Redesdale; the amalgamation became known as the Derwent Iron Company.(14) At about the same time the new company

(11) Wm. Backhouse and Edward Richardson were probably two of the Quakers. Counterpart lease of Ridsdale Iron Works by the Derwent Iron Company, 11 November 1846 (DCRO: D/CO/59(vi)).

(12) The British Association, A History of the Trades and Manufactures of the Tyne, Wear and Tees (London, 1863) p.57.

(13) Durham Chronicle, 2 July 1858.

(14) Ibid.

bought the Bishopwearmouth Ironworks from Messrs. White, Kirk, Panton and Company. The manager of the Bishopwearmouth concern later moved to Consett to become the general manager. (15)

The purchase of the Bishopwearmouth works provided the Derwent Iron Company with a readily built puddling plant and rolling mills, but it hardly seems a suitable integration. If the Consett works were to send their pig iron to Bishopwearmouth for finishing then the full advantage of cheap fuel would not be secured. It is difficult to appreciate the business logic behind this purchase, unless it was to infuse some expertise in the puddling and rolling mills which were soon built at Consett.

After the two mergers the newly constituted Derwent Iron Company expanded at a very rapid rate.(16) By 1846, it was described as the leading iron-making firm in the North, with a total of fourteen blast furnaces; the expansion was made possible not so much by the extension of the partnership in 1841, as by the large advances and loans made by the Northumberland and Durham District Bank.(17) Despite its size, the history of the company up to 1864 was not one of success and prosperity. It is worthwhile examining the conditions that encouraged the establishment of such a large concern, and whether they in anyway contributed to the absence of success.

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(15) Ibid.

(16) The British Association, op.cit., p.57.

(17) Lord Aberconway, The Basic Industries of Great Britain (London, 1927) p. 183.

First of all how ideal a location was the Consett area for the foundation of a large ironworks? The early partners were obviously satisfied with its suitability, in view of the rapidity with which they built the works up into a gigantic concern; later observers were more sceptical, but they had the advantage of hindsight.(18)

The iron ore reserves at Consett were the chief basis for establishing the works. The ore was found in a working section or seam, about seven feet high, with the ore actually occuring in six or seven bands, each about twelve inches thick; four and a half fathoms below this first seam occured another containing a six inch band of iron ore. At the outset the ore could be worked for between seven and eight shillings per ton. The original estimates of the extensiveness of the reserves, made by Cargill, put the potential output at 5,324 tons of ore per acre. However, sometime later the company's own mineral agent, Edward Boyd found that Cargill had over-estimated. In addition the ore was of a very poor quality, containing only 26 per cent of iron.(19) The local reserves remained economical only as long as the cost of working them did not rise above the alternative cost of importing ores from another source, or constitute such a propertion of final costs as to make Consett's products uncompetitive with ironworks elsewhere. The leanness of the ores and the uncertainty of their extent were not a sound basis for such a large concern. By the late 1840's the local ore was becoming very costly to mine. In the 1860's Lowthian

(18) The British Association, op.cit.,p.49.

(19) Ibid.

Bell observed that "Until 1850 the furnaces went on devouring the minerals found in the neighbourhood at an alarming pace, having in the meantime made extensive trials of those from the lead veins of Weardale".(20)

The search in Weardale proved fruitless, but the realisation of the extent of the Cleveland ironstones in the early 1850's proved to be Consett's salvation. By 1852 the Derwent Iron Company had ceased to use its own local iron ore, which was by that time costing about ten shillings per ton to mine, whilst the Cleveland ironstone, mined by the open-cast methods, could be delivered at Consett for about seven shillings per ton.(21) The Company leased mines at Upleatham, and these were later taken over by J. and J.W. Pease, the powerful and influential Darlington Quaker family. This family became closely involved in the affairs of the Derwent Iron Company, through their ironstone interests and their association with the Stockton and Darlington Railway. As major creditors they were at the forefront of those attempting to keep the company operational after 1857. In 1856 the search for ore spread even further afield, and hematite ore was brought to Consett from the West Coast ore mines.

Though the discovery of the iron ore was apparently the major factor in the formation of the ironworks, Consett's redeeming asset was to be throughout the nineteenth century its abundance of cheaply won top

(20) The British Association, The Industrial Resources of the Tyne, Wear and Tees, (London & Newcastle, 1864) p.86.

(20) Durham Chronicle, 2 July 1858.

quality coking coal. One of the reasons the coal was so cheaply worked was that the royalties were low. This derived from Consett's position as a monopsonist, and also from the over exploitation of the coal resources along the Stanhope and Tyne Railway during the 1830's. There were no other large industrial concerns in the area and the coal could not be exported competitively to the coast, because of the saturation of the market. The cheap coal was an enormous advantage, and it was often asserted that the total cost of coal at Consett was only as much as some other coal companies paid in royalty: though this was probably an exaggeration it does indicate the extent of the advantage, enjoyed by Consett in the supply of fuel. Through most of the period 1840 - 1864 the mines at Consett were producing coal for between two shillings and sixpence and three shillings.(22) An illustration of the disadvantage endured by unintegrated iron works is provided by J. Carr and Company of Wallsend, who bought coking coal from John Bowes and Partners at Marley Hill for six shillings and ninepence per ton.(23) It is hardly surprising that Carr's went bankrupt, and that during the 1850's most of the new Tees-side iron-makers followed Consett's example in securing their own pits.

By 1858 Consett was the leasor of 3,300 acres of coal royalties. Its requirements were mined from four pits on their estate; the Saint Pit (so called because it was first worked by Mormons, The Latter Day Saints), Weston, Bradley and Crookhall. Any additional requirements were purchased from another pit which worked the Derwent royalties.

(22) W. Fordyce, History of Coal and Iron (London, 1860), p.149.

(23) C.E. Mountford, History of John Bowes and Partners up to 1914 (Durham M.A. Thesis, 1967), p.91.

The coal was found in four workable seams, of which the Busty Seam was the most productive: this seam varied between four feet six inches and seven feet in height, with one other seam above and two below. The coal was ideal for coking in beehive ovens, being highly bituminous and giving a yield of 68 per cent, at a very low cost.(24) The ironworks were consuming nearly 600,000 tons of coal, 440,000 tons of ironstone and 110,000 tons of limestone by 1858. The slag heaps created by the waste of the pits and blastfurnaces towered above the old Crookhall Mansion, threatening to engulf it.(25)

The main royalties leased by the Company were those at Hownes Gill, Delves and most important of all, the Old Consett Estate. The latter was leased from Jonathan Richardson giving him a vested interest in the size of the Iron Company. This was significant because Richardson had in 1836 become the Managing Director of the Northumberland and Durham District Bank, which made very large loans to the Derwent Iron Company. Jonathan Richardson's commitment and involvement is made even more clear by the proceedings of 1840. In that year he was approached by the partners in the prospective ironworks, not to join them, but to purchase the then available Consett Estate, and lease the mineral rights to the partners.(26) Therefore, although Richardson was never a full partner in the Derwent Iron Company, he did make a considerable investment which depended for its success upon the working of the ironworks. Furthermore the larger the ironworks, the faster

(24) Durham Chronicle, 9 July 1858.

(25) Ibid.

(26) Jonathan Richardson to the Shareholders in the Northumberland and Durham District Bank, 26 January 1858.(DCRO : D/Ho/F119).

the return on the investment. The agreement made between Richardson and the Derwent Iron Company stipulated that the ironworks should work the minerals under the Consett Estate, paying a royalty on all that they took out, and also compensation on any land that they rendered unuseable by the dumping of slag.(27)

The third main material input, in the manufacture of pig iron, is limestone. This was obtained from the nearby quarries at Stanhope, where the Company purchased some quarries in 1842 when it acquired a section of the old Stanhope and Tyne railway.(28)

From the outset the Derwent Iron Company achieved a high degree of vertical integration, relying heavily upon local mineral resources. However, despite the proximity of the raw materials it was still necessary to have a good communications network, for distributing the output of the Company, and then in the 1850's for the assembly of raw materials. The most important element in communications at this juncture was the development of the railways. (See Map I.1.)

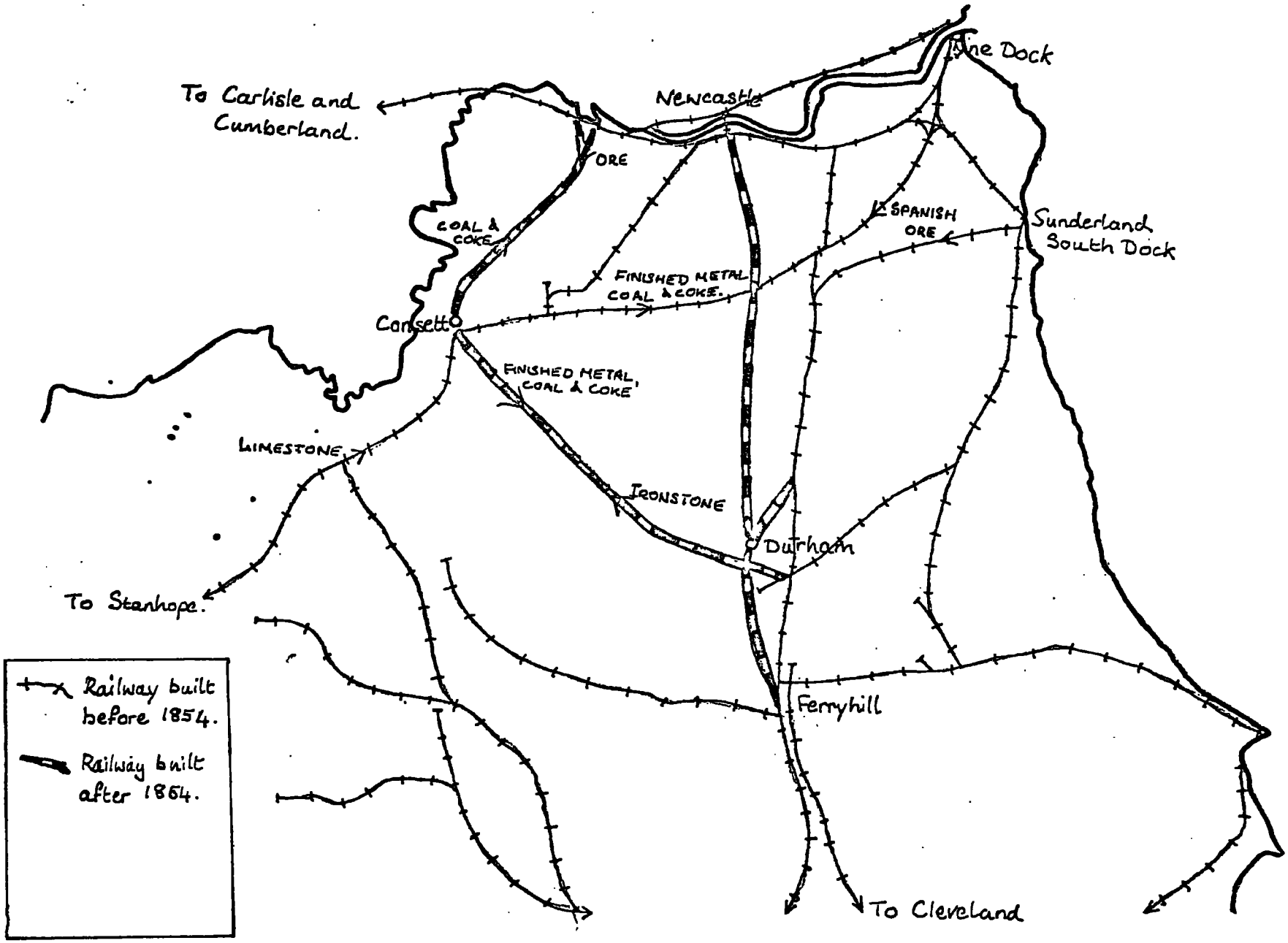
In 1840 the district's only through railway line was the Stanhope and Tyne which had been built in the early 1830's. The line had not fulfilled the expectations held for it, and fallen into financial difficulties by 1840. The ownership of the line was re-organised by an Act of 23 May 1842, and it became the Pontop and South Shields Railway.(29) The Derwent Iron Company bought the stretch of line between

(27) Durham Chronicle, 2 July 1858.

(28) C.J. Allen, The North Eastern Railway (London, 1964), p.75.

(29) Ibid.

I. 1. RAILWAY NETWORK TO CONSETT BY THE 1880's.



Consett (Carr House) and Stanhope, [30] and the new traffic generated by the ironworks helped to put the railway back on to its commercial feet. However, one line with links to Tyneside and the Wear was not sufficient and efforts were made to improve the network, particularly in the direction of South Durham and North Yorkshire. To this end it was proposed that a line be constructed between Waskerley Park on the Stanhope-Tyne line and Crook, where it would link up with the Stockton and Darlington system. As a further inducement to the Stockton and Darlington Company, the Derwent Iron Company offered to sell its section of the old Stanhope-Tyne Railway thus guaranteeing them the receipts of limestone traffic between Stanhope and Consett. The scheme was agreed to by the Stockton and Darlington and the new line was completed in 1844. The rails were supplied by the Consett ironworks, and the whole project cost £125,433.[31] The completion of the Wear and Derwent Junction Railway in 1845 paved the way for close co-operation between the Stockton and Darlington Company and the ironworks. The purchase of the Stanhope-Carr House section from the Derwent Iron Company was the first step in a scheme of amalgamation undertaken by the Stockton andDarlington in the middle of the 1840's. This gathered momentum during 1846, until by 1847 the Stockton and Darlington Railway had significantly increased its network in West Durham. The investment undertaken during these two years by the railway company almost brought about financial ruin, and a severe crisis was only averted by the

(30) Ibid., p.101.

(31) G. Whittle, The Railways of Consett and North-West Durham (Newton Abbott, 1971), p.53.

opening out of the Cleveland ironstone deposits. The Stockton and Darlington leased a line built by the Middlesbrough and Redcar Railway, and began carrying ironstone from Upleatham, near Saltburn, to Consett. The fifty-four mile haul between North Yorkshire and Consett became a most important source of revenue for the railway. After 1851 the Stockton and Darlington became particularly dependent upon the continuation of the Derwent Iron Company; this was to prove an important factor in later years.(32)

The exploitation of the Cleveland ores after 1850 also stimulated the interest of the North Eastern Railway in getting a direct link between Cleveland and Consett. It already had a substantial ore carrying line, the North Yorkshire and Cleveland Railway, but had no connecting line through County Durham. The Company eventually got Parliamentary sanction to extend a line from Durham in 1857, but at that time there were serious doubts as to the future of iron-making at Consett. Consequently the construction of the Relly Mill Junction, from the Durham end of the Bishop Auckland - Durham line to Blackhill, was not completed until 1863. The Lanchester Valley Branch, as it became known, was important for carrying Cleveland ore to Consett, and later for the importation of Spanish ore through Sunderland. It also served as an outlet for iron and steel to Wearside and Tees-side, and for coke from Langley Park bound for the Cleveland and South Durham ironworks.(33)

(32) C.J. Allen, op.cit., p.113.

(33) G. Whittle, op.cit., p.73.

The final important railway link with Consett was a connecting line down the Derwent Valley to join the Newcastle and Carlisle Railway. In 1856 the Derwent Iron Company had begun to use Cumbrian hematite ore, which had to be brought by a very circuitous route, over the Newcastle and Carlisle Railway past Gateshead to Washington, where it joined the Pontop and South Shields Railway. The traffic had then to double back to Consett. In 1856 it was proposed that the Newcastle and Carlisle Railway should link up with the Stockton and Darlington system at Cold Rowley, near Consett, creating a line which would pass the ironworks. The Stocksfield - Cold Rowley Branch was started in 1857, but was soon terminated because of the financial difficulties suffered by the Derwent Iron Company.(34) The Newcastle and Carlisle Railway's scheme was eventually superceded in 1862 when the North Eastern Railway had a Bill enacted to construct a line between Blaydon and Consett. Work was delayed until 1864 because of the continued uncertainty which surrounded the future of the ironworks, and of other large investment projects being undertaken by the North Eastern Railway. The line was eventually opened at the end of 1867 providing Consett with a valuable outlet for coke to the West Coast, and hematite ore on the return journey.(35)

The last input affected by location was labour. In 1840 the area was only thinly populated, Shotley Bridge being the only settlement of any size; by 1858 there were estimated to be about 20,000 people in the vincinity of Consett, most of whom were dependent either directly or indirectly upon the operation of the ironworks.(36) The development

(34) Ibid., p.60.

(35) Ibid., p.99.

(36) Durham Chronicle, 9 July 1858.

of the ironworks had necessitated a considerable immigration of labour. The immigrants seem to have divided into two groups. On the one hand there were the predominantly Protestant English, and on the other the Irish, of whom the majority were Roman Catholic. This religious division sadly produced a series of open and violent confrontations during the 1840's which were recorded both by contemporary observers and the local press. The most serious disturbance took place at Blackhill in November 1847 when some of the English workmen at the Derwent Iron Company threatened to attack the Roman Catholic Chapel.(37) Disturbances caused by drink and religious antagonism were not uncommon during the formative years of the new community at Consett, as the following passage illustrates.

"In the early history of Consett Iron Works a feeling of hostility unhappily existed between English and Irish workmen, and many a pugilistic encounter resulted in consequence. These fights generally took place at the end of the week, and their effect on the combatants may be inferred from the following description:- 'In the lower rooms of the public house there was not a table or chair but had its legs broken off, and these a number of mad drunken fellows were wielding to some purpose on each others heads. The landlord, Mr. Moore was in his shirt sleeves, and his arms from his hands to his elbows were just as though they had been dipped in a blood kit!'.(38)

(37) Durham County Advertiser, 26 November 1847.

(38) G. Neasham, A History and Biography of West Durham (Durham, 1882) p.72.

With so much hostility existing between factions of the labour force, it is a wonder that any iron was ever produced at Consett, and many years later when the Company was managed by the very able William Jenkins he often voiced his reluctance to employ too many strangers, especially when the Company opened a new Angle Mill in 1893. The early unrest at Consett, and later labour problems at Chopwell, would seem to justify Jenkins' reservations about "strange" workmen. However, the Derwent Iron Company does appear to have coped reasonably well with its wayward labour force. In his "Report on the Mining Districts in 1854", H.S. Tremenheere stated:

> ".....The just, firm and judicious principles of management adopted from the beginning by the Company ..... [have overcome] .....most of the difficulties generally incident to the sudden collection of large bodies of men".(39)

This may have been due to the Quaker influence, for they were more aware of the advantages of providing at least some of the trappings of civilisation, particularly schools. Edward Trow, the General Secretary of the Associated Iron and Steel Workers, spent part of his early life at Consett, and later recalled his part in organising a strike at Consett in 1852 because of the poor wage rates paid there, compared with some other works in the North East. The Company's failure cannot therefore be attributed to uncompetitive labour costs.

One more important aspect in the formation of a new company remains to be investigated, and that is the source of capital. It has already been noted that the original partners put up £10,000, and

(39) W. Fordyce, History of Durham p.702. footnote.

that in 1841 Messrs. Bigge, Cargill and Johnson were admitted to give an infusion of capital to enable the expansion to be carried out.(40) The new partners however do not seem to have been able to furnish all the necessary capital personally, but they do seem to have had established connections with the Northumberland and Durham District Bank, for during the five years 1841 - 1846 the Derwent Iron Company borrowed heavily from the Bank.(41) So from a very early stage the Bank had a substantial stake in the development of the iron company. In contrast to the Continental banking system, British Commercial banks were not normally associated with any financial involvement in industrial concerns, except in the provision of working capital. There were numerous connections between iron firms and banks, however, such as that between the Weardale Iron, Coal and Coke Company and Barings. On the whole, the association was limited to the provision of extensive working capital.(42) However, the District Bank became involved with apparently little regard for its own liquidity. The extent of the loans to the Derwent Iron Company seems far too great to be merely the provision of working capital. In the enquiry into the financial crisis of 1857 the investments of the District Bank were plainly regarded as of an "unsuitable nature" for a Commercial bank.(43) That the Bank chose to invest in industrial assets should not in itself have been grounds for criticism; what was at fault was the extent and manner in which the financing was conducted.

(40) See page 5.

(41) Lord Aberconway, op.cit. p.183.

(42) A. Birch, op.cit.,pp.209-210.

(43) P.P 1857 - 58 (381) V, QQ. 3468 - 3470.

The financial mismanagement of both concerns seems to be the clue to the collapse of the Bank in 1857, and to the persistent unprofitability of the iron company. In this respect the relationship between the District Bank and the Derwent Iron Company was markedly different from any Continental counter-parts, since German banks kept a close watch on their industrial investments, and in some instances even participated in the actual financial management of the dependent concern. How then did this situation of gross mismanagement occur?

It was not unusual that a bank should make advances to a new company which had prospects of making good profits, and was backed by respectable local businessmen. However the debt owing to the Bank soon outgrew the size which was commensurate with good banking practice. The personalities common to the Bank and the Derwent Iron Company are difficult to discern. In the list of shareholders in the Northumberland and Durham District Bank, only Charles I'anson, a Shotley Bridge ironmaster and an agent of the Derwent Iron Company provides any direct link.(44) A second avenue of influence was probably through the Bigge family. The Bigges had been partners in Matthew Ridley's Old Bank in Newcastle which was taken over by the District Bank in 1839.(45) Furthermore the Bank lent heavily to the Redesdale Ironworks, of which a Bigge was a partner.(46) In view of this it does not seem unlikely that this continued to be a channel along which finance flowed when the merger of Redesdale and Consett took place in 1841.

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(44) Durham Chronicle, 13 February 1852.

(45) Maberley Philips, A History of Banks, Bankers and Banking (London, 1894) p.174.

(46) W. Fordyce, The History of Coal and Iron, p.151.

However, undoubtedly the leading figure in this financial scandal was the Shotley Bridge Quaker, Jonathan Richardson who had a large stake in the success of the iron company and was also the Managing Director of the District Bank. Some ambiguity exists as to when exactly Richardson took up that post in 1836 when the District Bank opened. He had up to then managed Backhouse and Company's branch in Newcastle, but the business of that bank was transferred to the District Bank.(47) In his own account Richardson claimed he did not become Managing Director until 1845.(48) If the first account is correct then it would be reasonable to assume that Richardson played an important role in securing loans and credit for the iron company; if, however, it is not correct, it must be assumed that the partners in the Derwent Company were of very good credit standing, and that Bigge played an influential part in securing funds, for by 1845 the debt amounted to £500,000.(49)

When he later tried to justify his position, in face of mounting criticism, Jonathan Richardson stated:-

> "It was fully believed, by the then Bank Directors, that this undertaking was of a sound and legitimate character, and that it afforded every prospect of success. I freely admit, however, that the large property and respectability of the partners in the company rendered the Directors not sufficiently upon their guard against their banking account

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(47) Maberley Philips, op.cit., p.147.

(48) Durham Chronicle, 29 January 1858.

(49) Ibid.

being allowed, not by specific advances of large sums, but by degrees, and by heavy accumulations of interest, to assume objectionable proportions." (50)

Richardson may have been attempting to abdicate responsibility by claiming he did not take control until 1845. What is clear is that the Bank's management exercised too little control over the flow of credit to the Consett Works. Of the £750,000 debt owed on the accounts of the Bank, on the 30th September 1857, by the Derwent Iron Company, only £350,000 was secured in any form, and the security was of a very tenuous nature.(51) The Bank held £250,000 in Derwent Iron Company "debentures", which, since the Company was only a partnership, were really no more than promissory notes issued by the partners;(52) the other £100,000 was secured by a mortgage on the plant and estates. In addition to the £750,000 owed to the Bank the iron company owed £197,000 to other creditors, and this was secured by bills which had been endorsed by the Bank.

This then was how the Derwent Iron Company secured the means to carry out its expansion during the first five years of its existence; at its peak the works comprised eighteen blastfurnaces, 543 coke ovens, and sixty-nine kilns for calcining ironstone. It employed 2635 horse power in driving blast engines, rolling mills, locomotives and other

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(50) Jonathan Richardson to the Shareholders in the Northumberland and Durham District Bank, 26 January 1858 (DCRO:D/Ho/F119).

(51) P.P. 1857 - 58 (381)V, Q.3457 and Q.3459.

(52) It was not uncommon in Northumberland for a company to style itself Joint Stock, whether it was a Joint Stock Company or a Partnership.

miscellaneous machines.(53) As has already been suggested, the size of the concern may in some respects have been its disadvantage, but there may also have been operating inefficiencies which would have been felt during the depression years when the price of iron fell seriously.

Using the best techniques available in the production of pig iron during the 1840's, not an unreasonable assumption, since the plant had only just been constructed, the material cost of a ton of pig iron at Consett should have been in the region of 35 to 40 shillings.(54) By 1851-52 the use of the richer Cleveland ores would have slightly reduced the cost, to just below 35/- per ton for material inputs.

Cost of minerals per ton of pig iron(55)

3⅓ tons of ironstone (30 per cent Fe.)	@ 7/- per ton =	23/4
4 tons of coal	@ 2/9 per ton =	11/-
		34/4

If there had been any operating inefficiencies they would have affected the Company most adversely during the first half of the 1840's, when the price of pig iron was depressed. When trade picked up in the mid 1850's there was a series of boiler explosions at the works resulting in fatalities and considerable damage to plant. Operations were thus partially disrupted in the prosperous years of 1853, 1854 and 1855.(56)

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(53) Durham Chronicle, 9 July 1858.

(54) Using local iron ore (26 per cent Fe) at seven shillings per ton, and local coal at 2/9 per ton (about 80 cwts. would have been necessary)

(55) W. Fordyce, History of Coal and Iron, p.151.

(56) John Latimer, Local Records of Northumberland and Durham, 1832-1857 (Newcastle, 1857) pp. 231, 332, 342 and 371.

Thus although the 1850's were better years for the ironmasters, with the price of pig iron never falling below 39/9 per ton between 1850 - 1863, Consett was unable to make any profit either through inefficiency, or the crippling debt.

Table I.2. The Price of Pig Iron per ton(57)

Year	Price	Year	Price	Year	Price	Year	Price	Year	Price
1850	44/2	1853	62/3	1856	72/6	1859	51/9	1862	56/-
1851	39/9	1854	79/8	1857	69/2	1860	53/6	1863	55/9
1852	45/1	1855	70/9	1858	54/4	1861	49/3		

Even during this period of the full employment of the plants capacity, during the Crimean War, it was still said of the Derwent Iron Company.....

> "that it has never made any profits at all, even in the very finest years for the ironmasters, and it has gone on absorbing the money of the bank unchecked."(58)

However, the operating inefficiencies could not have been too gross, for when taken over by the Consett Iron Company in 1864 the works produced a profit of £21,062 for 1863-64, inspite of seven years of neglect; the boiler explosions were ill-luck.

Another possible source of weakness may have lain in the proud boast of one of the Company's selling agents..... "We make everything".(59) Such wide diversification may have denied the Derwent Iron Company the

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(57) A. Sauerbeck, Prices of Commodities and Precious Metals (London, 1886).

(58) P.P. 1857-58 (381) V., Q.3458.

(59) Durham Chronicle, 9 July 1858.

advantages gained by specialisation in a limited number of goods. However, there is evidence to suggest that the Company was progressive in marketing iron for new uses. In 1852, the first iron vessel launched on the Wear was built by George Forster, the manager of the Derwent Ironworks.(60)

However, the failure does not seem to have been on the production or selling side of the business, but in the financial structure. The collapse of the Northumberland and Durham District Bank in 1857 brought to light the mismanagement which had been rife in two of the North east's most important concerns. The ambition of the Derwent Iron Company's partners and the slackness of the Bank's Directors had eventually trapped both in a vicious circle, where the one could only survive as long as the other continued to exist. The Iron Company, unable to redeem the debt, required a steady infusion of capital, whilst the Bank could not write off the loan, because its very size would have destroyed confidence. It could only continue through the support and endorsement of the Bank of England.(61) In J.S. Jeans' view the iron company "experienced the fate that proverbially attends vaulting ambition - they 'o'er leaped themselves and fell on t'other side". (62) For the next seven years, the fate of North-West Durham remained in the balance, as various factions vied with one another over what should happen to the ironworks.

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(60) Durham Chronicle, 27 February 1852.

(61) P.P. 1857-58 (381) V, QQ. 3468-3470; 3472; 3481-3489.

(62) J.S. Jeans, Pioneers of the Cleveland Iron Trade (Middlesbrough 1877) p.202.

3. Crisis and Transition, 1857-1864

This period formed a watershed in the development of the ironworks at Consett. Since the fortunes of the Northumberland and Durham District Bank and the Derwent Iron Company had been very closely interwoven, the failure of one imperilled the existence of the other. The evidence up to 1857 seems to suggest that both concerns were equally badly managed. As has already been pointed out the securities of the District Bank were regarded by officials of the Bank of England to be of a most unsuitable nature.(63) The Bank only survived the 1847 crisis because of the timely intervention of Mr. Grote, the Bank of England's agent in Newcastle. By the way of a concession to that liquidity crisis, the Directors of the District Bank did increase the capital of the Bank, nominally by £1,200,000 of which £600,000 was paid up. It was hoped that the issue would cover the Bank's increased business and the diverse nature of that business.

After the closure of the Bank in 1857, the Bank of England investigator, Mr. Hodgson, discovered that the Bank's books were only balanced quarterly.(64) The Bank's financial control system was almost non-existent. It was also Hodgson's opinion that the Bank had survived as long as it did only through the Bank of England's endorsement stamp. By late autumn of 1857 a continual withdrawal of deposits through the summer months had drained the Bank of its liquid reserves, and on the 26th November, 1857 it was eventually forced to close its doors when its liquid assets were exhaused.

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(63) P.P. 1857-58 (381) V, QQ.3457 and 3459.

(64) Ibid., Q.3456.

The Bank had invested badly in assets of a dubious nature for a commercial banking business. The Derwent Iron Company was its largest single debtor. Even after the completion of most of the Iron Company's plant it was unable to reduce the size of the debt. This was probably because the expansion occurred so rapidly, and also during a period of depressed trade. The Company probably had to resort to further borrowing to service the interest of the debt, and by the time there was a period of full employment for the capacity of the plant in the 1850's, the debt was so large that interest payments alone were likely to absorb normal annual profits. The extent of the Iron Company's borrowing had therefore outstripped the profit potentiality of the concern. The financial structure and policy of heavy borrowing was probably the fundamental reason for the lack of success of the Derwent Iron Company. The original partners had over-estimated the buoyancy of the iron trade and might have expanded their interest more judiciously during the 1840's, when trade vacillated between wild optimism and serious over capacity.

To return to the plight of the Bank in 1857, it was soon clear that it was wholly insolvent, since its capital was exhausted and its securities were not readily convertible. The Bank of England refused any further support, despite emotional applications, which foresaw "the fear of disturbances and breach of the peace which might ensue if they were to fail, they being so largely connected with collieries and ironworks."(65) The Bank Directors appreciated the hardship that

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(65) P.P. 1857-58 (381) V, p.xviii.

their mismanagement was about to bring upon the district. Fortunately so did the Bank of England and they made alternative arrangements for the payments of wages.

The failure of the District Bank put the Derwent Iron Company in a most uncertain position, for it was largely at the mercy of the Bank's creditors. Under a compulsory liquidation, which would be more likely to secure a speedy remuneration of creditors, the works might have been broken up and sold much below their true value. Alternatively, the works could be carried on, and any resulting profits could be used to re-imburse the Bank's creditors. The Iron Company's past record and Hodgson's view that the works had been mismanaged and unprofitable, even in the finest years for the ironmasters, provided the creditors with little encouragement to continue operating the works. There was no evidence that the works could be profitable and remunerative to the creditors.

Two factions developed: on the one hand the London Banks, which were creditors of the Bank because of their endorsement of its bills, those included Glyns, Barclay, Overend and Company, and Alexander, and in the interests of their own liquidity they desired a quick settlement. On the other side there were the District Bank's shareholders, the Iron Company and its trade creditors, all of whom stood to lose by the closure of the works. Such a premature ending to iron-making at Consett would have brought severe unemployment in North-West Durham, and probably serious financial difficulties for the Stockton and Darlington Railway which depended so heavily for revenue on the Cleveland-Consett ironstone trade.

Thus, through 1858, a battle developed over the manner in which the Bank's assets would best be realised, simultaneously with a struggle for the control of the Derwent Iron Company and having an important bearing upon that struggle. The continuation of the works was only feasible if they were run at a profit, and this could only be achieved by some capital reconstruction of the Iron Company.

The works of the Derwent Iron Company went through three distinct phases of control and ownership between 1857 and the end of 1864. In general terms these could be classified as, first of all, an attempt by parties already concerned with the Derwent Iron Company to keep the concern afloat; then an attempted purchase by some of the shareholders in the District Bank; and finally the successful formation of Bank creditors and the general public into a limited company to buy the ironworks.

Jonathan Richardson was the chief figure behind the first scheme, by which he proposed to guarantee the Derwent Iron Company's overdraft, in company with some other partners.(66) Richardson and Bigge both resigned their Directorships in the Bank to concentrate their efforts upon the salvation of the Iron Company. However, Bigge and the other proposed guarantors soon dropped out, leaving Richardson to guarantee the debt on his own. The Scheme was to operate on a sliding scale principle, that is the annual repayments were to be dependent upon the price of pig iron, the minimum repayment being £10,000 per annum: this was over and above the annual interest payments.(67)

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(66) W. Backhouse to John Pease, 26 November 1857 (DCRO:D/Ho/F119).

(67) Joseph Pease to John Pease, 9 December 1857 (DCRO: D/Ho/F119).

Early in 1858 new pressure began to build up for a compulsory winding up order for the District Bank amongst the London creditors.(68) This was counter-balanced by a resolution from the Bank's shareholders to apply for registration under the Joint Stock Banking Companies Act, 1857, and then to voluntarily wind up the Bank's affairs.(69) The former course would probably ensure a swift settlement but it would probably have proved disastrous to both the Bank's shareholders and the Derwent Iron Company and its creditors. The Vice-Chancellor, in the Court of Chancery, eventually accepted the voluntary winding-up proposed by the shareholders, in February 1858;(70) the liquidators and accountants were then appointed. By May, Mr. Coleman had produced the Accountants' Report on the Bank's affairs.(71) A Court was set up in Newcastle by the Vice-Chancellor to settle the list of shareholders and how much would have to be called up on each share to clear the Bank's debts.(72)

These two events together settled the fate of Jonathan Richardson's scheme, for the report made by Coleman severely criticised the management of the Derwent Iron Company.(73) Since Richardson had long been implicated with the affairs of the Iron Company it was inconceivable that he could be

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(68) Durham County Advertiser, 1 January 1858.

(69) Ibid.

(70) Jonathan Priestman to John Pease, 7 February 1858 (DCRO:D/Ho/F119).

(71) Durham Chronicle, 23 April 1858.

(72) Durham Chronicle, 14 May 1858.

(73) Durham Chronicle, 23 April 1858.

allowed to continue to participate in its affairs, even under the guidance of inspectors, imposed upon Richardson by the Company's trade creditors.(74) The Bank's shareholders were also unlikely to accept the situation, where they would have a crippling outlay to their creditors whilst their own debtors remained largely unaffected.

There were other potent reasons why the Richardson scheme should fail; first and foremost it did nothing to remove the enormous debt and interest payments which had over-burdened its earlier operations. Secondly there were serious doubts about Richardson's ability to make good his guarantee,(75) and also about the way in which he was securing working capital and running the concern.(76) Richardson's scheme was in effect no more viable as a long term proposition than the Derwent Iron Company had been up to November 1857.

The alternative solution was first proposed at a meeting of shareholders in the Bank on the 29 May 1858, when the following resolutions were adopted:-

"1. That the only means of averting ruin which appears to be impending over the shareholders is to be found in the raising of a fund to relieve the bank from the heavy debt due from the Derwent Iron Company; and vesting in the contributors to that fund the property and effects of the said establishments.

"2. That a committee consisting of Mr. C. Allhuson, Mr. W. Benington and Mr. J. Priestman Jnr., be and is hereby appointed, for the purpose of procuring subscriptions from the shareholders and others with instructions that respective amounts proposed to be

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(74) Jonathan Priestman to John Pease, 11 January 1858, and Jonathan Richardson to John Pease, 20 January 1858 (DCRO:D/Ho/F119).
(75) P.P. 1857-58 (381)V, Q.3459.
(76) Durham Chronicle, 30 April 1858; W.Backhouse to John Pease, 29 December 1857 (DCRO:D/Ho/F119).

paid by shareholders be considered strictly confidential.

"The information which has been obtained regarding the value and future prospects of the Derwent Iron Company's works justifies the belief that a handsome annual return may be secured under good management - a circumstance which has induced many shareholders in the bank to attempt to compromise with the liquidators, which shall at once embrace a release from further liability and afford the chance of ultimate recovery of the amount contributed.

"It is intended, in persuance of this view, to form a company with limited liability, upon equitable principles for carrying on the said works." (77)

In effect, the capital structure of the Iron Company was to be changed, along with the ownership, and this would free it from the burden of fixed annual interest payments. The plan was enthusiastically received by many of the Bank's shareholders, and in little over a week £190,000 was contributed towards the purchase.(78) However, in some quarters this new scheme was regarded with reservations, the feeling being that the works should be carefully valued and offered for sale on the open market. Significantly, these reservations were held by parties more intimately connected to the iron trade who appreciated that the Derwent Iron Company's debt was a gross over-estimation of the plant's real worth. Any new concern burdened with a capital valuation such as the new Derwent and Consett Iron Company, Ltd., would have experienced difficulties in producing good financial results. One suggestion made was that, should the Bank's shareholders wish to keep an interest in the Company then they should put up about 25 per cent of the capital and they would then be followed by outside investors; all this should only be done

(77) Durham Chronicle, 4 June 1858. (78) Durham Chronicle, 11 June 1858.

after a careful evaluation.(79)

Vice-Chancellor Kindersley, however, agreed to the shareholders' scheme, with the provision that those taking part were to be discharged of further liability to the Bank's Creditors on completion of the purchase.(80)

The 1858 project was revised downward on 1st December 1859 to £825,000; the shareholders had paid £250,000 to procure release from all future liabilities of the Northumberland and Durham District Bank. Of the remaining £575,000, £150,000 was paid out of share subscriptions; the new company being capitalised at £150,000. The remaining £425,000 had therefore to be paid from profits by December 1864.(81)

The scale of the purchase, the time schedule for its completion and the conditions of trade after 1858 made the scheme unrealistic.

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(79) Durham Chronicle, 25 June 1858.

(80) Durham Chronicle, 6 August 1858.

"Telegraphic messages were received on Monday, by the official liquidators of the District Bank and by the shareholders' committee informing them that the Vice-Chancellor's Court had approved the arrangement whereby the Derwent Iron Company pass into the hands of some of the shareholders of the District Bank. The particulars of the arrangement may be described as follows:-

"Fify-four shareholders purchase the works, collieries and houses for the workmen, for £930,000. The payments will thus be made:-

£175,000 in cash	£ 41,000..... 30 months
£85,000..... 6 months	£129,000..... 36 months
£96,500..... 12 months	£ 14,000..... 42 months
£103,500.....18 months	£ 47,500..... 48 months
£191,500..... 24 months	£ 45,500..... 60 months

Add £36,831.00.06d already made by the same parties in respect of the £5 call prior to Mr. Coleman's Report, making a total of £966,831.00.06d.

"The above arrangement, it may ultimately turn out, will enable the liquidators, we believe, to declare a dividend of 5shillings in the pound on the 1st October next, as also to compound in full with creditors under £100, at the rate of 15 shillings, should they be disposed to entertain that offer."

In an effort to cut costs the owners tried to reduce wages. In the trough of depression in 1861 the Company's puddlers went out on strike when the practice of providing free rent and coal was withdrawn; this had been customary at the works since they were built. The men had received 3d. to 6d. per ton below the national norm in lieu of the free rent and coal. The men demanded 6/- per fortnight as compensation for the withdrawal of the privilege, when 4/6 would have brought them to the country average. The employers held out for 4/- per fortnight, and eventually forced the men back without any compensation at all.(82)

Labour relations continued to deteriorate, and the pressure from the District Bank's creditors increased in intensity. By mid-August, Vice-Chancellor Kindersley ruled that the Company must make its outstanding payments or be wound-up and disposed of. This was inspite of applications for postponement by both the Bank's liquidators,(83) and the creditors of the Iron Company, principally the Peases.(84)

The failure of the Sunderland shipbuilders, Oswald's, an important customer of the Iron Company, and the outbreak of another strike against a proposed 10 per cent reduction further aggravated the problems of continuing the works. By September 1861 the works were gradually closed down - Bishopwearmouth altogether, then Crookhall blastfurnaces and Delves pit.(85)

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(81) W. Fordyce, History of Coal and Iron, PP. 149-150.

(82) The Colliery Guardian, 27 April 1861.

(83) Relations between the liquidators and creditors of the District Bank were becoming strained by this time.

(84) The Colliery Guardian, 24 August 1861.

(85) The Colliery Guardian, 14 September 1861.

Despite constant rumours no buyers came forward with a firm offer. The strike dragged on and an aura of pessimism settled over the district - except for one optimistic observer, the leader writer of the "Consett Guardian" who could not envisage the closure of the greatest works in England. There was some basis for such optimism, however, for the Consett works had solicited the approval of the Admiralty for its iron. Whilst the ownership of the works remained uncertain, the order books were at least filling up.(86)

The leader writer of the "Consett Guardian" had the foresight, or at least the optimism, a valuable state of mind in such depressing times, to forecast:-

> "Consett, we will venture to tell the good people of Newcastle whether friends or foe, so far from sinking into ruin and decay, has yet bright and prosperous days before it - perhaps brighter and more prosperous than it has ever yet enjoyed."(87)

However, whilst trade remained depressed, the Vice Chancellor with-held permission for a further sale, until an advantageous deal could be made.(88) He came under increasing pressure from the Bank's creditors, who were becoming impatient at the absence of urgency in clearing off the debts owing to them.(89)

During 1863 the iron trade began to improve and with it, the profitability of the Consett ironworks; this induced the Vice-Chancellor

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(86) Ibid.; and The Colliery Guardian, 23 November 1861.

(87) The Colliery Guardian, 19 October 1861. Quoted from the Consett Guardian.

(88) Durham Chronicle, 5 June 1863.

(89) Durham Chronicle, 22 May and 5 June 1863.

to agree to a sale, but not before a realistic assessment was made of the works. By October 1863, rumours became so rife of an impending sale, that the Durham Chronicle announced that "the extensive ironworks at Consett will shortly be offered for sale....."

A group of the Bank's creditors organised themselves for the purchase of the works, in conjunction with the trade creditors, and the plant never was offered for sale on the open market. In March 1864 this group was constituted as the Consett Iron Company Ltd., and began the purchase of the ironworks. The remaining unsettled creditors of the Bank were offered shares in the new company to the extent of 5/- in the £ of their debts.(90)

There were no immediate changes in the management of the Company, except at directorial level. However it proved to be at this level that the fortunes of the Consett Iron Company rested. The financial debacle of the 1850's was avoided by the shrewd management of David Dale and there could have been no greater contrast than that between the financial results prior to 1857 and those after 1864.

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(90) Shipperdson MSS. 1729.
(University of Durham, Department of Paleography and Diplomatic.)

CHAPTER II

THE CAPITAL STRUCTURE AND FINANCIAL PERFORMANCE OF THE CONSETT IRON COMPANY

A company's potential to make profits may be undermined by a number of considerations, one of which is financial mismanagement. Financial obligations may outstrip the earning capabilities of a firm if its management are too optimistic and reckless in their approach to the control of its capital structure. Such a fate overtook the Derwent Iron Company.

In this chapter the financial management and performance of the Consett Iron Company will be examined. The Company's origin had a profound affect upon the nature and extent of its ownership. The Directors did not become detached from the body of shareholders generally, and their management of the concern was directed primarily to satisfy the expectations of those shareholders.

Calls for additional capital were avoided by using current earnings for plant construction, with intermittent capitalisation of such expenditures. Alternatively payment on calls for share capital was synchronised with dividend payments. Efforts were made to keep borrowing within reasonable limits, and it never threatened to engulf the profit earning capacity of the Company.

The profits earned by Consett were handsome, and the dividends paid generous. Every attempt was made to equalize dividends by varying the level of profits distributed, and by contemporary standards, especially for a Colliery Company, this was a most conservative policy.

The careful financial management of the Company was probably the single most important factor in the improved performance of the Consett Ironworks. However, probable under-capitalisation concealed a deterioration in the efficiency in the iron and steelworks after 1900. For this reason profitability is a dangerous indicator to choose for assessing the performance of an industrial concern.

1. The Nature of the Company's Ownership

It has been seen that one of the main weaknesses of the Derwent Iron Company had been their unsound capital structure; this was a defect which their successor the Consett Iron Company avoided successfully. The interregnum of 1858-1864, when the Derwent and Consett Iron Company attempted to purchase the works and repay the debt to the Bank illustrated the unreality and impracticability of such a great burden of debt. The Consett Iron Company eventually purchased the works in 1864 for £295,318.08s.00d. by the issue of 40,000 shares of £10. denomination, of which £7.10s. was called up to facilitate the purchase.

Consett was thus among the pioneers of the New Acts which had introduced the concept of limited liability to the structure of company ownership in Britain. For these pioneers, attracting investors was one of the primary problems, and this is reflected in contemporary literature dealing with the new opportunities created by the 1862 Act.(1) Not only was attracting investors important, but also attracting ones of the

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(1) J.B. Jeffreys, "The Denomination and Character of Shares, 1855-85" Economic History Review XVl, (1946).

right quality; many early limited companies maintained a narrow base of ownership, almost akin to partnership, so that they might preserve the confidence of their trade creditors. Consett's case is somewhat different since almost half the shares were offered to and taken up by creditors of the Northumberland and Durham District Bank in lieu of money still outstanding to them. The Company from the outset had a broad ownership, with 385 shareholders in 1864. Another unusual feature of Consett's capitalisation was the relatively low denomination of the shares, because coal, iron and engineering companies floated in the same period generally opted to issue shares of large denominations, £1,000 being not unknown.(2) A possible explanation of the low denomination is that since many of the early shareholders were the small creditors and depositors whose claims on the District Bank had yet to be settled, large shares would have been impracticable in carrying out the exercise.(3)

In respect to the low denomination and large ownership Consett was truly a pioneer for this did not become the norm until well into the 1870's. Most companies floated at this time were attempting to achieve respectability, particularly in the eyes of their creditors, and so they had a few respected shareholders, high share denomination and most important, a high proportion of uncalled capital.(4) Consett had no problem in persuading creditors, since some of the leading creditors

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(2) Ibid.

(3) Register of Shareholders in the Consett Iron Company, Ltd., Vol 1. (DCRO: D/Co/3.)

(4) J.B. Jeffreys, op.cit. The high proportion of uncalled capital became a weakness since it encouraged adventurism and in effect offered no real security to the creditor.

became owners in the concern, particularly the Pease family of Darlington. Furthermore Consett had become such an important constituent of County Durham's economy, that many creditors were dependent upon the continuation of the concern, no matter who the owners were: this was especially true of the railway companies which derived a substantial revenue from carrying freight to and from Consett.

The practice of having a large reserve of uncalled capital was also prevalent during the 1860's; this served several ends. First and foremost it was a sop to trade creditors who formed the main source of short and medium term loans; secondly it was sometimes necessary during the early years of experiment, because of the imperfections in forecasting capital requirements; and finally it was sometimes due to over-valuation of nominal capital, as in the cases of Bolckow Vaughan, Palmers and Ebbw Vale.(5) Once more Consett did not follow the normal pattern since £7.10s. was paid up, a relatively high proportion by the standards of the time. However, despite such an enlightened start Consett was not to remain amongst the front runners in the progression towards the more typical £1. share of the twentieth century; this was not introduced until the capital reconstruction of 1913.

During the fifty years up to 1914, the Company carried out seven alterations in the size of its share capital of which only one was a capital reduction, and that involving a very small amount.(6).

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(5) Ibid.

(6) Directors' Minute, 8 October 1881, P.9 (DCRO:D/Co/33). Some members of the Company had voluntarily paid up their share capital to its full extent (3342 shares in all). It was found that the owners of these shares were at a disadvantage when they tried to sell them. It was therefore resolved to repay the £2.10s. on each of the fully paid shares so that they might be equally marketable as all other Consett shares.

The other alterations merit an explanation since they give an insight into the financial policy adopted by the Company, and also the dominant role played by David Dale in formulating that policy.

The first alteration took place in 1866 when 6,000 additional shares were created to enable the Consett Iron Company to take over the nearby Shotley Bridge Iron Company. This take over was a straight purchase of the works of the Shotley Bridge Company, and did not involve any exchange of shares.(7) The effect of this was that there was no significant dilution of the Consett ownership. The year was also marked by a sharp decrease in the trading in Consett's shares, probably due to the depression of 1866 and the completion of sales of shares by ex-Bank creditors anxious to realise a quick cash benefit.

The second alteration followed during the boom years of 1872-73 when the Company capitalised £92,000 out of profits, by issuing 9,200 shares. Since there was no provision for paying bonuses out of reserves, the new share issue was used as a substitute; in effect it was a bonus of £1.10s. upon every existing share.(8) However, this issue did occur during a period of blast furnace reconstruction, and much of the undivided profit was being applied to finance the reconstruction. It was therefore more desirable that it should appear as new share capital rather than as a reserve fund, which in principle would be divisible among the shareholders.

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(7) Directors' Minute, 13 September 1866. p.104. (DCRO: D/Co/29).

(8) General Meeting Minutes, 28 September 1872. (DCRO:D/Co/44).

The next occasion on which the share capital was increased was during 1880 when the Directors suggested an alteration and also made provision for bonuses to be paid from the Reserve Fund, with the sanction of a General Meeting of the Company.(9) A bonus share issue was then made, in the ratio of one new share to every three existing shares, and this increased the Compnay's capital by £184,000.

The final increase of the Ordinary share capital was under-taken between 1886-1890, during which time the number of shares issued was brought up to 100,000, with paid up capital of £750,000. The issue was necessary to finance the extensive alterations which attended the change over from iron to steel production.

After 1890 there was only one further increase in the Company's share capital before 1913, and it was of a different kind, for it involved the issue of 100,000 8 per cent Preference Shares of £5. denomination. Since these shares carried a fixed interest payment, they had first call upon any profits that the Company made. In this respect they were a compromise between debenture stock and ordinary shares, since they avoid an annual payment that is a cost, whilst they offer the investor greater security. The issue was made with a dual purpose; overtly to finance the construction of a New Angle Mill and open out some extensive coal tracts acquired by the Company north of the River Derwent. However, behind this was a scheme to reduce the extent of Consett's indebtedness. The Company estimated that the extensions would cost £339,000, whilst they had £207,000 on loan. Bymaking an

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(9) Articles of Association, The Consett Iron Company Limited, 1864 Article 109A. (DCRO: D/Co/125).

issue of £500,000 of Preference Shares, fully paid up, and selling 1867 Ordinary Shares at their market value of £29, the firm would be able to clear the indebtedness at an early date.(10)

The desire to pay off the loan capital was understandable since it was all in the nature of short term borrowing, that is it was repayable on six months notice from either side. This was not a sound basis upon which to finance fixed assets. Therefore the rationale behind the Preference Share issue was that the first calls would be used to clear off the £207,000 indebtedness, and the later calls could coincide with dividend payments to remove any burden of payment from the shareholders. The extension of the plant was in fact planned to be financed out of current profits. The Preference Share issue facilitated the whole operation and an attempt was made to protect the value of the ordinary shares by introducing a cumulative dividend upon the Preference Shares, so that interest payments started at 6⅔% in 1892 rising to 8% in 1895.(11)

The alterations of 1886-1890 and 1891-94 were both planned by David Dale, the Company's Chairman, and they give an insight to his astute financial control of the concern, despite the fact that his time was split between several business activities. His aim was as far as possible, to finance the expansion out of current profits, capitalising them as they went along(12) and also to keep the Company's borrowing within

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(10) "The Chairman's Proposals for providing additional Capital," Directors' Minute, 28 October 1890, pp. 213-219. (DCRO:D/Co/34).

(11) Ibid., p.218.
"A. It may be better to make the dividend on the suggested Preference Shares 'cumulative' because this would increase their market value without correspondingly decreasing the market value of the ordinary shares."

(12) Newcastle Daily Chronicle, 5 August 1886.

realistic limits[13] and so avoid the rock upon which the Derwent Iron Company had run aground.

Finally a further overhaul of the Company's capital structure took place in 1913 when both the Ordinary and Preference Shares were subdivided into £1 units. Shortly after the Ordinary Shares were also fully paid up by a bonus payment.[14]

What was the significance of these various share capital alterations? The Consett shareholders were not divorced from control, since the Board of Directors was non-executive, being made up of the more substantial shareholders. The Company therefore adopted a policy in the interests of the owners, and in this respect Consett probably approximated to the notion of profit maximisation, a goal not necessarily compatible with the organisational structure of the modern business enterprise.

However, Consett was not typical of companies in the iron and coal trades during the 1860's and 1870's because of its broad base of ownership, which would have been more typical of the twentieth century than the second half of the nineteenth. (See Diagram No II.1). The Board of Directors existed as an effective link between the owners and the managers, and out of this structure emerged a profit conscious company.

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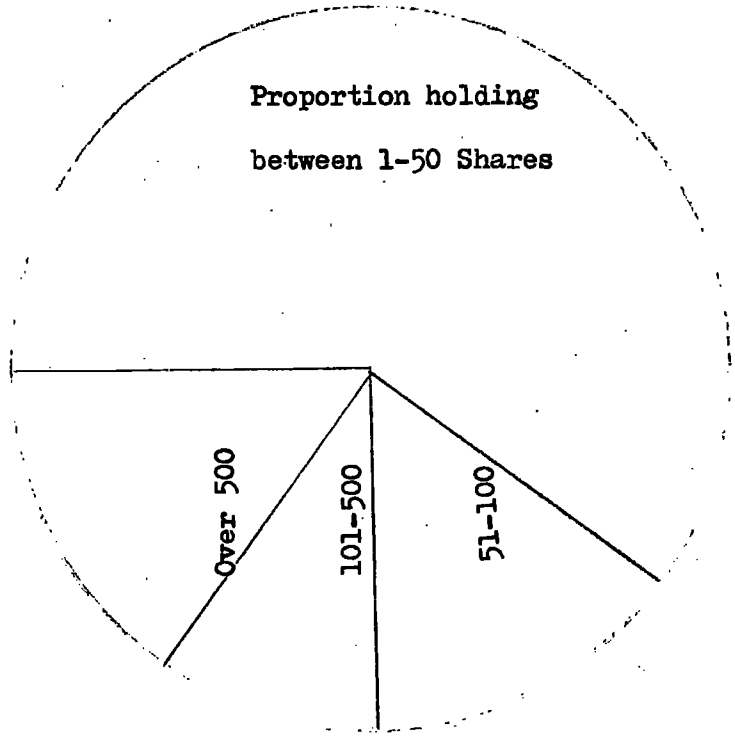
(13) "The Chairman's Proposals for providing Additional Capital," Directors' Minute 28 October 1890. pp.213-219 (DCRO:D/Co/34); and "The Chairman's Suggestions for Increased Capital," Directors' Minute 6 April 1886. pp.247-252. (DCRO:D/Co/33).

(14) Articles of Association, Consett Iron Company Ltd., 1900 Revised 1913, (DCRO:D/Co/125).

DIAGRAM II.1

THE DISTRIBUTION OF SHARES AMONGST SHAREHOLDERS IN 1864



Source: The Register of Shareholders Vols. 1-IV (DCRO: D/Co/3-6).

From the outset the financial policy adopted was more realistic than that followed by the original Derwent Iron Company. New plant was paid for either by new share issues or out of accumulated reserves, rather than by borrowing. At the outset the Directors had authorisation only to borrow up to £60,000, although this ceiling was gradually increased. This sound financial policy limited the burden of fixed interest payments.

As has already been noticed, the Company issued 40,000 shares for the purchase of the plant and equipment at Consett, Bradley, Crookhall and Bishopwearmouth. Of these shares fractionally under half were allocated to the creditors of the former District Bank, who were also able to submit offers for the remaining unallocated shares.(15) The issue was taken up enthusiastically in the North East: geographically most of the shareholders were from Durham and Tyneside, whilst their occupations broke down into the following categories

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(15) Directors' Minute, 14 May 1864, p.14 (DCRO:D/Co/29). The Company alloted 19,895 shares to the Bank creditors and the remaining 20,105 shares to the general public, including any Bank creditors who wished to take up shares in excess of their quotas.

TABLE II.2

OCCUPATIONAL STRUCTURE OF CONSETT SHAREHOLDERS

Classification of Shareholders	Per. Cent. of Shares Held
Professional	34%
Private	33%
Industrial	24%
Merchants	9%

Included in each category were the following occupations.

(1) Professional - lawyers, accountants, bankers, clergymen, doctors of medicine.

(2) Private - small businessmen, farmers, spinsters, widows, gentlemen, gentry.

(3) Industrial - owners of industrial concerns, and employees of such business.

(4) Merchants - anyone described in the Register as a Merchant.

Source: Register of Shareholders, Vols. 1 - IV. (DCRO: D/Co/3-6).

The wide range of occupational groups covered in the ownership of the Company is a reflection of its origins amongst those people who had business with a bank, but it was not a typical cross-section business investors in the early days of limited liability.

Noticeable by its absence from the list of shareholders is the institutional investor; not until the 1890's did this group figure at all in Consett share transactions. Prior to that Consett's only involvement with institutional investment was that with theFriends Provident Society, who lent £7,000 to Consett during the 1870's, and this probably only existed because of the Quaker influence exerted in the Company by the Pease and David Dale.

Unfortunately no records exist of the dealings in Consett Preference Shares, and so a true picture of the influence of institutional investors is difficult to assess. It was this category of shares that Victorian Institutional investors would most probably have been interested in, because of their relative security, and in Consett's case their very attractive rate of interest. One would not expect institutional investors to be heavy traders in the more speculative ordinary shares, especially in the late nineteenth century, when investment in industrial concerns was only just beginning to gain acceptability.

There were, however, two prominent dealers in Consett shares, from the 1890's onwards, and these were both northern banking firms, the North - Eastern Banking Company, Ltd. and the York City and County Banking Company, Ltd. Their frequent dealings in small quantities of shares is probably an indication of a speculative motive. Other institutional investors included trust companies such as Northern Trust Ltd.

and the Tyne Shipping and General Investment Trust, Ltd., and also the Union Property Association, Ltd. Even amongst the institutional investors there existed a high degree of regionalism. Unlike the banks, the last mentioned investors tended not to trade in the shares but to hold them over longer periods of time.

Not until 1913, when the National Securities Trust Company, Ltd. invested in the Ordinary shares of the Company, was any attention paid to institutional investors by the Board of Directors. The absence of any earlier comment may be indicative of an absence of such investors, for it is likely that once a company does become attractive to the institutional investor it is accepted as a good risk, therefore becoming more attractive to the small independent investor. This in turn would probably lead to more frequent dealings in the shares and consequently greater marketability. As this would benefit all shareholders it is something that a Board of Directors is likely to take note of.

Returning to the Preference shares, there are one or two indicators, which, in the absence of any concrete data, might give some lead as to the extent to which these shares were taken up by institutional investors. The first is the availability of these shares on the market, and since it was a pro rata issue,* those shares not taken up by existing Consett shareholders would have been sold at a premium on the open market, to equalise the 8 per cent rate with the ruling market rate. Thus any institutional investors would only get a yield approximating to the ruling market rate of interest at the time they bought the shares. Therefore in any normal

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* One Preference Share alloted per Ordinary Share.

trading after the original issue there would be no financial advantage in purchasing the 8 per cent Consett Preference Shares; the only advantage would be with regard to such features as security and risk.

The main features of ownership in the period under consideration are the comparatively large number of shareholders, their regional nature and apparent absence of any significant institutional investment. However, despite the large number of shareholders and the small denomination of shares there was a tendency towards the concentration of shares in the hands of a few families. Most prominent, through their continuous representation upon the Board were the Bainbridges, Hendersons and the Dales, but other important holders were the Peases, the Spencers, the Newburn Steel Manufacturers, and the Fenwicks. The management of the firm did continue to respect the interests of the smaller shareholders in their policy of distributing profits. If they took the size of the dividend as the criterion of success, then there was no ground for complaint. For the fulfilment of general satisfaction for the ordinary shareholder, Consett had a structure of management which at least approached the ideal, for the Directors, though non-executive, were usually successful local businessmen with knowledge of management and its problems. They adopted a policy of a sensible balance between distribution and retention of profits, and this was often noted by contemporary observers as one of the main factors in the overall strength of the Company.(16)

The retention of profits in Reserve Funds can, however, create a misleading picture to the relatively uninformed shareholder, for they are

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(16) Newcastle Daily Chronicle, 5 August 1886.

legally distributable amongst the owners. Reserve Funds are rarely kept in the form of liquid assets, and are more normally used to carry out plant extensions, maintenance etc., thus effectively being capitalised. Once the reserves are embodied in plant it becomes expedient to capitalise them as share capital, and they are then no longer legally available for normal distribution. Throughout the period the Consett Board tended to follow such a policy, and much of the increase in the nominal capital from £400,000 to £1,500,000 was achieved by bonus issues.

What are the advantages of bonus payments and issues? Above all else they are a reflection of the Board's confidence in the continuation of profitability, for they dispatch to the realms of share capital, reserves which could otherwise be distributed as a dividend. Thus the capitalisation of reserves is an indication that the Directors expect profits to remain at least at their current level, under normal trading conditions, and that they have continuing faith in the line of business they are in. A further implication might be that the level of the dividend will be maintained and this could lead to an appreciation in the value of the share, and so a possible capital gain to the shareholder. Finally an increase in the number of shares a Company has issued, will lead to greater marketability of the shares. The reality of this advantage is demonstrated by Consett's application in 1881 for a quotation on the London Stock Exchange: this would create a potential national market for the Consett shares, and deriving from that, greater marketability. A similar effect was generated in 1913 by the subdivision of existing shares, creating a larger number of lower denomination with the tendency for them

TABLE II.3

NUMBER OF TRANSFERS OF CONSETT IRON COMPANY LTD.

ORDINARY SHARES BETWEEN 1865-1913

YEAR	TRANSFERS	YEAR	TRANSFERS	YEAR	TRANSFERS
1865	98	1882	389	1899	638
66	65	83	344	1900	606
67	101	84	313	01	570
68	80	85	220	02	464
69	140	86	633	03	373
1870	78	87	379	04	435
71	52	88	491	05	529
72	92	89	560	06	443
73	190	1890	666	07	462
74	356	91	540	08	405
75	342	92	555	09	490
76	216	93	446	1910	352
77	202	94	314	11	400
78	178	95	473	12	423
79	250	96	458	13	610
1880	568	97	519		
81	762	98	548		

Source: Register of Share Transfers, (DCRO:D/CO/6-28)

to become more widely held and more frequently dealt in. Some evidence of this tendency toward greater marketability can be seen from Table II.3 which records yearly transactions in Consett's Ordinary shares.(17)

The table shows a general upward trend through the whole period, with peaks in 1874, 1880-81, 1886 and 1913 coinciding with the new issues.

The adjustments to the capital structure between 1886-1894 produced a better gearing between loan and share capital. When David Dale drew up his first capital reconstruction plan in 1886, loan capital was about 30 per cent of total capital,(18) whilst after 1894 it was only between 15-20 per cent. The Company then had a moderately low geared capital structure.(19) This was a most desirable policy for a Company operating in an industry, more susceptible than most to violent fluctuations in profits. The gearing between Preference shares and Ordinary shares also indicated a sound financial policy for a firm in the iron and steel industry; in years of low profit the dividend on the Preference shares could still be paid, whilst profits did not have to be abnormally high before a dividend could also be paid on the Ordinary shares.(20) This arrangement contributed towards the maintenance of a fairly stable value for Ordinary shares. The decision to issue Preference shares

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(17) Another factor which influenced marketability was the dividend paid, though this would not account for continuous upward trend in the number of transactions.

(18) "The Chairman's Suggestions for Increased Capital", Directors' Minute 6 April 1886. pp. 247-252. (DCRO: D/Co/33).

(19) The influence of the borrowed capital was further reduced by the inflation after 1896, which reduced the burden in real terms.

(20) F.W. Paish, Business Finance (London, 1965) pp.25-27.

was due to a feeling amongst the Directors that it would be desirable for the investor to have an assured income from his stake in the Company. This would enable shareholders with commitments to make plans of expenditure in advance with reasonable certainty as to the income from their investment.

2. Loan Capital and Financial Policy

The Directors of the Consett Iron Company were authorised at the first Annual General Meeting of shareholders, in September 1864, to borrow up to £60,000. The money was not to be raised by a specific debenture issue, but merely by the acceptance of loans at 5 per cent with either six or twelve months notice of repayment necessary by either party. This money was used for working capital and for the provision of small items of plant.

For example, in 1867 the Company still had £15,680 of unexercised borrowing power, and this, plus calls on shares due and working surpluses, amounted to £47,841 - after deductions the firm had a cash balance of £26,044 and the Board of Directors urged David Dale to watch for suitable opportunities to apply this sum to Colliery extensions.(21) Thus some loan capital was applied to plant improvements, but not on a large scale, and also to a sphere of business activity where the Company expected a swift return on outlay.(22)

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(21) Directors' Minute, 27 April 1867, p. 141. (DCRO: D/Co/29).

(22) "The Report of Messrs. Boyd and Armstrong on Colliery Operations," Directors' Minute, 29 January 1867. (DCRO:D/Co/29).

By 1871, however, the Directors were eager to repay certain loans, or at least get a reduction in the rate of interest. The Friends' Provident Society which had lent £7,000 to the Consett Iron Company was given notice that its loan would be repaid unless they accepted a reduction in interest from 5 per cent to 4 per cent. The two parties however eventually negotiated a compromise of 4½ per cent.

The boom conditions of the early 1870's in the coal and iron industries placed Consett in a very strong liquidity position, and by 1875 the cash balances were so large, and the rate of interest paid on current Banking Accounts so low, that the Directors resolved to repay all debenture holders, or further reduce the rate of interest to 4 per cent.(23) However, the downturn in trade in 1876 altered the Company's liquidity position, and the programme of expenditure exceeded expected revenue, forcing the Directors to extend their borrowing powers to £150,000 rather than carry out their proposed reduction.(24) By March 1877 loans amounted to £84,462 all of which, except for £440 was borrowed at 4½ per cent.

Trade remained depressed for the rest of the decade, and one would not have expected the liquidity position of the Company to ease in such conditions. However it did at Consett, for in 1879, one of the worst trading years in the second half of the century, the Company had

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(23) Directors' Minute, 6 April 1875, p.101.(DCRO:D/Co/31).

(24) Directors' Minute 11 July 1876, pp. 212-213. (DCRO:D/Co/31).

accumulated such a large cash balance as to be able to repay the loans from the Friends' Provident Society, and the National Life Assurance Society,(25) and also to deposit between £20,000 and £25,000 in a special account with J. and J.W. Pease, one of the firm's bankers.

As depression faded and buoyant trade returned the loan capital was further reduced; £25,190 being repaid on 31st December 1881. Furthermore the majority of outstanding loans were then held at 4% (£95,899) as opposed to only 4½% (£13,381). However, this reduction of loan capital was short-lived for in 1883 the Directors had to seek further borrowing powers, to the extent of an additional £100,000.(26) Atthis juncture loan capital amounted to 30% of total capital, and the financial policy from this time onwards consciously attempted to reduce the proportion of loan capital. In 1886 David Dale put forward a plan to raise share capital and reduce loan capital, whilst at the same time extending steelmaking capacity. The scheme had much to recommend it; by 1891 it was proposed that borrowed capital would be reduced to £20,000. Such a realisation was not feasible, for no account was taken of the proposed colliery extension. However the essence of the scheme was to constrain the absolute size of loan capital, whilst it would fall as a proportion of total capital, because of the new share issues.(27) The 8 per cent

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(25) Directors' Minute, 2 December 1879, pp. 177-178.(DCRO:D/CO/32).

(26) Directors' Minute, 31 July 1883, p.101.(DCRO:D/CO/33).

(27) "The Chairman's Suggestion for Increased Capital," Directors' Minute 6 April 1886, pp. 247-252. (DCRO:/D/CO/33).

Preference share issue between 1891-84 was directed to the same end, the Preference shares offering a compromise between debentures and ordinary shares.

The depressed nature of trade in the mid-1890's hindered the completion of the loan capital reduction scheme, and in 1898 Consett still held loans of over £100,000. However, as trade picked up the Company gave notice of the repayment of £104,775, though at first they put in an option for the renewal of 50 per cent of the loans. This privilege was also withdrawn two months later.(28)

The boom of 1899-1900 gave the Consett Iron Company a substantial reserve of liquidity. As a reserve fund was established to conserve funds for the proposed reconstruction of the blast furnace plant, money was invested in Government securities. In all £150,000 was invested by Consett, in 1900, in Consols, War Loans and Exchequer Bonds, at a rate of 2¾%.(29) The Directors also transferred their pay account to Messrs. Lambton and Company, since the business contemplated by the 1864 banking agreement had not materialised. By that agreement all the Iron Company's discount business was to be handled by Lambton's Bank, whilst J. and J.W. Pease handled all the general banking business. The pay account was to be provided for by the Iron Company remitting direct to Lambton's local and other cheques. This concession to Lambton's was probably secured by Mark Fenwick, a Director of both concerns.

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(28) Directors' Minute, 19 July 1898, p.39. (DCRO:D/CO/38)

(29) Directors' Minute, 23 January 1900, p.169; Ibid., 28 April 1900. p.195; Ibid., 6 November 1900, p.236. (DCRO:D/CO/38).

In 1902 the ironworks at Consett were involved in the second failure of a local bank; on this occasion, however, the circumstances for the Iron Company were not so traumatic or damaging as in 1857. The bank was that of J. and J.W. Pease of Darlington, with whom Consett was a large creditor. The crisis had been caused by a succession of difficulties culminating in an unsuccessful law suit by J. and J.W. Pease. The large creditors agreed upon a plan to assign the property of the bank and its Partners to W.B. Peat, the liquidator. The assets would then be realised by Peat, under the supervision of a Committee of Inspection, upon which Consett's solicitor, Mr. Cooper served. However, despite donations and guarantees from friends of the defunct bank to the extent of £140,000,(30) the Consett Iron Company had to write off £50,000 for the year ending June 1903, as bad and doubtful debts. As part of the Pease settlement Consett received £6,450 worth of shares in Henry Pease and Co., Ltd. in 1906.

When J. and J.W. Pease failed in 1902 their 'current banking business' was taken over by Barclay and Co., Ltd.,(31) who continued as the bankers for the Consett Iron Company. Between this period and the outbreak of the First World War, the Directors continued to pursue the policy of placing cash reserves to either Government bonds or special deposits with Barclays, the former normally paying 2¾%, the latter 3 - 3¾%.

The financial policy of the Company shows a keen awareness of the dangers that can befall a concern short of cash reserves, and overburdened

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(30) Directors' Minute, 23 December 1902 p.150.(DCRO:D/CO/39).

(31) P.W. Matthews and A.W. Tuke, History of Barclays Bank Limited (London, 1926) p.209.

with loan capital. The bitter lesson of 1857 appeared to have been well appreciated by the Directors, and David Dale in particular. He steered the Company along a path of liquidity strengthened through short-term borrowing and retained profits, whilst preventing the loan capital from becoming too large a proportion of total capital. The policy, both with regard to share capital and loan capital, reflects the influence of a Board of Directors, made up of substantial shareholders, with an extensive range of business interests; but more than anything else it reflects the almost continuous presence of David Dale.

3. FINANCIAL RESULTS AND THE COMPOSITION OF THE COMPANY'S PROFITS

The main criterion for the success of a company, in the eyes of the shareholders, is inevitably its profitability. It was this feature of consistently good profits which marked Consett out from many of its contemporary iron and steel makers. However the use of profits and dividends as a measure of a firm's success contains hidden pitfalls for large profits do not necessarily indicate operating efficiency. The first pitfall may be that a company is under-capitalised, an indictment that might well have been laid against the Consett Iron Company in the 1860's, and after 1900. From an original capitalisation (or valuation) of about £1million in 1858, the works were eventually sold in 1864 for £295,318.08s., and the nominal capitalisation was £400,000 of which £300,000 was paid up. Bolckow Vaughan, which converted to a limited company in 1864 also, and had a productive capacity in the same range as

Consett had a nominal capital of £2½ million of which £813,737 was paid up by 1867. Even though Bolckow's reduced their capitalisation to £1½ million in 1867, it was still considerably greater than Consett's.(32) Their profits and dividends were therefore not likely to be as striking as those of Consett.

However until 1870 the profits made by Consett were themselves unspectacular, for much of the blast furnace plant was obsolete, and it was only when the new furnaces came into commission that profits improved. It was necessary to have a considerable outlay on replacement before the company was able to compete in terms of operating efficiency with Bell Brothers and Bolckow Vaughan on Tees-side. After 1870 it has been shown in the last section that much plant renewal and expansion was carried on from accumulated profits with periodic share issues to increase the capital value of the plant. The spectacular appearance of Consett's profits and dividend payments seems therefore to suggest that the plant was relatively under-capitalised.

The second pitfall that might be concealed by high profits was possible operating inefficiency induced by a monopoly position. This is not the place for a detailed discussion on Consett's market position, but suffice it to say that Consett did have limited monopoly powers in providing materials for shipbuilding, especially on Tyneside. However during the last 15 to 20 years of the period coal and coke products accounted for an increasing contribution to the overall profitability of the concern, and with these products the company was competing with numerous sellers.

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(32) A. Birch, The Economic History of the British Iron and Steel Industry 1784-1879. (London, 1967) pp. 207-208.

TABLE II.4

CONSETT IRON CO. LTD. - PROFITS 1864 - 1914

Year	Profit per year (after tax & interest) (I)	Per Cent of Profit Distributed (A) (II)	Ordinary Dividend Rate % p.a. (III)	Profit on Capital Employed per cent (B) (IV)
1864	£ 21,062	66.0	9½	9.2
5	39,096	76.7	10	12.0
6	35, 872	66.8	10	10.9
7	31,605	74.2	7½	8.9
8	38,413	67.2	7½	10.4
9	39,786	65.0	7½	10.8
1870	101,791	58.4	17	24.5
1	101,208	45.5	13⅓	23.5
2	160,194	39.5	18⅓	31.7
3	302,505	73.0	53⅓	49.2
4	304,128	81.7	60	47.1
5	215,102	77.0	40	33.7
6	86,257	72.0	15	13.9
7	83,289	74.6	15	12.9
8	57,996	89.2	12½	9.3
9	55,995	73.9	10	8.9
1880	104,497	79.2	20	15.6
1	195,071	75.5	26⅔	27.1
2	128,495	85.9	20	18.9
3	130,219	77.7	18⅓	18.5
4	85,631	86.0	13⅓	11.8
5	60,123	91.8	10	8.6
6	72,502	76.1	10	9.9
7	95,752	69.2	11⅓	11.9
8	117,746	70.2	13⅓	13.5
9	220,389	59.7	20	24.8
1890	366,410	63.2	33⅓	38.6
1	275,689	86.8	31⅔	26.4
2	157,623	93.3	16⅔	14.3
3	110,971	96.9	10	8.8
4	124,786	91.8	10	9.5
5	114,973	93.5	9	8.6
6	182,383	76.8	13⅓	13.2
7	246,771	77.0	20	17.4
8	272,885	69.6	20	18.5

TABLE II.4. CONTINUED

Year	I	II	III	IV
1899	433,900	65.8	33⅓	29.0
1900	672,585	61.7	50	38.7
1	575,088	72.2	50	30.5
2	299,996	88.3	30	15.8
3	231,324	98.4	25	12.4
4	250,067	91.0	25	13.5
5	244,825	92.9	25	13.6
6	303,181	81.2	27½	17.0
7	498,468	68.2	40	27.5
8	374,019	77.5	33⅓	20.8
9	243,579	78.0	20	13.6
1910	221,326	94.3	22½	12.4
1	338,501	85.7	33⅓	18.6
2	427,007	88.4	45	24.0
3	581,998	84.2	60	32.1
4	408,014	77.0	30	22.6

(A) Profit distributed after 1894 includes £40,000 per annum as dividends on £500,000 of 8 per cent preference shares (during the period 1891-94 when the shares were in the process of being paid up smaller sums were distributed.)

(B) This compares profit earned (including interest payable) with total capital employed (the total of share capital, reserves, long-term loans, and undistributed profit.)

Source : H.W. Richardson and J.M. Bass, "The Profitability of the Consett Iron Company up to 1914", Business History (1965)

Having illuminated two of the possible explanations of Consett's high profitability, what then were the profits and dividends made and paid during the fifty years up to 1914? Table II.4 gives a summary of profits, amount distributed, dividends and the rate of return on capital employed.

From the Table it can be seen that the dividend paid to shareholders was never below 7½ per cent, and in 33 of the 51 years recorded it was 15 per cent or above. The only other industrial concern in the heavy sector, in the North-east, that could compete with Consett's performance during the particularly bleak years of the mid-1890's was the engineering firm of Armstrong, Mitchell and Company of Tyneside, who paid dividends of 10¾ per cent, 11¾ per cent and 16⅞ per cent in 1894 - 95 - 96 respectively. For the same years Bolckow Vaughan were only able to pay 2½, 2½ and 3 per cent, and Palmers Shipbuilding and Iron Company had sunk into deep financial trouble, through over-valuation and managerial inefficiency.(33) The performance of the Consett Iron Company was even more spectacular after 1900 when the dividend never fell below 20 per cent.

The dividends were stabilised as much as possible, by the Company's policy of retaining profits during the exceptional boom years, allowing expansion and replacement to be financed by profit to a considerable degree. In depressed years almost all the profits would be distributed to keep up the dividend and so secure the price of Consett's Ordinary shares. The Board were following a policy which brought the greatest benefit to the shareholders.

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(33) Newcastle Daily Chronicle, 17 November 1893.

It would be wrong to create the impression that Consett did not suffer from exigencies of depressed trade; on the contrary, Consett was particularly susceptible to recession because of its concentration on providing for the shipbuilding industry, at least until the late 1890's. The absolute level of profits show violent fluctuations, typical of firms engaged in the heavy industrial and capital goods sectors. The profits for the year ending June 1878 were only 19.1 per cent of those for 1873-74, and those for the year ending June 1893. only 30.3 per cent of the profits for the year ending June 1890.

The impressiveness of Consett's record is in a large part due to the financial skill of the management, and also to the effect of vertical integration which enabled the firm to keep going through depression by charging coal to the ironworks at cost, and thus being able to reduce its total manufacturing costs as price fell. Table 11.5 illustrates how as trade worsened in the 1870's the proportion of gross profits accruing to finished metals (plates and pig iron) increased as the proportion attributable to coal and coke used at the works fell. By transfering the profit earning potential from the intermediate inputs to the finished product the Company were able to compete fiercely in any price cutting during depression, thus keeping their plant as fully occupied as possible. Consett's success rather dispells the oft quoted opinion that integrated firms benefit during the booms from cheap raw materials but suffer during recessions, as they are not able to speculate.(34) This theory of speculative buying is also inappropriate to the market for coal and coke, since both these materials deteriorate quite rapidly when stocked.

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(34) H.W. Richardson and J.M. Bass, op.cit.,p.81.

TABLE II.5

THE CONTRIBUTION TO PROFITS OF THE COMPANY'S VARIOUS EARNING FUNCTIONS, 1873-1893

Year Ending June	Finished Iron & Steel Products	Pig Iron	Coal & Coke Sold	Coal & Coke used at Works	House Rent Royalties Share Transfers &c.
1873	49.22%	8.07%	4.33%	35.96%	2.39%
74	71.27	3.34	23.05	- *	2.32
75	65.61	3.04	26.78	- *	4.54
76	31.14	2.73	21.0	27.8	11.13
77	38.39	11.90	24.1 **	14.6	11.03
78	36.71	15.55	24.4	7.9	15.40
79	50.59	8.74	21.2	4.1 ±	15.35
1880	36.12	32.23	21.83	*	9.10
81	54.06	24.13	16.54		5.25
82	52.33	25.54	16.29		5.82
83	53.59	22.52	16.86		7.00
84	52.18	21.95	15.23		10.62
85	44.42	26.35	14.15		15.05
86	57.67 +	18.40	9.21		13.54
87	64.56	15.11	10.72		9.58
88	75.71	6.45	9.14		8.68
89	86.82	2.81	5.33		5.01
1890	71.19	8.47	17.65		2.67
91	75.72	4.87	15.05 ※		4.32
92	81.44	4.41	5.73		8.33
93	77.24	0.28	12.49		11.62

* Included in Finished Iron and Steel Products, as it was not accounted separately.

** A loss of £1185 was made on the sale of coke from the new Langley Park Colliery.

± A loss of £217 sustained on coal used in the ironworks.

\+ Profits from steel exceeed those from finished iron for the first time.

※ First sales of coal from North of River Derwent.

Source : Profit and Loss Accounts, 1873 - 1893 (DCRO:D/CO/89).

From the beginning of the 1890's Consett began to diversify the range of products it offered, though it had the effect of further tying the Company to shipbuilding. An angle and sectional steel mill with additional ingot capacity began operating in 1893, and sales of coal and coke from north of the Derwent started in 1890. The addition of the angle mill, however, absorbed the extra blastfurnace capacity, and sales of pig iron became negligible after 1893. The angle mill did help to improve the marketability of steel plates, since Consett was able to provide all the steel requirements of shipbuilders. The extension of coal and coke sales was very large, and appears to have proved wise. During the depression of the 1920's Consett's Chairman, Clarence D. Smith recalled that:

> "In a composite company like ours it had frequently happened in the past that when the coal trade was depressed we were able to make substantial profits in our iron and steel departments, and, conversely, when iron and steel were depressed we were able to make up for it in our coal and coke departments."(35)

A test of the Company's dependence on the shipbuilding industry may be ascertained from the relationship in the fluctuation of profits to the fluctuation of activity in the shipbuilding industry.(36)

$$\frac{\Delta P}{P_t} = \alpha + \beta \frac{\Delta S}{S_{(t-\frac{1}{2})}} \qquad \text{or} \qquad \Delta Pt = \alpha + \beta \Delta S(t-\tfrac{1}{2})$$

where P = Profit, S = Shipping tonnage launched.

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(35) Evening Chronicle, 25 June 1925.

(36) The Statistics on tonnage of Shipping launched in the U.K. taken from:- P.P. 1889 (5862) LXXX11.1; P.P. 1899 (9182) CV.365; P.P. (4805) C.1; P.P. 1914-1916 (7636) LXXV1.1.

Allowing for a six month lag in profits behind tonnage launched produces the result:

$$\Delta P_t = 9.8481 + 0.4876\ \Delta S_{(t-\frac{1}{2})}$$

$$(0.2206)$$

$R^2 = 0.1225$ F - Value = 4.886, $F(1,35) > 4.13$ at 5%

for the period 1877-1913. Thus over the whole period fluctuations in shipbuilding activity appear to account for only 12½% of the fluctuations in the Company's profits. More surprising is the result for the sub-period 1897-1914.

$$\Delta P_t = 8.8227 + 0.5289\ \Delta S_{(t-\frac{1}{2})}$$

$$(0.2325)$$

$R^2 = 0.2564$ F - Value = 5.173, $F(1,15) > 4.54$ at 5%

This apparently indicates that fluctuations in profits became more susceptible to fluctuations in shipbuilding activity after the mid-1890's when the Company had adopted a broader base of saleable goods by manufacturing sectional steel and selling more coal.

One explanation may be that during the period more dependence rested on business from shipbuilding because the sale of pig iron had ceased, and was diverted to the manufacture of steel angles which was dependent upon the level of activity in shipbuilding. A second explanation was that during the period 1877-1897 movements in prices and costs over-rode the influence of changes in the level of activity in shipbuilding whilst between 1897-1914 the effective collusion of steel-plate manufacturers from 1904 onwards accentuated the relation between profits and output of shipping tonnage. This occured because the price of ship-plates

was held longer than under free competition, and so revenue would decline with sales to shipbuilders as opposed to the alternative where it may decline through the reduction of price, although sales were maintained.

It can be inferred from this that if the level of activity in shipbuilding was a relatively minor cause of the fluctuation in profits, then the change in price relative to that of costs must have been significant, and also that this factor does not correlate well with activity in shipbuilding. That is, in a normal competitive situation a downturn in price will probably lead the downturn in deliveries to buyers, and in reductions in costs. Therefore before there is any appreciable change in output of shipping there will be a downturn in profits. Profits will stablise then begin to rise when price stabilises and costs begin to fall. This is to some extent substantiated by allowing fluctuation in profits to lead by six months the fluctuation in ship launchings.

$$\Delta P_t = \alpha + \beta \Delta S_{(t+\frac{1}{2})}$$

For the period 1876-97 when the market was relatively free from collusive activity, the following regression is found.

$$\Delta P_t = 4.1017 + 0.916 \underset{(0.3768)}{\Delta S_{(t+\frac{1}{2})}}$$

$$R^2 = 0.2579 \quad F\text{ - Value } = 5.909,\ F(1,17) > 4.45 \text{ at } 5\%$$

The implications of these results are that the inter-play between costs and price, as much as the level of activity in the chief customers' industry, were crucial to Consett's profitability. That the

Company made respectable profits even in the worst trading years is a credit to the management's responsiveness to changing conditions within several markets. However the number of markets in which the Company had to buy and sell was minimised by the extent of vertical integration.

CHAPTER III

IRON ORE : THE SEARCH FOR SUPPLIES.

For the ironmaster the acquisition and supply of iron ore was fundamental. The original Derwent Iron Company had been located at Consett upon the expectation of rich ore deposits, but these were rapidly devoured by the large concern, and within a decade it had become apparent that the ore only occured in dispersed 'pockets' which could only be mined at a prohibitive cost. The owners of the Derwent Iron Company turned their attention elsewhere, trying ore from Northumberland and Weardale, but both of these failed to provide an economic alternative. The Derwent partners were not alone in their search for more satisfactory iron ore supplies. John Vaughan, a partner in Bolckow Vaughan, who built blastfurnaces at Witton Park in 1845, was also seeking to obtain a regular and cheap supply of ironstone. His search bore fruit in 1850 when he discovered the main seam at Eston. Vaughan's discovery opened the floodgates of exploitation of the Cleveland ironstone. In the following year the Derwent Iron Company opened out mines at Upleatham, on land leased from the Earl of Zetland.(1) However, the most important development did not take place until 1853 when Joseph Pease and J.W. Pease began opening out the mines at Hutton Lowcross near Guisborough Messrs. J.W. Pease and Company later took over the Upleatham and Skinningrove mines, and became the largest workers of ironstone in Cleveland.(2)

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(1) J.S. Jeans, Pioneers of the Cleveland Iron Trade (Middlesbrough, 1875) p.139.

(2) Ibid., p.140.

Simultaneously, across the Pennines, the West Coast hematite ores were being exploited around Whitehaven (where there were 19 mines in 1858) and Ulverstone in Furness. In the latter district the main progress was made by Messrs. Harrison, Ainslie and Co. and Messrs.Schneider, Hannay and Co. who owned eight of the twenty-three mines between them.(3) The importation of this hematite ore to Consett was not feasible on a large scale until a more direct rail connection was constructed between the Newcastle and Carlisle Railway and Consett ironworks - such a link was not opened until 1867. Cumbrian ores were used at Consett from 1856, inspite of the circuitous route. This was necessary because the high phosphoric content of the Cleveland ironstones made them unsuitable for use alone in the manufacture of iron ship-plates; they, therefore, had to be mixed with the non-phosphoric West Coast iron ore to produce a suitable pig iron for the manufacture of plates.

In 1855 Jonathan Richardson had leased ironstone and iron ore rights on Alston Moor and Carrigill from the Commissioners of Greenwich Hospital, for 28 years. The royalty rent was 5d. per ton and he was obliged to work or pay royalty on at least 2,800 tons annually. This lease was surrendered in 1864 when the ironworks were transferred to the Consett Iron Company.(4) Iron ore from this royalty was never significant in supplying ore for Consett, and was probably just another burden which Jonathan Richardson took upon himself.

Another source of iron ore which Consett explored but did not exploit, was the rich magnetic ore at Rosedale in Cleveland. In 1860 William

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(3) W. Fordyce, History of Coal and Iron (London, 1860) p.152.

(4) Agreement with the Commissioners of Greenwich Hospital for Ironstone at Alston. (DCRO:D/CO/59 (viii)).

Fordyce believed that the Derwent and Consett Iron Company were going to take 175,000 tons annually, at 6s.10d.[5] However there is no further mention or indication as to whether this contract ever materialised, and it certainly was not fulfilled.

Thus when the Consett Iron Company took the works over in 1864 the main sources of iron ore were Cleveland, Ulverstone and Whitehaven. The Company was at a grave locational disadvantage compared with its competitors on the West Coast and Tees-side, with regard to the iron ore input. However the beneficial association between the Company and Pease and Partners, through the persons of David Dale and J.W. Pease, ensured at least the continuity of ironstone supplies on favourable terms.

1. Types of Iron Ore[6]

Since iron is rarely found in nature in a pure form, because of its affinity with oxygen, it is necessary to process the ore by removing the oxygen. Iron ore itself is not homogenous, for beside oxygen it may contain traces of numerous other elements such as phosphorous, silica, sulphur, manganese etc. Nor does the ore necessarily occur as an oxide of iron; the Cleveland ironstones were carbonates of iron, and before they could be used in the blastfurnace they had to be reduced to an oxide by calcining (roasting). This process removed carbon dioxide. The Cleveland ores also contained phosphorous in a quantity sufficient to make them unsuitable for use in the manufacture of steel by the acid process (i.e. in furnaces lined with silica). In terms of iron content the Cleveland ironstones produced about 30 tons of iron per 100 tons of

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(5) W. Fordyce, op.cit., p.150.

(6) This section has been based upon information from: W. Fordyce, History of Coal and Iron, p.115; M.W. Flinn, British Overseas Investment in Iron Ore Mining 1870-1914 (M.A. Thesis, University of Manchester, 1952) pp. 57-62.

ironstone, and this was regarded as a relatively lean ore.

The Cumbrian and Ulverstone ores however were both richer and free from phosphorous, making them suitable for the manufacture of steel. The Red Hematite or specular ores used at Consett contained on average about 60% of iron.

In the 1870's Consett began to draw upon Spain for its ore requirements, and several types of non-phosphoric ores were imported. Most popular, and so most rapidly exhausted, was the red hematite or 'campanil' which contained about 50% of iron and was very easily mined. Richer in iron content (52-56%) but not as pure because of a 4-5% silicon presence was 'rubio' or brown ore; this was extensively used by Consett after 1880. Much less common, but highly valued for its high metallic content and the presence of manganese was 'vena dulce' or purple ore. Manganese was a necessary input in the manufacture of Bessemer steel, in order to remove oxygen and replace some carbon.(7) At Consett manganese was used in the production of mild steel for ship-plates. By the mid - 1890's the rubio deposits of the Bilbao district were nearing exhaustion, and the mining companies began to work out the siderite or spathic ores, which like the Cleveland ironstones were carbonates of iron. These ores had to be calcined, a process which was carried out at the mines, reducing the ores to quite a rich concentrate, which was more economical to ship.

2. The Changing Sources of Ore: Cleveland, Cumberland and Spain

The source from which an iron company drew its iron ore supply was dependent upon two factors. First and foremost it depended upon the

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(7) A. Birch, The Economic History of the British Iron and Steel Industry, 1784-1879. (London, 1967). p. 326.

use the pig iron was to be put to, the clearest example being the unsuitability of phosphoric pigs for making steel prior to 1879, but this did extend even to the use of different types of pig iron for manufacturing different finished products. In Consett's own case the Company needed hematite ores, even before it began to manufacture steel, because the unadulterated Cleveland pig iron was not suitable for producing ship-plates. The second factor was the changing relative prices of iron ores from different sources.

The first factor was crucial in the substitution of hematite iron ore for Cleveland ironstone during the 1880's when Consett turned over gradually to the production of steel. The second operated in the 1870's as the price of West Coast ore rose phenomenally due to the pressure of demand upon a limited supply. This opened the way for the exploitation of overseas deposits, by far the most important of these being in Spain.

As mineral deposits are finite, they reach the point where they became either too costly to work, or are simply exhausted. This became a potent force from the 1890's onwards as the deposits in North Spain became more difficult to mine. Consett in company with other steel producers was forced to search for alternative sources.

In the early 1870's there was a marked boom in iron prices during 1872-73, and an increasing production of steel by the Bessemer process for the manufacture of rails. The only domestic source of suitable ore was the West Coast, but although there was a substantial increase in output between 1868-1873, the rise in price suggests that there was a large excess demand.

TABLE III.1

PRODUCTION AND PRICE (PER TON)

OF WEST COAST HEMATITE IRON ORE.

Year	Output ('000 tons)	Price (f.o.t.)
1868	1694	13s.8d
1869	1832	14s.5d
1870	2093	14s.0d
1871	1969	19s.9d
1872	1767	28s.6d
1873	2156	33s.6d

Source : M.W. Flinn, British Overseas Investment in Iron Ore Mining 1870-1914 pp. 18-19.

William Jenkins had purchased some samples of Spanish ore for blastfurnace tests as early as 1870, an idea he probably brought from Dowlais, since the Welsh ironmasters had been importing Spanish ore from the early 1860's although only on a small scale.(8) At the beginning of 1871 he contracted with Henry Clapham to supply 20,000 tons of Bilbao ore at 18s.0d. per ton ex ship in the Tyne. If the ore was freighted to Consett at $\frac{7}{8}$d per ton mile then the cost from Tyne Dock (22 miles from Consett) would have been 1s.7d. Spanish ore could thus be delivered at the Consett blastfurnace tops for between 19s.6d. - 20s.0d. per ton, which compared

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(8) M.W. Flinn, op.cit.,p.74.

favourably with the price of West Coast Red ore, which cost about 20s.6d. per ton at Consett even in 1869.(9)

The Spanish ore proved satisfactory, for the Board instructed Jenkins to make further enquiries about the feasibility of importing Spanish ore on a permanent basis. The rapid increase in the price of West Coast ore during 1871 added urgency to Jenkins' enquiries. Between December 1869 and September 1871 the price of Hodbarrow hematite in trucks at the mines rose from 13s.0d per ton to 27s.0d.(10)

The rush to secure Spanish supplies caused a bottleneck in the inadequate shipping facilities at Bilbao. Consett attempted to ease its difficulties partially by chartering a steamer at 22s.0d. per ton gross register, to transport ore between Spain and the north east coast. It also sent two of its agents, Messrs. Greenwell and Dick to Spain to make a survey of the extent of the ore resources in both the north and south. Whilst in Spain they made orders for 5,000 tons of ore from Garrucha in the South (8s.0d per ton f.o.b.) and also for 10,000 tons from Messrs. Ybarra, and 20,000 tons from Sgnr. Chavarri (6s.0d per ton f.o.b.), to be shipped from Bilbao, It was also their opinion that Bilbao was the most feasible source of supply since the ore was cheaply worked, close to the coast and the port was one of the nearest shipping points to Great Britain.(11) On the basis of Greenwell and Dick's Report the Consett Board resolved to approach the Directors of Bolckow Vaughan with a view

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(9) Directors' Minute, 3 April 1869. (DCRO:D/CO/29).

(10) Directors' Minute, 4 December 1869. p.44.; Directors' Minute, 2 September 1871 p.128. (DCRO:D/CO/30).

(11) Directors' Minute, 22 July 1871. pp.121-122. (DCRO: Ibid.).

of undertaking a joint project for acquiring and working mines in Spain.(12) Though nothing came of the Bolckow Vaughan scheme, Consett's intent was clear. The next proposed project was less soundly based. The Company contemplated a long term contract with a shipping firm, Holloway Brothers, for the supply of 25,000 tons of ore in 1872, and 50,000 tons annually for six years thereafter. On the completion of the first year's deliveries, Consett was to pay £50,000 (for the second year's supply @ 20s.0d. per ton in trucks at Sunderland or the Tyne) and this sum would be used by Holloway's for the purchase of purpose built ore carrying vessels.(13) The main drawbacks in this scheme were that there was no sound guarantee of the ore being delivered, and that Holloways would be dependent upon docking facilities at Bilbao, over which they or Consett could have little control. In one respect Consett's proposed involvement with Holloway's was not dissimilar from the Marbella Iron Ore Company's unfortunate association with the shipping firm of Malcolm's,(14) for both shippers went bankrupt. Fortunately Holloway's bankruptcy occurred before Consett had entered into any contracts.

However, just as it became apparent that Holloway's were unlikely to be able to fulfill any commitments, Consett was approached by the Welsh iron company of Dowlais to enter a partnership with them and a

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(12) Ibid., p.122.

(13) Directors' Minute, 28 October 1871. p.123. (DCRO: Ibid).

(14) M.W. Flinn, op.cit.,p.111.

Spanish interest, Messrs. Ybarra. The proposal was to work the mining concession of the Ybarras' near Bilbao, and to build a railway to the river below Bilbao, and there erect the partnership's own shipping facilities.(15) William Jenkins' past connection with Dowlais was probably an important factor in bringing Consett and Dowlais together in this partnership. As for Messrs. Ybarra, they not only owned iron ore concessions, but were also the proprietors of the most important ironworks in Spain, and so a portion of the mines' output would be destined for their own works. Shortly after, Ybarras' decided to admit Krupp of Essen to the partnership, thus splitting the capital four ways.

The mines belonging to Don Juan Maria de Ybarra, Don Gabriel Maria de Ybarra and Don Cosme de Zabiria were leased to the Orconera Iron Ore Company Ltd. for 99 years from 1st July 1872.(16) The Orconera Iron Ore Company had a nominal capital of £200,000 in twenty £10,000 shares divided equally between the partners. Consett, however, ran into some legal difficulties arising out of its own Articles of Association which did not cover investment in overseas operations. For this reason a holding company was floated, the Consett Spanish Ore Company, Ltd. for the purpose of holding shares in the Orconera Company. The capital of this new holding concern was £55,200 in fully paid £1. shares, and these were offered to the shareholders of the Consett Iron Company. At the first General Meeting the Directors of the Consett Spanish Ore Company

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(15) Directors' Minute, 9 April 1872. p.169 (DCRO: Ibid.).

(16) An Agreement between the Orconera Iron Ore Company Ltd., and the Consett Iron Company Ltd, 15 August 1873, (DCRO:D/CO/59 (xiv)).

underlined the relationship between their Company and the Iron Company:

"It must at the same time not be forgotten that the Shareholders of this Company, so far as they remain identical with those of the Consett Iron Company will it is hoped derive the important collateral advantages which really led to the Establishment of this Company." (17)

In this respect, the Spanish Ore Company was not directly controlled by Consett, and theoretically could have passed out of Consett's control through dealings in its shares. In reality, however, the Directors of the Spanish Ore Company were always Directors of Consett, in effect making it a subsidiary concern.

The partners in the Orconera Company were to be allotted ore at cost plus 1s.7d. profit; Krupp and Dowlais were to take up to 200,000 tons each annually, Consett and Altos Hornos (Ybarras') 100,000 tons each. Any ore produced in excess of the 'original contract' could be purchased at the going market price. As M.W. Flinn points out the contract terms gave the participants a very real cost advantage in producing pig iron from hematite.(18)

Though the Orconera Iron Ore Company was registered in July 1873, it began to export ore only in 1876 because of the interference of the Carlist War (1872-76) in Spain, and delays connected with the construction of haulage and shipping facilities. During this interim period, Consett took its ore requirements from Ybarras' at 17s.6d. per ton delivered in

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(17) Consett Spanish Ore Company Ltd.: Minutes of the General Meetings, 6 September 1873. pp.4-5.(DCRO:D/CO/179).

(18) M.W. Flinn, op.cit., p.124.

the Tyne or Wear. This was a remarkably low price in 1873; and was probably the result of the ore being shipped in two steamers belonging to Thomas Morton, a Director of the Iron Company.(19) Between 1873-1879 Spain replaced the West Coast as the source of hematite ores used by Consett.

TABLE III 2.

PRICE AND QUANTITY OF HEMATITE IRON ORE BOUGHT BY THE CONSETT IRON COMPANY, HALF YEARLY BETWEEN 1873 - 1879

Six Months Ending	Spanish Ore		Cumberland Ore	
	Quantity	Price per ton	Quantity	Price per ton
June 1872	7,589	25s. 0d	14,161	27s. 5d
Dec. 1872	10,039	27s. 7d	17,270	29s.10d
June 1873	10,749	29s. 6d	12,598	30s. 3d
Dec. 1873	16,439	30s. 9d	8,379	31s. 4d
June 1874	20,007	29s. 6d	5,617	34s.10d
Dec. 1874	22,188	21s. 8d	9,627	25s. 6d
June 1875	15,380	24s. 9d	9,194	26s. 0d
Dec. 1875	10,884	22s. 1d	10,115	24s. 5d
June 1876	12,973	24s. 4d	8,937	25s. 0d
Dec. 1876	17,538	22s. 5d	135	22s. 0d
June 1877	19,221	21s. 0d	642	20s. 0d
Dec. 1877	29,492	21s. 7d	143	22s. 0d
June 1878	17,738	20s.11d	782	20s. 0d
Dec. 1878	22,847	18s. 9d	383	18s.11d

Source: Private Cost Book, 1868-1905. (DCRO: D/CO/97).

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(19) Directors' Minute, 3 December 1872, pp.207-208.(DCRO:D/CO/30).

The opening of the Orconera's railway in 1877, and the increased output from the mines ended Consett's trade with the West Coast, even though they were by then able to compete more evenly in price. However, the future ore supply lay in Spain, for a guaranteed flow of ore was imperative. The shipments of ore by the Orconera in 1877 produced the profits out of which the Consett Spanish Ore Company began to pay its dividends; this pseudo-subsidiary of Consett was to have even more startling financial results than the parent Company.

TABLE III 3

ANNUAL DIVIDEND PAID BY THE CONSETT SPANISH ORE CO., LTD.

Year	Dividend	Year	Dividend	Year	Dividend
1873	- ‡	1887	40%	1901	86¼%
74	5%	88	38¾%	02	70%
75	3¾%	89	37½%	03	70%
76	2½%	1890	41¼%	04	75%
77	0	91	50%	05	67½%
78	7½%	92	47½%	06	63¾%
79	7%	93	42½%	07	67½%
1880	8¾%	94	45%	08	67½%
81	10%	95	52½%	09	50%
82	5%	96	50%	1910	50%
83	15%	97	50%	11	47½%
84	32½%	98	50%	12	62½%
85	36¼%	99	50%	13	57½%
86	42½%	1900	51¼%	14	47½%

‡ During these years there were no dividends paid by the Orconera Iron Ore Company; the Consett Spanish Ore Company's dividends were paid out of interest accruing to them on the capital which was deposited with the Consett Iron Company Ltd.

Source: The General Meeting Minutes of the Consett Spanish Ore Co. Ltd., (DCRO : D/CO/179).

The inadequacy of domestic supply had driven Consett abroad in search of a suitable source of supply. The next major alteration in the origin of iron ore was the replacement of Cleveland ironstone by Spanish ore; a change which was necessitated by the Company's decision to produce steel in 1880.

Consett drew its Cleveland ironstone from J. and J.W. Pease, through a contract that had originated with the Company's predecessors, in 1859.(20) In 1867 a revised agreement was drawn up between the two parties with Consett guaranteeing to take 50,000 tons, and Pease to supply up to 200,000 tons per annum. The ore was to be delivered into trucks at 2s.10d per ton at Upleatham,(21) and transported by the North Eastern Railway for 4s.0d per ton. By 1873 it had become evident that Peases were unable to supply Consett's ironstone requirements in full. The Company entertained two alternatives: the first was to import Northampton ore, which they did during the boom of 1872-1873, though this was uneconomic in normal conditions; the second choice was to acquire an ironstone concern in Cleveland. In September 1873 negotiations went on over the acquisition of the Liverton Iron Ore Company but by the year's end the Board had resolved that the time was not right for the purchase of further ironstone mines.(22)

On David Dale's initiative Pease and Company approached Consett to further revise the contract, in a downward direction. They were

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(20) Directors' Minute, 29 September 1866 p.106. (DCRO:D/CO/29)

(21) Agreement between the Consett Iron Company and Joseph Whitwell Pease and Gurney Pease, 1867. (DCRO:D/CO/59 (x)).

(22) Directors' Minute, 2 December 1873 p.9. (DCRO:D/CO/31).

only able to deliver 2,200 tons per week against the 3,846 tons of the 1867 Agreement. As an alternative, Consett began to buy ironstone from Messrs. Stevenson, Jacques and Company, at considerably more than it had to pay Pease and Company. In 1874 it bought 26,000 tons at 4s.9d per ton at the mines, and the following year 60,000 tons at a similar price.(23)

After 1883 the quantities of Cleveland ironstone taken by Consett dropped rapidly as Bessemer pig replaced Hematite and Cleveland pig iron, as the production of steel was quickly expanded.

TABLE III.4.

PERCENTAGE OF HEMATITE AND CLEVELAND, AND BESSEMER PIG IRON IN TOTAL OUTPUT, 1880 - 1885

Year	Hematite & Cleveland.[a]	Bessemer[b]
1880	40%	19%
1881	42%	22%
1882	42%	30%
1883	36%	36%
1884	18%	48%
1885	2%	45%

[a] Hematite and Cleveland: hematite ore and Cleveland ironstone mixed mixed in 1:3 ratio, aoproximately.

[b] Bessemer : Spanish hematite and some 'purple ore.'

Source: Private Cost Book, 1868-1905. (DCRO:D/CO/97).

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(23) Directors' Minute, 6 October, 1874, p.68; Directors' Minute, 2 February, 1875, p.90. (DCRO:D/CO/31).

Only in 1882 had Pease and Partners drawn up a new contract with Consett, by which the price of ironstone was fixed to a sliding scale of pig iron prices. Under the new agreement Messrs. Pease were to provide between 1,500 - 3,000 tons a week, from any of their mines, though the price varied from one mine to another.

However, when this expired in 1885 it was allowed to lapse for two years, and though a new contract was arranged in 1888 it was finally cancelled in 1889 on the payment of £2,750 compensation by the Consett Iron Company to Pease and Partners.(24)

This brought an end to the association between the Darlington firm and Consett which had had its origins back in the 1850's and had been considerably strengthened in 1858 when Joseph Pease appointed David Dale as an Inspector of the Derwent Iron Company's affairs. Dale was simultaneously involved with both concerns, and in 1872 resigned from active management at Consett to become Managing Director of Pease and Partners; this association probably enabled Consett to secure such a favourable contract, and eventually such a painless withdrawal.

Thus by 1890 Consett was firmly committed to Spain for its iron ore, but even by that relatively early date there had been pessimistic forecasts regarding the impending exhaustion of the ores in the Bilbao district.(25)

The Orconera Company's railway had been completed in 1877 and the staithes were able to handle 6,000 tons of ore a day by 1882. The full range of northern Spanish hematite ores were mined in the Orconera royalty,

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(24) Directors' Minute, 14 December, 1889 p.143.(DCRO:D/CO/34).

(25) M.W. Flinn, op.cit.,pp.176-177.

although the 'purple ore' only occured in small deposits and was shipped only when mixed in with other ores.(26) Consett's imports of Spanish ore reached a peak in 1883, coinciding with the trade revival in the early 1880's and the adoption of steel. However, in the following year they fell and stabilised at the lower level until 1888, when trade began to improve once again, and the Company's new steelwork extension came into operation.

The trade improvement encouraged the speculators who had acquired concessions in Spain, and had been holding them undeveloped during the depressed years. The Bilbao district was fully exploited and the centre of speculative activity moved to the southern provinces. The moment was particularly opportune for the speculators, for not only was there a sound improvement in the iron and steel industry, but there were also signs that the 'rubio' ore of the Bilbao district was rapidly nearing exhaustion, and some companies had turned to the less attractive spathic ores which required calcining. Between 1893-1914, 92% of investment in new mining companies in Spain was allocated to those operating in the south, an almost complete reversal of the 1871 - 1891 position.(27) The British steel companies looking for alternative supplies turned their attention not only to the South of Spain, but also inland, and as the 1890's drew to a close the search for other ore deposits had extended far beyond Spain.

Consett's extensions to capacity by the addition of the new Angle Mill in 1893 accentuated the Company's need to find further ore supplies. On a medium term basis Wm. Jenkins approached the San

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(27) M.W. Flinn, op.cit., p.183.

(26) Wm. Gill, "The Iron Ore District of Bilbao," Journal of the Iron and Steel Institute, I(1882), p.64.

Antonio Mining Company to ascertain whether they would be able to supply 150,000 tons per annum for ten to fifteen years.(28) However, this did not provide the certainty of supply that the steel company was looking for, and so Consett both independently and through the agency of the Orconera Company sought to acquire new mining interests, at first in Spain, but after 1900 elsewhere.

In the acquisition of property in Spain the Orconera Iron Ore Company was more successful than Consett. In 1893 the liquidators of the Parocha Iron Ore Company offered, for £175,000 the mines adjacent to Orconera containing ore resources of 3,000,000 tons of ore; however, the offer was regarded as unattractive. More important was the purchase in 1896 of Joseph McLennan's Obregon Mine, near Santander. This was bought for £100,000, and the Orconera borrowed the money in equal shares, from each of its shareholders. The mines were 9 kms. from shipping staithes at Astillero, and the ore, which had to be washed to remove the clay, was treated at Solia, about mid-way between the mines and the staithes. There were facilities to ship 2,000 tons of ore per day at Astillero, but in 1895 McLennan was handling only 65,000 tons of ore a year at Solia; however, by 1899 204,450 tons were exported from the Obregon Mine, by the Orconera Company.(29)

The Orconera Company also extended its range of operations by constructing calcining kilns in 1894; the two kilns had a daily capacity of 156 tons between them, but this was increased in 1896 by the addition of a 120 ton kiln. Whether Consett was ever a large

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(28) Directors' Minute, 13 September 1890 p.204 (DCRO:D/CO/34).

(29) M.W. Flinn, op.cit., p.129: Wm. Gill, "Iron Ore Industries of Biscay and Santander," Journal of the Iron and Steel Insitute,(1896)II.p.86.

consumer of the calcined spathic ores is difficult to ascertain. However, in 1895, tests were carried out on these ores and they were found to be usable for about 10% of each burden in the blast.(30) This suggests that Consett continued to rely mainly upon 'rubio' ores which were easier to handle and had a lower silica content.

Consett's own attempts at acquiring alternative ore supplies appear to have started in 1888 - 1889 when offers of properties in the Santander and Sevilla districts were made to Jenkins. The mines near Sevilla aroused the interest of the Company. They were offered by W_m. Thomas, and preliminary samples seemed to indicate that the ore was satisfactory. Consett, however, was not willing to act alone, and sought the co-operation of Dowlais.(31) In March 1890, Mr. Halmer was sent to Spain to inspect the Pedroso mines on behalf of Consett and Dowlais. His report could not have been favourable for neither Consett nor Dowlais participated in the Iberian Iron Ore Company, which took over Thomas's mines.(32)

Jenkins estimated that Consett required 350,000 tons of ore per annum, in addition to the Orconera contract, and on the grounds that Dowlais would require a similar amount, a joint venture seemed to him "to be the most feasible mode of proceeding."(33)

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(30) Directors' Minute, 5 February, 1895 p.53.(DCRO:D/CO/36).

(31) Wm. Jenkins to Wm. Thomas, 26 November,1889. (DCRO:D/CO/70).

(32) Wm. Jenkins to E.P. Martin, 25 June,1891, (DCRO:D/CO/76).

(33) Wm. Jenkins to D. Dale, 5 March, 1891. (DCRO:D/CO/75).

The offers in the north at Santander, Corunna and in the Bilbao district were not encouraging - in Jenkins' view there was not "much in the way of advantageous outlet for investment in Bilbao minerals," and preliminary analysis of Corunna ores was disappointing: The two companies thus concentrated their attention in the south, upon the mines at Pedroso, and also in mines at Lucainena in Almeria. The latter were offered in 1891 by Mr. H. Borner, a London merchant dealing primarily in the iron ore trade. William Gill the Orconera's General Manager, was also of the opinion that the Lucainena mines were more suited to Consett and Dowlais' requirements.(34) The negotiations between Consett and Dowlais on the one hand and Borner on the other reached a tentative agreement, by which £35,000 would be paid to Borner to relieve him of the concession, and £6,800 certain rent, and 10d per ton to the superior Lessor. An expedition to Spain reported on the ore and the facilities for shipping, and the content was unfavourable because the estimated reserves did not warrant the proposed expenditure on shipping facilities. The venture was dropped, and £4,000 compensation paid to Borner(35) for keeping the option open. However, a visit made to some mines at Pedroso on behalf of Don Jose de Ybarra proved more encouraging, and Consett and Dowlais began to show an interest in joining Messrs. Ybarra in a Pedroso scheme.(36) Tests proved the ore from Pedroso to be rich and pure, and although it would cost Consett 4d to 1s0d per ton more than Bilbao ore because of the extra distance, it was about 14% richer in iron content. Ybarras were

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(34) Wm. Jenkins to D.Dale, 8 August 1891. (DCRO:D/CO/77).

(35) Directors' Minute, 1 September 1891. pp. 270-271.(DCRO:D/CO/34).

(36) Directors' Minute, 3 November 1891. pp.4-5. (DCRO:D/CO/35.).

authorised by the two British firms to bid up to 2,500,000 pesetas for the mines, which would then be vested in an English limited company much the same as the Orconera Company. The capital was to be taken out in the following proportions:-

Messrs Ybarra	$\frac{3}{12}$
Dowlais	$\frac{4}{12}$
Consett	$\frac{5}{12}$

The scheme did not reach maturity because the Trustees of the Pedroso estate asked a much higher price than the three partners were prepared to pay.(37) The Pedroso mines were eventually opened out in 1895 by Bairds of Glasgow, and were successfully worked.(38) After this Consett was involved in a number of other fruitless negotiations, particularly for mines at Cerain in Guipuzcoa during 1892-93, and then later in protracted negotiations for the Cala mines in Huelva in 1898, but all its enquiries came to nothing.

Between 1888-1914 no fewer than 258 mining properties in Spain were offered by speculators anxious to make quick profits on unproven ore reserves, but Wm. Jenkins and George Ainsworth, his successor, were too astute to be caught by such unscrupulous operators. One such devious dealer appears to have been a Mr. Vittoria, but Jenkins was forewarned of his activities by Wm. Gill:

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(37) Directors Minute, 1 December, 1891. pp.11-15 (DCRO: Ibid).

(38) M.W. Flinn, op.cit. p.185.

"I am thinking that there is at the root of this that not very acceptable man Vittoria, of whom Mr. Gill has given us such a graphic account, and there is the usual extreme declaration as to the 30,000,000 tons which are alleged to be in the mines. It requires a good deal of patience to listen to these high flying accounts from time to time."(39)

Consett's failure to find a suitable alternative source of supply to the Orconera Company, was probably due to the high standards they set themselves. The Orconera venture had been an unqualified success but the experience gained therein was not a suitable frame of reference for ore exploration and acquisition after 1890, for the competition for good properties was fiercer. The case of the Pedroso mines probably highlights this more than any other; the price the Consett-Dowlais-Ybarra consortium was prepared to pay appears to have been ill-conceived, since the Scottish firm, Bairds were able to exploit the royalty profitably.

3. The search for further foreign ore sources 1900-1914

As the opportunities for further exploitation in Spain dwindled in the closing years of the 1890's, Consett began to look elsewhere for its future iron supplies. Though there were still mines to be bought in the Iberian Peninsula, the chance of getting a bargain had vanished in the speculative booms of the 1870's and 1890's. In an effort to emulate the success of the Orconera venture Consett turned its attention to other undeveloped areas where the risks might be higher, but so too would the returns. Unfortunately the ventures which Consett opted to enter into illustrated only too well

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(39) Wm. Jenkin's to D. Dale, 26 September, 1892. (DCRO:D/CO/82).

the risk and frustration encountered in mineral prospecting and exploitation.

The two areas in which Consett directed its energies were Algeria and Norway. The former had been a source of limited ore imports from as early as the 1870's, mainly because the ore was rich and could be imported cheaply, to South Wales especially, as a return cargo for the coal exporters.(40) However, despite this the ore fields were still undeveloped.

Consett's interest in Algeria was aroused in 1901 when Mr. E. Carbonel, of Paris, approached the Company with a report on the ore reserves of the Ouenza district. A syndicate originally made up of Consett, Guest, Keen and Co. (formerly Dowlais) and Krupp of Essen formed the Societe d'Études (authorised capital 300,000 frs.) to investigate the reserves and the feasibility of working them. The fact that it was purely an exploratory concern explains the modest capitalisation.(41) Having visited the mines and the port of Bône and substantiated the claims of Mr. Carbonel, the partners in the investigation syndicate resolved to take up the option granted by the Government of Algeria, and develop the area.(42)

Even at this stage difficulty was encountered in gaining the necessary concessions, but by September 1905 Mr. Carbonel felt that all had been overcome, all that remained being the passage of the

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(40) M.W. Flinn, op.cit. p.209.

(41) Ibid; Directors' Minute, 5 May 1903. p.169 (DCRO:D/CO/39).

(42) Directors' Minute, 3 November 1903 p.200. (DCRO: loc.cit.

Act by the French Chamber. Plans were made for the provision of capital to float two companies, one to work the ore, the other to operate the railway and harbour facilities. There were nine companies now involved as prospective partners in the scheme from Britain, France, Germany and Belgium.(43)

However, Carbonel's optimism was ill-founded. The approval of the French legislature did not prove to be the foregone conclusion he had anticipated. The problem revolved around the precise authority to make the concessions; the Chamber of Deputies could not, or would not pass a Bill granting concessions for open cast mining at Ouenza, for the Ouenza-Bône railway or for a site for facilities in the port of Bône. They asserted that the first and last concessions must be approved by a decree of the President after approbation by the Council of State. However, the Council of State decided on the contrary that the concession of a site in Bône could not merely be approved by decree but required to be enacted by the legislature. Furthermore the Council of State demanded an enquiry into the advisability of foreigners participating in the exploitation of the ores at Ouenza. These problems seemed to have been surmounted by the energies of Monsieur Jonnart, the Governor General of Algeria, who had formulated and acceptable programme to grant the concessions, when a characteristic Ministerial crisis upset the apple-cart.(44)

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(43) Directors' Minute, 5 September 1905 pp.84-85. (DCRO: loc.cit.)

(44) "A Report by Monsieur Carbonel," Directors' Minute, 6 November 1906, pp.190-191.(DCRO:D/CO/40).

Although not explicitly stated, some of the trouble was probably caused by another interest, the Societe Concessionaire des Mines de L'Ouenza, which was controlled by the Dutch mineral merchants, W.H. Muller. From Carbonel's statement in 1906, it is clear that the Societe d'Etudes was only seeking an open-cast mining concession, as the deep mining concession was held by Muller's. Also later evidence suggests that the greater part of the ore would be extracted by open-cast methods.(45) The clash of interests between the Societe d'Études and Muller's probably provided the opposition lobby of the French legislature with a rallying point. The situation was aggravated by the volatile and transient nature of French Governments during this period.

In an effort to placate the nationalists opposing the scheme, the capital of the Union Siderurgique (the consortium of iron and steel companies) was increased from 4,000,000 to 4,600,000 frs; the 6,000 new shares were to be offered principally to French subscribers. Three new Directors were to be appointed, all French, and 10% or up to 120,000 tons of the concerns output was to be sold to unassociated French works.(46)

However, the Societe d'Études' claim was not as strong as they had at first thought, and Muller's became a very serious threat.(47) The wrangle continued through 1907 and into 1908, before the two factions finally reached an agreement. The outcome was that the Union Siderurgique was to be enlarged from an authorised capital of 4,000,000

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(45) Directors' Minute, 7 April, 1908, pp.83-86. (DCRO:D/CO/41).
(46) Directors' Minute, 8 January, 1907, p.215. (DCRO:D/CO/40).
(47) Directors' Minute, 9 April, 1907, p.239. (DCRO:D/CO/40).

to 5,000,000 frs., with Muller's taking a 30% holding. In return Muller's were to hand over their lease to the Ouenza syndicate, free of royalty and all other payments; this would then run concurrently with the syndicate's own lease on the Minières d'Ouenza.(48) The President of the Republic then signed the decree granting the lease of the Minières d'Ouenza to the Societé d'Études, but the Act for the railway concession was deferred.

The matter continued on until 1912 when a new Ministry was formed containing Messrs. Briand and Millerand, both favourable to the Ouenza scheme in the past. Once more, Carbonel grew optimistic and he declared, "no Ministry has ever had more power on Parliament to bring the Ouenza affair to a finish, either by a vote on the Bill already deposited.....or by a modification of the Algerian legislature."(49)

The Briand Ministry neither solved the problem, nor lasted long; by Spring 1913 it had fallen from power. The situation for the Societé d'Études was now critical, for it was threatened with the termination of its concession unless it began to mine the ore. This was impossible as the Bill to construct the railway was opposed both by the Bône-Guelma Railway Company and the legislature. Muller's were also actively trying to disrupt the Societé d'Études' concession, and when it was finally revoked, it was Muller's who dominated a new limited company formed to work the concession. Although Consett was

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(48) "A letter of agreement between the Societe d'Etudes de L'Ouenza and the Muller syndicate, sent to the Reporter of the Conseil d'Etat," 6 March 1908 in Directors' Minute 7 April, 1908 pp.83-86. (DCRO:D/CO/41).

(49) Directors' Minute, 5 March, 1912 p.216.(DCRO: D/CO/42).

were granted the option to subscribe to the new company, it declined since there were to be no preferential ore contracts.

The New Societé de L'Ouenza paid indemnity to the Societé d'Études for the forfeiture of the concession, and out of this 26,000 frs. was repaid to Consett, corresponding to its advances and share capital. Therefore although the Company suffered no financial loss, the loss of the concession was very costly, in the foregone benefits it would have bestowed. In a mood of frustration and indignation George Ainsworth wrote to the Foreign Secretary, Sir Edward Grey, in 1914 attempting to solicit his aid. The opinions expressed in this letter deserve citation in full:

> ....."The plan we have always worked on is to secure ourselves a certain proportion of the ore produced by any mine in which we have an interest at a figure below the market price. In the case of the Ouenza, the arrangement was that we should receive 120,000 tons of ore per annum at 1 franc per ton f.o.b. above the cost price, and this it was estimated would be about 5 francs per ton below the average price. Since 1901 the value of Hematite has been enhanced. You will therefore see what a serious thing it is for the Consett Iron Company to be deprived of this.
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> "We think that the French Government, in view of the fact that we are prepared to and in fact did take up this scheme years ago before the value of these deposits was fully recognised, should see that our share of the ore is reserved for us on favourable terms. It has not been our fault that the Railway

has not been built. The Government of Algeria reported very much in our favour, and the Commission appointed by the French Governments also reported to the same effect - the delay has been caused by the French Parliament itself."(50)

At the prices prevailing in 1913 the Consett Board estimated that the loss of preference would cost them £25,000 per annum on 100,000 tons of iron ore from Algeria.(51) This case amply illustrated the vulnerability of overseas investment, especially in an atmosphere of international tension. A major French objection to the scheme had been the participation of German armament firms, notably Krupp. The French, for their part, particularly the Barti-Socialists had been more alert to the removal of natural wealth from France. As economic nationalism and armaments were growing in Europe, Consett was a sufferer.

If the Algerian venture illustrated the vulnerability of overseas investment to nationalism, then the Norwegian enterprise revealed some of the technological pitfalls inherent in mineral exploitation. Scandinavia had long been an area of ore prospecting and exploitation on an international scale, especially since the early 1870's. Activity, however, had been concentrated in Sweden, and though British capital was important at the outset, the Swedish ores proved disappointing to British steel producers because of their phosphoric content. As British interest and capital declined in Sweden around 1890, attention switched to Norway where there were more deposits of non-phosphoric

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(50) "Geo. Ainsworth to Sir Edward Grey, Bart," Directors' Minute, 16 January, 1914. p.112. (DCRO:D/CO/43).

(51) Directors' Minute, 4 November 1913 p.92. (DCRO: loc.cit.)

ores. In 1890 the Norwegian Geological Survey published a report on the iron ore deposits in the Dunderland Valley 200 miles north of Trondheim.

Consett had shown interest in Norway from about 1893 onwards, and in 1898 Professor Louis, the Company's geological adviser and Professor at the University of Durham, had visited some mines in Axendal.

In 1900 a group of British businessmen had acquired the European licence for the American 'beneficiation' process. Invented by Edison, the process involved the crushing of the ore, and the separation of the metallic content by magnetism. The ores in the Dunderland Valley were not rich, and required some form of concentrating to make exportation feasible, and so the associates of the Edison Ore Milling Syndicate, Ltd. "suggested that persons or Companies interested in Pig Iron or Steel production should take a pecuniary interest either in the Syndicate properties as a whole or in an independent Company acquiring from the Syndicate the Dunderland property and the right to use the Edison patents in connection therewith."(52)

Consett was interested, and on a visit to the U.S.A. in 1901, George Ainsworth arranged for some Dunderland ore samples to be treated by the Edison process. As a result of the tests Ainsworth was satisfied that the process could be fruitfully applied at the Norwegian mines.(53) In January 1902 the Consett Directors agreed

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(52) Directors' Minute, 5 March, 1901. pp.13-14.(DCRO:D/CO/39).

to subscribe £50,000 to the capital of the Dunderland Iron Ore Company, which was to buy the Norwegian interests and patent rights vested in the Edison Syndicate. As was customary Consett was to be entitled to a share of the production at preferential rates.

The total share capital of the Dunderland Company was £2.million, half of which was used in buying out the Edison interest, the rest for the costly construction of railway, harbour, process and bricquetting plant, power station and a township.(54) It was planned that the capacity of the plant would be 750,000 tons of ore bricquettes annually, and that production would begin in 1905. However, by 1907 only 35,735 tons had been exported, even though the Company had 600 men employed.(55) The problem was that the Edison process was unable to cope with the dust and low magnetism of the Dunderland ore, and in an effort to avert total loss the process was abandoned and replaced by the Ullrich wet separator.(56)

On top of the technological difficulties the Company ran into financial difficulties, because of its large Debenture issues between 1904-1907. The Ullrich process offered some hope of salvation since Krupp agreed to invest a further £400,000 if the bricquettes produced were suitable for use at Essen. They were not, and the withdrawal of German support led first to financial reorganisation, by which the capital was reduced to £450,000 and eventually to

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(54) M.W. Flinn, op.cit., p.249.

(55) Consular Report, No. 3997, Norway 1907.

(56) P. Nicou, "Etudes sur les Minerais de Fer Scandinaves," Annales des Mines. 10th Ser., XIX (1911), p.321.

liquidation. Although the New Dunderland Iron Ore Company took over the capital of the old firm, Consett withdrew its support; George Ainsworth declined an offer to serve on the new Board. The failure of the Norwegian scheme and the frustration in Algeria illustrate only too vividly the high risk nature of mineral development, and they stand in contrast to the rich returns of the Orconera Iron Ore Company.

Despite the attempts to break away from Spanish dependency, Consett was still in 1914 importing most of its ore from Spanish mines. However, in 1910 it had reached an agreement with the Rouina Iron Ore Company in Algeria to supply, over several years, 400,000 tons of ore from Braira; to facilitate this deal Consett advanced £40,000 against a mortgage on the mines. This sum was to be repaid to Consett by a reduction of 2s.3d per ton, on 360,000 tons of ore. Later in the same year Consett negotiated a sliding scale contract with the merchants, W.H. Muller and Co. for 150/200,000 tons of Zacar Iron Ore at 19s0d per ton ex ship at Tyne Dock or South Dock, Sunderland. The sliding scale was to be governed by iron content, silica content and the price of East Coast Hematite pig. A similar type of contract was offered by the Sydvaranger interests, with a loan similar to that to the Rounia Company part of the scheme. However, the Consett Iron Company was not sufficiently satisfied with the prospects at Sydvaranger at the Northern tip of Norway. This was possibly the most serious miscalculation on the part of Consett, for Sydvaranger was the most important ore deposit in Norway, and fell largely under the control of Krupp.

The last date for which there are records of Consett's ore demands from Orconera was 1909. The Company took 100,000 tons on contract, and 108,333 outside the contract, mainly from the Obregon mine. The balance came from the San Salvador Iron Ore Co. in which Consett was a Debenture holder, and also had a representative on the Board. Further ore was supplied by the Tafna Iron Ore Co. and the Mines Parocha. Thus until 1910 the hold of Spain remained unbroken.

In 1910, however, the Consett Iron Company's interests in possible ore deposits actively extended beyond Europe. Some capital was subscribed to an exploration syndicate investigating the Itabira region in Brazil, and then in 1912 another £2,000 was subscribed to the Glasgow based Olga Exploration Company, Ltd. By 1914 Consett had received offers of ore deposits from every corner of the globe, Canada, Brazil, South Africa and even Australia, but in such cases the distances acted as an effective barrier.

4. The Cost of Iron Ore

The main components in the price of ore at Consett were mining costs and freight. Since the beginning of the 1850's, when the firm had to start importing ironstone from Cleveland freight charges had been a major consideration, and the subject of continuous negotiations between Consett and the railway companies.

From the outset the Company sought to reduce the rates charged by the North Eastern Railway. The cost of transporting ore over 56 miles from Cleveland to the blastfurnaces at Consett was 4s0d per ton. The rate from Ulverston at the beginning of the 1870's was 8s.6d per ton for a 117 mile journey. The North Eastern Railway was notorious for the high rates it charged, and this led to resentment

amongst both ironmasters and coal-owners - who even threatened to build an alternative line in North Yorkshire and South Durham.

In 1877 Wm. Jenkins complained that the rates for conveying ore from Cumberland and Lancashire to the North-East were the same as those to South Wales. The policy of the Railway Company was both prejudicing the ironmasters and restricting traffic.(57) Despite its representations, the Consett Iron Company was no more able, than the body of Tees-side ironmasters, to modify the freight policy of the N.E.R. . Small token concessions were made in 1876 and 1878-79 during the sharp depressions in iron-making, but they were only of a temporary nature. The high cost of carrying West Coast Hematite ores to Consett probably accounted for the rapid decline of this trade in the second half of the 1870's.

There were, of course, more fundamental causes for the shifting source of ore supply than the cost of ore freights, but there are enough indications to support the views of Burn and Flinn that the cost of freighting ore to British ironworks was sufficient to create a competitive disadvantage for British ironmakers. This was firmly borne out by Consett's unhappy experiences in importing Spanish ore through Tyne Dock, in particular, but also through other north-east docks.

As Spanish ore imports began to reach their peak at the end of the 1880's, and the trade boom at the turn of the decade stretched resources, the inadequacy of ore importing facilities on the Tyne

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(57) "Steel Report by Messrs. Wm. Jenkins and Edw. Williams," Directors' Minute, 6 March, 1877. p.12.(DCRO:D/CO/32).

became apparent. In 1891 Jenkins complained of the position to David Dale:

"I must, later on, explain to you my fears as regards the capacity of the North Eastern Railway Co. to deal with large quantities of ore coming in. Not only are the docks at both places [Tyne and Sunderland] unequal to their work without causing considerable irratation with the steamer owners - and inevitably certain will accrue in the matter of scant dock accomodation, but in addition to this there is repeated admission on the part of the North Eastern Railway Co. that they have not sufficient trucks to keep this ore traffic going. In time to come this will certainly be aggravated."(58)

The Tyne Dock had never been constructed to cope with such an inflow, for by 1890 approximately 300,000 tons of ore were imported annually. It was anticipated that this would rise to 450,000 tons when the new Angle Mill was completed at Consett.(59) However, the North Eastern Railway were still unwilling to make rail freight concessions to Consett, and switch some of the traffic to the Albert Edward Dock on the north bank of the Tyne.

In view of the growing difficulties, Consett began to explore other possibilities, and decided to expand its recently acquired shipping facilities at Derwenthaugh. An extensive scheme for exporting coal and finished metal, and importing ore was expected to save £39,375

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(58) Wm.Jenkins to D. Dale, 26 December 1891. (DCRO:D/CO/79). My brackets. David Dale was in addition to being Chairman of Consett a Director of the North Eastern Railway.

(59) "Report on the Derwenthaugh Shipping Places," Directors' Minute, 25 February 1890. pp.165-166. (DCRO:D/CO/34).

annually, and the Company computed a saving of 1s.0d per ton on imported ore.

TABLE III.5.

ESTIMATED SAVING ON IMPORTED IRON ORE.

(1) Ore imported via Tyne Dock and the Lanchester Valley Branch.

(a)	Cost of discharging ore (N.E.R.'s charge).....	0s.7½d per ton
(b)	Railway Rates, Tyne Dock to Consett	2s. 1d per ton
(c)	Railway Co's. wharfage charge.....	0s. 4d per ton
(d)	Charge for vessels clearing at Tyne Dock.....	0s. 2d per ton
	Total Cost	3s.2½d per ton

(2) Ore imported via Derwenthaugh and the Blaydon - Consett Branch

(a)	Cost of discharging ore.....	0s. 6d per ton
(b)	Railway rate on the new route	1s. 6d per ton
(c)	Newcastle Swing Bridge Dues.....	0s.2½d per ton
	Total Cost	2s2½d per ton

Estimated Saving per ton (1) - (2)

3s.2½d - 2s.2½d = 1s.0d. per ton.

Source : "Report on the Derwenthaugh Shipping Places," Directors' Minute, 25 February 1890 pp.172-173. (DCRO:D/CO/34).

The scheme could not be undertaken immediately because the Company had to buy some more land at Derwenthaugh, but the project was agreed in principle. The Company was convinced that a great economy could be made by handling its own ore imports as was done by Linthorpe and Jarrow.

However, despite its conviction about the wisdom of such a scheme, it never came to fruitation. The staithes remained in use solely for exporting the output of Chopwell, Garesfield and Whittonstall Collieries. The size of these exports grew very rapidly after the opening of Chopwell in 1897. In 1908, 71,000 tons of coal and coke were exported during July alone, and in 1910 permission was granted by the Tyne Improvement Commission for a further extension of coal shipping facilities.(60) The expansion of the coal exporting facilities left no room for the implementation of the rest of the scheme. In 1914 Consett's ore was still being shipped in via Tyne Dock or South Dock.

The reluctance of the Railway Company to improve their dock facilities, probably had repercussions upon the willingness of ship-owners to invest in specialist ore carriers. If the docks were unable to unload quickly then the vessels would be of little advantage.

In Spain, on the other hand, the facilities built by the Orconera Company were very good. By 1882 6000 tons of ore could be loaded in a twelve hour day, and between 1881-1895 the size of ore carriers

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(60) Proceedings of the Tyne Improvement Commissioners, 1909-1910 (Newcastle, 1910) pp.813-814.

which could be accomodated at the staithes, rose from 1,690 tons to 5,380 tons.(61) However, although cargoes of over 5,000 tons could be despatched from Bilbao in the 1890's, Tyne Dock was unable in 1890 to take cargoes as large as 3,200 tons because the water was too shallow.(62) Despite the vagaries of trade and the increasing inconvenience of Tyne Dock, Consett was lucky, as were all Spanish ore importers, in that the cost of mining ore remained stable between 1882-1896.(63) This worked in Consett's favour especially with the preferential contract, as the price was governed by a mark-up on cost, and not by an rebate on the market price.

From the outset the provision of adequate iron ore reserves was a high priority, not only on a short-term working basis, but also over the long-term. This was necessary so that investment decisions could be made, with a high degree of certainty that the Company's ore supplies would remain economical, or that there was a readily available alternative.

The Consett Iron Company never gave serious consideration to the East Midlands ores before 1914. This was primarily because they were phosphoric, but also because they were too lean to be economically transported to Consett, whilst the strong local influence in the Company's ownership made a relocation of operations outside the region unthinkable.

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(61) Wm. Gill, "Iron Ore District of Bilbao," Journal of the Iron & Steel Institute, 1882.I. p.85; M.W. Flinn, op.cit., p.142.

(62) Wm. Jenkins to J.H. Hicks (N.E.R's representative at Tyne Dock), 9 October, 1890. (DCRO:D/CO/74).

(63) Wm. Gill, "Iron Ore Industries of Biscay and Santander," Journal of the Iron & Steel Institute, 1896. II. p.43.

The solid association between Consett and the Peases was followed by the brilliant participation in the Orconera venture. However, the failure after 1900 to find another major new source of ore left Consett in an uncertain, although not a critical position at the outbreak of the Great War. The dilemma the Company faced was crystallised in the protestations to Sir Edward Grey:

> "We shall be much obliged if you can see your way to give us some assistance in Paris in the matter of the deposits of Hematite Iron Ore situated at Ouenza in Algeria.....
> ".....We fear that the situation is now getting beyond our control and that unless some pressure can be brought to bear in the most influential quarters in Paris, this valuable deposit will be lost to the British Steel Trade.....
> ".....We mention this (details of Orconera, Dunderland and Braira ventures) to show what efforts have been necessary in the past to keep ourselves supplied with ore, and what a serious thing it will be to be deprived of our share of these deposits at Ouenza."(64)

Although Consett was not the only firm which failed to recreate the Spanish bonanza in other ore fields, the catalogue or failures after 1900 was an indicator that some of the drive had left the Company. Carbonel the representative of the Societe d'Etudes, does not seem to have been adequate to the difficult diplomatic task he had at hand. Nor does the Company seem to have been very effective itself as a

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(64) "A letter from Geo. Ainsworth to Sir Edward Grey, Bart." Directors' Minute, 16 January 1914 p.112 (DCRO:D/CO/43.)

lobbyists. In the Norwegian venture the tests carried out in the United States on Dunderland ores were surely insufficient when such a large investment was to be made to acquire the European licence for the Edison process. These were the tell-tales of declining dynamism in the Company.

CHAPTER IV

COAL-MINING AND COKE MANUFACTURE : THE BASIS OF CONSETT'S STRENGTH

From a very early date Consett operated as an integrated concern with substantial interests in coal-winning and coke production. The change of ownership and reorganisation of the ironworks during the period 1857-1864 led to an even more active pursuit of the opportunities which were presented by the coal-trade. Throughout the period 1864-1914 coal production grew substantially, putting Consett amongst the largest producers in the North east. The growth was not attributable to the increasing demands of the ironworks but to the diversification in the sales policy, which established Consett as a considerable force in the markets for the sale of coke and coal. Like many other aspects of the Company's development this trend reflects the influence of both David Dale and William Jenkins. Dale, as well as being a Director, and later Chairman of Consett, was also the Managing Director of Pease and Partners' collieries, and was thus intimately connected with the coal-trade. William Jenkins, prior to his appointment at Consett, had been employed at Dowlais, and this other great iron-making concern had seized the opportunity to enter the steam coal-trade in the 1860's.(1) This probably had some effect in convincing Jenkins of the wisdom of such diversification.

In this chapter the growth of the Company's production of coal and coke and the techniques employed by Consett in marketing its coal products will be examined. The expansion of output could not be achieved without an increase in the coal tracts held by the Consett Iron Company. The acquisition of royalties served a dual purpose; firstly it was necessary to facilitate the

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(1) J.H. Morris and L.J. Williams, The South Wales Coal Industry, 1841-1875 (Cardiff, 1958) pp. 88-89.

increase in output; and second for a successful sales drive the company needed to acquire coal tracts closer to the market. It will be shown that in its negotiations for the coal tracts in the proximity of the ironworks it enjoyed the position of a monopsonist. In their efforts to increase its coal royalties in the direction of the market, the Company was naturally confronted by stiffer competition for the acquisition of new tracts. However, in one out of the two major extensions the Company gradually asserted its power as a monopsonist; this was the acquisition of the royalties north of the River Derwent. Only in the case of Langley Park was Consett inflicted with royalty payments significantly above the County average.

The advantage of coal at a low price was partially derived from the monopsony power which conferred upon Consett low royalty charges. Cheap coal was fundamental to the success of the ironworks, and so negotiations for coal royalties were crucial, and took up a large amount of the Directors' time.

The first problem will be to discuss the growth of output and its distribution between the ironworks and sales, and the forces which induced Consett to enter the ranks of the sale collieries.

1. The Growth of Output of Coal and Coke, and its Distribution.

In 1865, one year after the Consett Iron Company had taken over control of the ironworks and collieries, the concern raised 354,499 tons of coal, and produced 132,158 tons of coke,(2) which was almost

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(2) Profit and Loss Accounts, 1873-1893. (DCRO:D/CO/89).

exclusively devoted to consumption within the ironworks themselves. Within ten years coal output had doubled, and coke production had almost doubled.

Though this dramatic increase could be partially attributed to increased demand from the Company's own iron-making departments, it was due also the Directors' decision to sell coal and coke from some of their more advantageously located collieries.

The following Table shows the pattern of the growth of output from 1871 to 1914. The rapid growth which began in the late 1860's was sustained through until the early 1880's. There was then a decade of relative stagnation and this was followed by a very rapid growth in the late 1890's which was sustained through the first decade of the twentieth century.

TABLE IV.1

The five year average of coal production, and the change from one period to the next.

Year	Average Output	% Change over the previous five years
1871-75	629,263	
1876-80	774,497	23.08%
1881-85	968,484	25.04%
1886-90	882,452	8.88%
1891-95	1,026,561	16.33%
1896-1900	1,424,017	38.71%
1901-05	1,568,017	10.11%
1906-10	2,180,398	39.05%
1911-14	2,218,610	1.75%

Source: Annual Statistical Returns of the Durham Coalowners' Association. (DCRO : Nation Coal Board Deposit.)

CHART IV. 1

GROWTH OF COAL OUTPUT AT CONSETT, 1865-1914.
(Semi-logarithmic Scale).

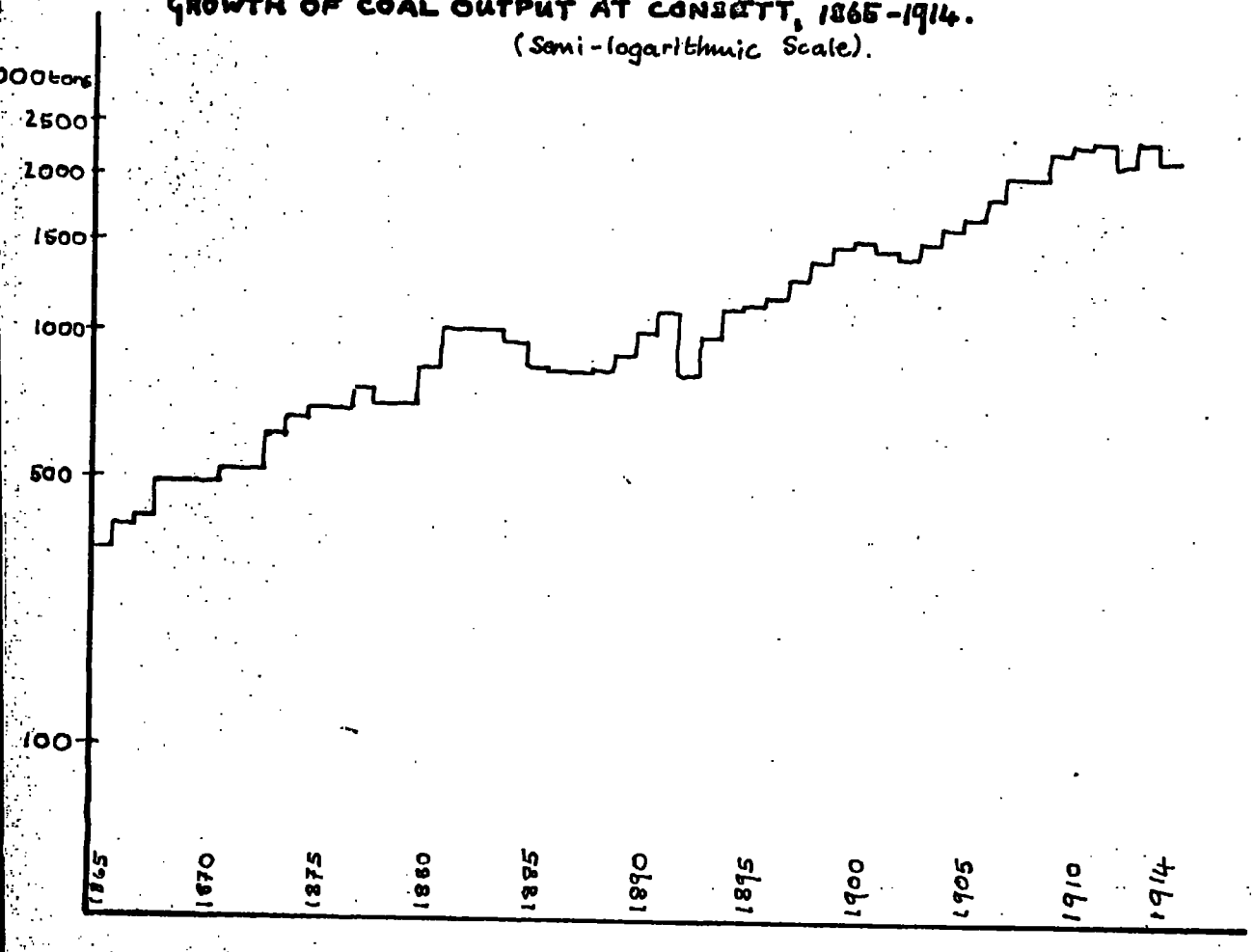
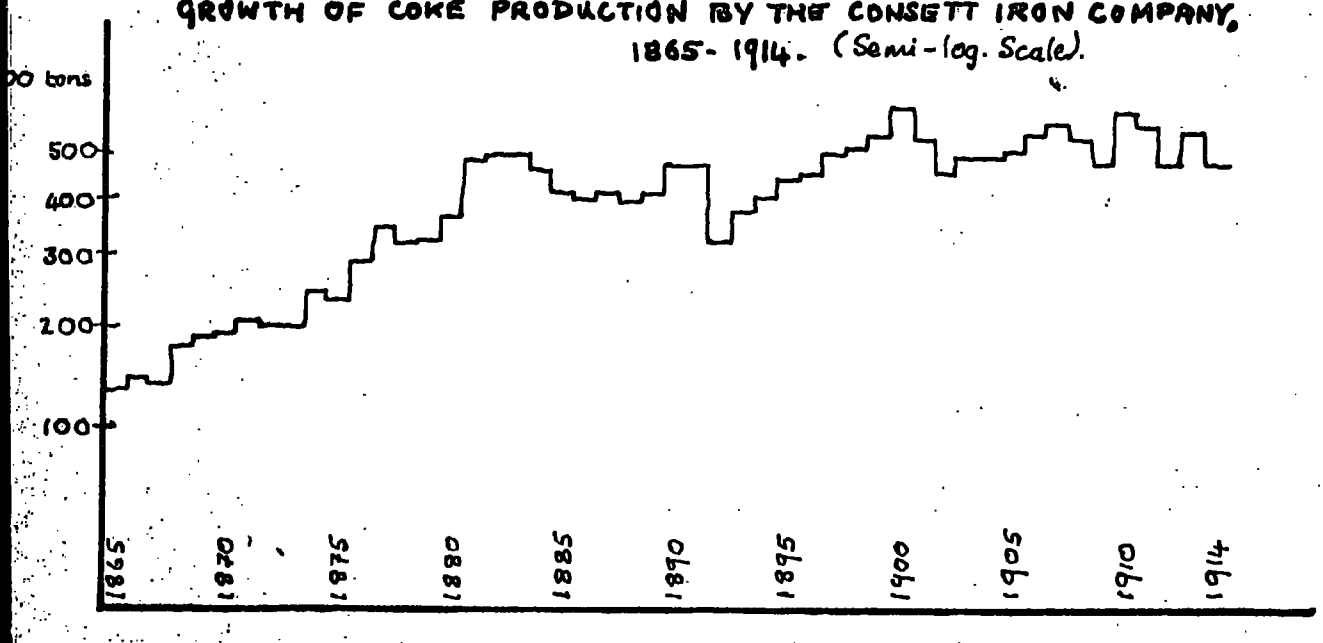


CHART IV. 2

GROWTH OF COKE PRODUCTION BY THE CONSETT IRON COMPANY, 1865-1914. (Semi-log. Scale).



The progress of coke production was more interrupted, as can be seen from the next Table. The main period of growth was the decade 1876-1885, although there was another significant upsurge between 1896-1900. However coke production was much more susceptible to the business cycle, and its fortunes fluctuated closely with those of the ironmasters. Furthermore the stagnation after 1900 was attributable to the trend of amalgamation which reduced the number of pig iron producers dependent on the open market for their coke supplies.

TABLE IV.2

The five year average output of coke, and the percentage change from one period to the next

Year	Average Output	% Change over the previous five years
1868-70	186,609	
1871-75	216,712	16.13%
1876-80	328,259	51.47%
1881-85	466,928	42.24%
1886-90	418,044	-10.46%
1891-95	401,604	-3.93%
1896-1900	522,141	30.01%
1901-05	491,814	-5.80%
1906-10	541,928	10.18%
1911-14	514,331	-5.09%

Source: Private Cost Book, 1868-1905; Private Cost Book, 1892-1909; Private Cost Book, 1910-1926. (DCRO:D/CO/97,100&.101)

The first phase of expansion up to 1885 was facilitated by the acquisition of new royalties, and the opening of two sale collieries at Westwood and Langley Park, which utilized the improved railway communications to Consett, which were opened during the 1860's. The

second phase after the mid-1890's was caused by the purchase of the coal tracts north of the River Derwent and the exploitation of these, and to a lesser extent by the opening out of the non-coking coals at Langley Park.

In 1864 the collieries of the Consett Iron Company probably served only the ironworks, with their few sales being local landsale. There is no reference to coal sales in the Prospectus for the Consett Iron Company, Ltd., and had they been significant then one would have expected some reference to be made in this source. The principal reason for the absence of sales was the poor location of Consett's collieries, especially in the early 1860's before the important Lanchester Valley and the Blaydon-Consett Branch lines were opened. Furthermore Consett was at a competitive disadvantage with the collieries scattered along the Pontop-Shields Railway line, its most direct outlet to the open market.

However, the construction of additional railway communications did strengthen Consett's ability to compete. The Consett-Blaydon Branch gave Consett a slight edge over other Durham coal and coke producers in the trade to Cumberland. The Lanchester Valley line opened an alternative route to the Tees-side market.

The first indication that the Board were preparing to take advantage of the new railways was shown in 1866 when the installation of screens was approved for Medomsley Pit, so that the quality of coke might be improved for sale.(3) Early in the following year the Board's intentions were crystallised in their approval of Messrs. Armstrong and Boyd's Report on the means by which coal output could be expanded to facilitate sales. The output from the existing Derwent and Medomsley Pits, and from a new colliery near Ebchester (Westwood) was to be devoted to sales, because of

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(3) Directors Minute, 29 September 1866. (DCRO: D/CO/29).

their proximity to the Blaydon-Consett Branch line.(4) In 1868 the Consett Iron Company sold 74,129 tons of coke, out of a total production 179,362 tons.

This rapid development of coke sales was intimately bound up with the opening of the Branch line in 1867, and the rapid growth in the output of hematite pig iron, which was stimulated by the development of the Bessemer steel process. Output of pig iron increased five fold in Lancashire between 1862-70, and three fold in Cumberland because of the exploitation of the non-phosphoric iron ores. Consett was well sited for access to both these markets; to Barrow via the South Durham and Lancashire Union Railway and to Cumberland via the Newcastle and Carlisle Railway. When Westwood was opened in 1872 it became the Company's main supplier to these markets.(5)

Even by the early 1870's Consett was unable to take advantage of the equally impressive growth of pig iron production in South Durham, and on Tees-side. This was due to the distance and discriminatory railway rates which favoured the Auckland District collieries. In order to tap this market Consett entered negotiations with the Earl of Durham for his Langley Royalty in 1871, and the acquisition of this Royalty in 1873 opened the way for competition between Consett and the Auckland collieries. Although Langley Park Colliery was not opened until 1877, Consett began to sell coke to Tees-side firms in 1874, at the tail-end of the "Coal-famine." The Company was thus able to establish connections with

(4) Directors' Minute, 29 January 1867, (DCRO:D/CO/29).
(5) In 1886, of 80,420 tons of coal and coke from Westwood which went on the North Eastern Railway's system, 72,504 tons went via Blaydon to Carlisle G. Whittle, Railways of Consett and North West Durham (Newton Abbot 1971), p.110.

some reputable Tees-side iron-makers, such as Gjers, Mills and Company, and Hopkins, Gilkes and Company.(6)

By 1873-74 the increased output which resulted from the Armstrong-Boyd Report began to outrun demand, and stocks started to accumulate (see Table IV.4) . Since coal deteriorates, stocking was an unprofitable procedure and the Board instructed the Chief Viewer, Mr. Hedley, to cut back output. This was implemented by the closure of Delves Pit, which had been the highest cost colliery in the Consett group.(7)

From 1874 until the end of the decade there was a persistent downward drift in prices, reaching its nadir in October 1879, when the average price of Durham coals was 4s.3d per ton.(8) It was during this depression that the Company's sale collieries became more clearly separated from their 'home' collieries. Sales from Derwent and Medomsley began to fall off as these two were the least well located of the sale collieries, and the Company's selling operations were concentrated upon the pits at Westwood and Langley Park. Furthermore the latter two were able to make significant cost reductions during the difficult years 1878-1880, and so maintain their ability to compete.

1879 was not only depressing from the point of view of insufficient demand but also because the trade conditions sent some iron-makers to the wall; three local firms which suffered such a fate were the Rosedale and Ferryhill Iron Company, Hopkins, Gilkes and Company, Ltd., and Lloyd and Company. All three had outstanding accounts with Consett. In face

(6) Directors' Minutes, 3 November 1874, and 15 May 1874. (DCRO:D/CO/31).
(7) Directors' Minute, 11 April 1874, p.29. (DCRO:D/CO/31).
(8) Ascertained net selling price of all types of Durham coal, as given on the Accountant's Certificates of the Durham Coal Owners' Association and the Durham Miners Association. C.E. Mountford, The History of John Bowes and Partners up to 1914 (Durham, M.A. Thesis, 1967) Appendix D.

of such trade instability Consett wisely adopted a pricing and marketing policy which restricted credit to buyers and demanded more general monthly settlement of coke purchase accounts.(9)

At the end of 1879 the production of pig iron began to show signs of picking up. Sales of coke began to increase once again, whilst the ascertained price of coal turned up reaching 5s.0d per ton in the last quarter of 1883. Between 1878-79 and 1880-81 profits made from the sale of coke rose from £6,712 to £30,979 through a combination of slightly reduced costs, rising prices, but most significantly because of a 33 per cent increase in sales. These days of profitability lasted until 1884-85 when dropping sales and diminishing profit margins pushed the profits earned down to £7,875, and there was little further improvement until 1889-1890.(10)

The 1880's proved to be a period in which the delineation between the Home and Sale collieries became complete. Coke sales from the Consett group (Home) fell from 84,023 ton in 1879, to only 1232 ton in 1889. The Directors had resolved in 1885 that their coke sales policy should be to sell freely from Westwood and Langley Park, whilst reserving Consett's output for the Company's own use, except where it might be expedient to ship it.(11)

Throughout the period from 1864 to the end of the eighties the sale of coal remained fairly constant, fluctuating between 15,000 and 20,000 tons a year. Small quantities of coal were sold during the late 1860's

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(9) Directors' Minute 7 January 1879, p.116.(DCRO:D/CO/32).
(10) Profit and Loss Accounts, 1873-1893. (DCRO:D/CO/89).
(11) Directors' Minute, 10 February 1885 p.190.(DCRO:D/CO/33).

for export from the Tyne, and gas-making at Tow-Law, but the main market was for local consumption. Why the quantities sold should have remained so insignificant is puzzling, since the profit on coal sales never fell below 1s.6d. per ton.(12) The most plausible explanation is that the Company was supplying the local household market, where the Company accrued some of the benefits of a monopoly position, or at least a partial monopoly because of the protection bestowed by distance. However the very factors that protected Consett's local market excluded it from the larger domestic markets which were open to the East Durham collieries.

In 1887 Westwood Colliery began to raise coal for sale, as well as conversion into coke, but the most important development was the acquisition of the Garesfield Colliery in 1890. By 1899 sales of coal had risen to 298,802 tons, and of the Sale Collieries only Westwood sold more coke than coal. Whilst the demand for coke had remained fairly stable there was a dramatic surge in the coal market. Consett's growth rate for coal sales over the twenty years from 1890 to 1910 was more typical of a colliery company located in the newer East Midlands and South Wales Coalfields than in the old slow growing Durham Coalfield. This development was mainly achieved in the royalties acquired north of the Derwent and at Langley Park, where the Company began to exploit the non-coking coal seams in 1898 on a large scale.

During the 1880's the stagnating demand for coal manifested itself in very tight margins between costs and price. In the Autumn of 1885 when the price at the Langley Park ovens fell to between 7s.9½d per ton, and 8s.4½d per ton, the average costs varied between 8s.3d.and 7s.10d

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(12) Profit and Loss Accounts, 1873-1893. (DCRO:D/CO/89).

over the last half of 1885 and the first half of 1886.[13] This was the first indication of the growing cost inefficiency of the beehive coke ovens when prices were forced down in depression. Although the Company made £6,433 profit on coke sales in the year ending June 1886, the 91,263 tons of coke sold from Langley Park yielded only £57.11s.7d. profit.[14] The balance was probably made by sales from Westwood and Consett to the West Coast for prices at the oven for delivery to the West were normally higher by about 6d or 9d per ton,[15] and the average cost of producing coke at Consett was lower than at Langley Park in 1885-86.

The profitability of coke sales improved slightly in the next two years mainly because the cost of coal was held down to about 4s.0d per ton. Then there was a dramatic upturn in coke prices in 1889-1890 caused by the renewed activity in the pig iron trade. Profits leapt from £11,217 in June 1889 to £64,166 in June 1890., and though they slid back to £37,317 the following year prices continued to boom,[16] but ominously costs had risen by 2sld per ton at Langley Park, mainly because of rising labour costs in the pit. The cost of coal at Langley Park and Westwood rose to 5s.5d. and 5s.4d. per ton respectively in 1891.[17]

The boom collapsed early in 1891 when contracts came up for renewal. Customers began to hold out for lower prices. In a letter to David Dale, Jenkins compalined that .....

> "Linthorpe declines to proceed further with their 300 tons per week, so that we are on the verge of serious curtailment of

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(13) Directors' Minute, 6 October 1885 p.217 (DCRO:D/CO/33): Private Cost Book, 1868-1905; Langley Park Coke, (DCRO:D/CO/97).
(14) Profit and Loss Accounts, 1873-1893. For the year ending 3rd July 1886 (DCRO:D/CO/89).
(15) Wm. Jenkins to D.Dale, 25 March 1891.(DCRO:D/CO/75).
(16) Profit and Loss Accounts, 1873-1893. (DCRO:D/CO/89).
(17) Private Cost Book, 1868-1905. (DCRO:D/CO/97).

output at Langley unless we sell quickly."

He was more sanguine about Westwood's prospects because.....

"for the West Coast locality we pretty nearly always get about 6d to 9d better oven price than we do for Cleveland."(18)

By mid April, deliveries from Langley Park had fallen to 1,200/1,500 tons per week, compared to the normal capacity of about 2,000 tons. A decision had to be made as to the ovens which should be closed down.(19) Jenkins was growing more concerned about the rising cost of coal winning at Consett's Collieries, and felt that attempts should be made to win some relief -

"The important point is I think that we should endeavour to find out calmly whether relief can be brought about in some way in the costs of the pits that have been so high in the expense of getting coal, especially in those where wages alone form 4s.0d per ton."(20)

The situation was reaching critical dimensions, for though the Company continued to reduce the price it was unable to stimulate fresh demand. Finally in May, when the price of coke had been reduced to 10s.6d per ton at Langley Park and 11s.6d at Westwood enquiries began to flow forth again, but in the case of Langley the current cost of producing coke was 10s.10d. per ton.(21)

By September orders were more plentiful, but the price remained low, between 12s.9d and 13s.0d. per ton at Middlesbrough and 12s.7½d per ton

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(18) Wm. Jenkins to D. Dale, 25 March 1891.(DCRO:D/CO/75).
(19) Wm. Jenkins to D.Dale, 23 April 1891. (DCRO : D/CO/75).
(20) Wm. Jenkins to D.Dale, 21 April 1891. (DCRO : D/CO/75).
(21) Wm. Jenkins to D.Dale, 16 May 1891. (DCRO: D/CO/76).

at Stockton, and there was no sign of an abatement in the high costs of production.(22) The increasing price of the chief factor input, coal, was having an adverse effect not only on the Company's coke sales but also on the advantage Consett held as an iron and steel producer.(23)

The natural course of action adopted by the coal producer was to seek relief in the labour cost component of mining. However the miners were not surprisingly resolute against any wage reduction. The alternative was to improve the utilization and productivity of the relatively expensive coal input. This could be done by reorganising the production of coke in by-product ovens instead of the traditional and wasteful beehive ovens. Early in 1892 William Logan examined the advantages of establishing a Central Coking Plant, with Simon-Carves ovens installed.(24) This plan was rejected in favour of W.H. Hedley's suggestion that instead of a new coking plant, additional beehive ovens could be built at the pits, and their waste gas used for raising steam for pit engines.(25) This only became a feasible alternative because the miners' resistance to a wage reduction had been broken during the strike/lockout during the Spring of 1892. Coal costs began to decline, restoring some semblance of profitability to coking operations.

Through the rest of 1892-1893 there was little improvement in price although demand rose and costs fell. In February 1893 David Dale was of the opinion that if sales could not be made at 12s9d. per ton delivered on Tees-side then the trade should be foregone. The price level remained unaltered

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(22) Wm. Jenkins to D. Dale, 12 September 1891.(DCRO:D/CO/77).
(23) Wm. Jenkins to D. Dale, 21 April 1891.(DCRO:D/CO/75).
(24) Directors' Minute, 26 March 1892. p.35. (DCRO/CO/35).
(25) Directors' Minute, 5 July 1892 p.49. (DCRO: D/CO/35).

through the year when.....

> "The Tees Bridge Coy. offer us 12s.3d. per ton for Stockton for 1,000 tons of coke in continuation of an existing contract, but I consider this price rather bare, and inasmuch as we are rather oversold at Langley I think we might let it slide for a few weeks, and in the meantime we might have an opportunity of disposing of the coke at somewhat better prices for the Midlands." (There was a Miners' Strike in the Midlands District.)(26)

Although there are no price details for 1894 it appears to have been a better year for coke sales, as sales rose whilst costs fell. Thereafter there was a sustained, even if unimpressive growth of coke sales to a peak of 336,344 tons in 1900. A new boom had begun in 1898-1899, and the Company brought 244 new ovens into operation at Chopwell Colliery and Bradley. In addition coal sales also expanded rapidly after a period of stagnation between 1895-1897, during which time the price of coal never exceeded 5s.5d. per ton. However in 1898 price began to move rapidly upward reaching a peak of 11s.4d. per ton in the third quarter of 1900. This trade improvement was fortuitous for Consett, whose new Chopwell Colliery became operational in 1897. The Company also responded by exploiting the deeper non-coking seams at Langley Park from 1898.

In 1901 coke sales slumped, mainly because of the fall in overseas demand for pig iron. The effect on Consett was such that it had to close the Westwood Colliery.(27) This decision was taken on the grounds that short-time working would raise costs, and thus it was more desirable to close one pit and keep the others on full-time working. Westwood was chosen since its principal markets on the Tyne and West Coast had been taken over by Chopwell and Garesfield. It was also the smallest sale colliery, and thus its closure would not seriously damage the Company's capacity to fill

See page 114 for footnotes (26) and (27).

remaining demand.

The recession of 1901 finally persuaded Consett to adopt by-product ovens, but not at Langley Park where the pressure of high coal costs had first manifested itself. In the mid-1890's there had been only a small reduction in the cost of coal at Consett, and the trade upturn at the turn of the century renewed the upward spiral. This was tolerable while the iron and steel trades were booming, but when collapse eventually came in 1902 the cost of coke became an intolerable burden. It was all the more serious since the Company was contemplating extensive replacement of its blastfurnace plant. If such a plan were carried out the Company had to be assured of a reasonably priced coke supply over a long term period. Eventually in 1904 the Board decided to erect 50 Otto Hilgenstock by-product ovens to provide for the requirements of the Consett blastfurnaces.(28)

On the sales side of the colliery operations, coke sales slumped to their lowest level for seven years in 1902 but thereafter rose gradually, with only a slight interruption in 1904, to an all time peak of 359,714 tons in 1908. Coal sales continued to grow uninterrupted passing the 1 million ton mark in 1909. It was probably this period which Clarence D. Smith had in mind when he talked of the counter-cyclical nature of coal and steel profits, for 1907-1908 was a peak for coal prices whilst it proved a sharp recession in steel prices. The demands upon the Home collieries were so small between the winter of 1908 and early 1909 that the Board, rather than lay in the pits, began to sell the coal

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(26) Richard Evans to D. Dale, 17 November 1893.(DCRO:D/CO/88).

(27) Directors' Minute, 5 March 1901. p.11. (DCRO:D/CO/39).

(28) Directors' Minute, 19 January 1904 p.208.(DCRO:D/CO/39).

and coke. Despite this attempt to keep the Home Collieries operational, working was irregular, and a certain amount of resentment developed between the pitmen of the Home collieries and those at the more prosperous Sale collieries.(29)

Information on the uses of coal from Consett's pits is very sparse. However, precise indication is given for 1892 in a return to the Durham Coal Owner's Association.

TABLE IV.3

Colliery Company	Coke	Gas	Household	Manufacture	Steam	Total
Lambton	110,001	379720	461,392	501,057	322,299	1,774,469
Bolckow Vaughan	921,476	38252	218,317	382,034	141,292	1,701,371
Bowes & Partners	390,413	820703	48,176	171,487	42,484	1,658,274
Pease & Partners	1,101128	-	40,261	21,640* / 62,859	-	1,225,888
Consett Iron Co.	659,258	-	26,579	235,748	80,893	1,002,478
Bell Brothers	453,746	-	7,145	165,319	-	647,385

* Exported.

Source: National Coal Board Statistical Return No.321. (D.C.R.O.:N.C.B. Deposits.)

As coal sales up to the end of the 1880's only amounted to between 15,000 to 20,000 tons it is likely that they were for local household purpose. In 1892 Consett sold approximately 80,000 to 90,000 tons of coal, the

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(29) Directors' Minute, 2 March 1909 p.179.(DCRO:D/CO/41).

balance probably being steam coal from the newly acquired Garesfield Colliery. This is likely since steam in the ironworks was raised mainly by the utilization of waste heat and gas from coke ovens and blastfurnaces.

However the development after 1892 added coal for gas making. After 1892 it is not possible to differentiate between the types of coal mined by the Consett Iron Company. Coal for gas-making was certainly mined at Langley Park and sold to some local corporations. By 1925 Consett advertised coal for gas, bunker, coking and smithy purposes from the Sale Collieries.(30)

2. Marketing and Pricing Policy.

Coal is not an homogenous commodity since its chemical and physical properties vary. Different uses require different qualities of the coal. Similarly coke quality is variable, depending upon the properties and mixture of coals used in its production. From this basis the rudiments of a marketing policy were derived. At the same time the differentiation of product does not take the place of price competition, and so the Company also had to develop a pricing policy. However, given the price, the Company then tried to increase the attractiveness of its product by adopting some fairly simple marketing techniques.

The most fundamental of these techniques was the use of the communications media for advertising. With products such as coal and coke intensive advertising was unlikely to yield realistic returns, thus Consett adopted

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(30) Consett Iron Company, Ltd. 1925 (Leeds, 1925) p.12.

the normal practice of trade advertising, which was more of an informative than a persuasive nature. Customarily the advertisements informed potential customers of the range of goods sold, and sometimes the Company's capacity to produce them.(31)

However, in a basic product industry, once the information had been conveyed to the potential consumers, the retention and extension of of sales to these customers depended increasingly on both the maintenance of quality, delivery and goodwill in the trade. The importance of the continuity of goodwill was illustrated when Consett took over Lord Bute's Garesfield Colliery. Though William Jenkins decided to drop the name 'Bute' on the 'certificate of origin', he did call it 'original Garesfield Colliery' emphasising that there was a continuity of quality.(32) When in 1897, the Company opened the Chopwell Colliery in the same area as Garesfield....."the Secretary urged the desirability of maintaining if possible the name 'Garesfield', to which a considerable market value was attached. The matter was discussed and various suggestions made, a final decision being deferred. In the meantime the coals disposed of might be described as 'Garesfield' by arrangement with the Railway Company, which the Secretary was instructed to carry out."(33)

The value attached to the name was dependent upon the maintenance of quality over a number of years. This proved a constant source of worry

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(31) The Consett Iron Company regularly advertised in the Iron and Coal Trades Review.

(32) Wm. Jenkins to R.W. Cooper, 27 January 1890. (DCRO:D/CO/71).

(33) Directors' Minute, 26 January 1897, pp. 137-138.(DCRO:D/CO/37).

to the management. Langley Park was from the outset a troublesome colliery with regard to quality.(34) Alternative methods of working the coal were tried, and the viewer, William Logan, was instructed to ensure more care in the cleaning and preparation of the coal for the coke ovens. Ten years later in 1887 Jenkins warned Hedley that inferior coke was endangering the continuation of contracts with Spain and restricting profits.(35) The problem was not limited to Langley and the gravity with which complaints were treated by William Jenkins can be ascertained from his frequent communications with the colliery viewers:

> "I have received from Westwood a couple of lumps of coke which appear to me to be from a very inferior class of coal and certainly if there is much of this quality sent to the west coast our trade is not likely to be continued there.
>
> "....What between bad quality and high costs you may take my word for it that we are coming to a very serious state of things."(36)

Such was just one of Jenkins' remonstrances. There were three main problems encountered in maintaining the quality of coke: carelessness in mixing the coals for the ovens, poorly cleaned coal, and the presence of sulphur and ash. All resulted from human negligence and could be put to rights by closer supervision. To this end Jenkins urged closer co-operation between the Colliery viewers and Mr. Keenleyside, the Coke Oven Manager.(37)

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(34) Directors' Minute, 24 February 1877, p.265.(DCRO:D/CO/31).

(35) Wm. Jenkins to W.H. Hedley, 17 January 1887, (DCRO:D/CO/68).

(36) Wm. Jenkins to J.J. Hedley, 27 July, 1891.(DCRO:D/CO/77).

(37) "I think it would be worth your while to meet Mr. Keenleyside occasionally at the Westwood ovens, and let him have the opportunity of describing to you what the difficulties are." Ibid.

The maintenance of quality helped retain current customers, but as the coke trade began to stagnate after 1890, the Company turned to coal sales, and this meant improvements had to be made in the quality of coal. A rapidly expanding demand for coal was in the provision of bunker coal. To exploit this opportunity W.H. Hedley was encouraged to persevere in his efforts to get a process of better mingling so that splint coal could be sold to the shipowners as bunker coal.(38) Four years later in 1891 when the firm's coal sales had grown considerably, Jenkins attempted to market bunker coal "as a kind of reciprocity in the freight business we are doing..."(39) This was not a particularly novel approach since the Company had been working a reciprocal freight trade with Spain since the 1880's, coke outward and iron ore on the return.(40) In Durham only the Stella Coal Company and Priestman's were larger exporters of coke than the Consett Iron Company.

The relationship between Consett and the shippers was such however, that the Company reacted tardily to a scheme for regulating coal prices:

"Assuming that such a scheme (price regulation) would be brought about it might adversely affect us in the matter of freights much more than any benefit we might receive in the sales of our coals and coke. When arranging the freights this year much was made by the shipowners of the high cost of bunker coals.....I fear that the Consett Co.'s cost of Bilbao iron ore would be seriously affected by the increased freights on its 300,000 to 400,000 tons of imported ore every years."(42)

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(38) Wm. Jenkins to W.H. Hedley, 8 June 1887. (DCRO:D/CO/69).

(39) Wm. Jenkins to W. Dickinson & Co., 12 December 1891.(DCRO:D/CO/79).

(40) Wm. Jenkins to W.H. Hedley, 17 January 1887. (DCRO:D/CO/68).

(41) Quantity of Coal and Coke Exported, excluding coals put into ship's bunkers, during 1900, National Coal Board Statistical Return No.429 (DCRO: N.C.B. Deposits.).

However the fears of Consett's executive management were over-ridden by the Directors and the Company did participate in the scheme.(43) Presumably, the Directors who had other interests in Durham Coal companies could not permit Consett to renege because of the effect this would have upon the Association and their other interests.

In the early stages of the evolution of management structure it was common for the sales of a concern to be handled by agents. In some branches of industry their control was complete, and firms could not sell directly to consumers. William Jenkins resented the interference of these speculative and non-productive commission agents. When in 1891 Mr. Swan approached Consett offering a sale contract with Millom and Askam Company on the payment of 1d per ton commission - William Jenkins by-passed Swan and made a direct offer to Millom and Askam.(44)

Direct contact gave Consett more freedom both in dealing with complaints and also spreading the total sales over a number of customers It was one of Jenkins' principal objectives to avoid dependence upon one or two large customers - this was more difficult when operating through merchants. Such a policy minimised the risk of acute depression due to the cessation of any one large contract. When Sir Bernhard Samuelson's enquired for a sample of Consett coke, Jenkins congratualated F.W. Hodges, the Company's Newcastle sales agent:

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(42) R. Evans to D.Dale, 9 February 1894. (DCRO:D/CO/88).

(43) Directors' Minute, 4 September 1894. p.240.(DCRO:D/CO/35).

(44) Wm. Jenkins to D. Dale, 6 April 1891.(DCRO:D/CO/75).

"This may lead to business and it may place us ultimately in a little more independent position with other parties."(45)

For efficient operation it was important that the Company's plant was fully utilized, and so to facilitate this Consett occasionally oversold; sometimes it was caught out by its own precautions.

"I regret that the Normanby Iron Works Co. should feel aggrieved in any way ..... Like most Coke owners we oversell a little in order to meet contingencies of stoppage by the Railway Co., accidents at Furnaces &c. - so as to keep the ovens regularly supplied. During the early part of the contract the Normanby firm sometimes ordered less than their contract quantity and the overselling was partly to meet such contingencies as these and what they claimed for themselves we presume they would not refuse to us....."(46)

Although he was anxious to broaden the Company's customer base, Jenkins was not prepared to go to any lengths. When Stephens of Bilbao inserted stipulations about quality and delivery dates in a coke enquiry, Jenkins replied that such stipulations were neither customary nor likely to be granted by any northern coke manufacturer.(47) Jenkins was similarly unenthusiastic about enquiries from the Moss Bay Hematite Iron and Steel Co. who had an unfortunate record of late settlement on contracts.(48) Their reliability and credibility were rightly suspect, and Jenkins was loath to deal with them even when trade was slack.

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(45) Wm. Jenkins to F.W. Hodges, 29 June 1887. (DCRO:D/CO/69).

(46) R. Evans to D. Dale, 17 November 1893. (DCRO:D/CO/88).

(47) Wm. Jenkins to R. Stephens, 29 April 1887. (DCRO:D/CO/69).

(48) Wm. Jenkins to Jos. Ledger (Moss Bay Co.), 14 February 1887, (DCRO:D/CO/68).

"Mr Hodges might have sold to Moss Bay Co. 500 tons, but for such a weak customer (he) did not think it wise to exhibit our glut of coke on hand, nor did I think it well to quote any low figure in the way of temptation to such a consumer." (49)

The credit-worthiness of customers was of great interest to Jenkins, for a wise choice could save loss through bad debts, or at least the administrative inconvenience of securing repayment from bankrupt firms. During depression the Company rejected the principle of extending long credit to customers, insisting that accounts should be settled monthly by cash.(50)

Not all the Company's sales were by contract, for during periods of low activity ad hoc orders were taken to draw in the slack in the capacity of the plant. Sales for early delivery were not uncommon in the grey areas between boom and recession. Such a period was late autumn of 1893 when the Company was prepared to sell for early delivery to the Altos Hornos Company, 1,000 tons of coke at 14s.6d per ton f.o.b. at Tyne Dock, less 2½% for cash. This was infact the Spanish iron company belonging to the Ybarra Brothers, who were Consett's partners in the Orconera Iron Ore Company.(51) Hand to mouth selling was more characteristic of the coal trade during recession, since it avoided the costly and wasteful practice of stocking coal,(52) and so prevented the illusion taking hold amongst the miners that the Company was prepared to put any amount of coal to stock, in order to avoid closing

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(49) Wm. Jenkins to D. Dale, 22 February 1890. (DCRO: D/CO/72).

(50) Directors' Minute, 7 January, 1879. p.116. (DCRO : D/CO/32).
R. Evans to D.Dale, 27 November 1893. (DCRO:D/CO/88).

(51) R. Evans to D.Dale 27 November 1893. (DCRO:D/CO/88).

(52) Wm. Jenkins to W.H. Hedley, 18 January 1890. (DCRO:D/CO/71).

the pits.(53) It was only found prudent to stock coal at the Home Collieries for use in the iron and steel works in the event of any stoppages in the pits.(54)

TABLE IV.4

Corrected Coal Stocks on 31st December, 1870-1914.

Year	Consett	Langley Park	Garesfield	Chopwell	Westwood
1870	4,607				
1871	573				
1872	1,270				
1873	28,500				
1874	18,519				
1875	16,559				
1876	12,433				
1877	10,887				
1878	8,545	388			
1879	6,411	392			
1880	11,880	240			
1881	18,006	3576			
1882	24,403	-			
1883	32,338	63			
1884	28,183	1284			
1885	32,541	25			
1886	30,643	560			
1887	29,001	390			
1888	26,937	1100			
1889	24,627	150			
1890	19,095	90	97		

(53) Wm. Jenkins to W.H. Hedley, 27 October 1892.(DCRO:D/CO/83).
(54) Directors' Minute, 22 July 1871. p.120.(DCRO:D/CO/30).
Mr. Boyd recommended the wisdom of keeping a coal stock of about 10,000 tons. See Table IV.4. for the significant difference in stocking policy between the Home and Sale Collieries.

TABLE IV.4. Continued

Year	Consett	Langley Park	Garesfield	Chopwell	Westwood
1891	38,291	300	1,053		
1892	8,582	225	1,458		
1893	9,020	825	356		
1894	21,505	150	1,612		
1895	35,579	225	818		
1896	34,985	525	319		
1897	20,918	300	74		
1898	21,330	748	448	974	
1899	10,579	217	318	20	
1900	10,975	1,610	856	756	2,697
1901	20,188	1,255	376	1061	1,025
1902	22,677	572	1,129	1359	423
1903	26,878	1,017	876	867	370
1904	29,904	448	1,856	4168	402
1905	31,917	772	1,657	1781	289
1906	21,421	1,257	2,021	3018	1,085
1907	19,766	422	564	1342	151
1908	27,585	1,372	1,077	1532	999
1909	38,167	1,009	1,976	4195	38
1910	31,388	602	600	536	350
1911	32,112	263	390	649	-
1912	27,000	422	600	578	145
1913	33,669	1,240	765	875	625
1914	61,287	659	250	440	165

Source: Production and Stock Books. (DCRO:D/CO/107-109).

As the operations of the ironworks expanded the amount of coal stocked at Consett, in case of emergency also increased to between 20,000 - 30,000 tons.

With respect to pricing policy the Company was bound more or less by a market price, and there is no indication that it was a price leader. As mentioned earlier, there was a price differential of between 6d and 9d per ton, at the Company's ovens, between Cleveland and West Coast buyers.(55) Inevitably price competition was stiffest during the slumps, as manufacturers strove to keep their total capacity employed, in an effort to minimize their overheads. In some instances Consett had to damp down its ovens since the price of coke became unremunerative.

"Teesbridge have refused 13s.0d d/d and have bought elsewhere, Langley will not deliver more than 1,200 / 1,500 tons this week..... it would seem that we are coming to a stage in which we must consider the policy of extinguishing some of our ovens and selling our coal if this is thought a prudent thing to do." (56)

Such was William Jenkins impression of the state of trade in 1891; on this particular occasion Consett was forced to reduce its oven price for coke at Langley Park to 10s.6d before it was able to induce buyers. The deterioration of price was so bad that it had fallen below the average cost - in such a situation some ovens had to be damped

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(55) See footnote (15).

(56) Wm. Jenkins to D. Dale, 15 May 1891, (DCRO:D/CO/76).

down.(57) Though Jenkins always tried to hold out for the price he regarded as acceptable, the trend inevitably drove prices down to those prevailing in the market generally.(58)

Consett was not powerless in face of the force of the market for though the profit margins were nipped it performed creditably in maintaining the level of its sales. This was due in a large part, to the astuteness of Wm. Jenkins and the extensive knowledge of the trade which David Dale possessed. As Managing Director of Pease and Partners, Dale was confronted by the very same problems as Jenkins, and thus the two men were able to counsel one another. Dale was also for sometime a Director of the Barrow Hematite Steel Company, thus strengthening the position of Consett on the West Coast. When trade began to slacken at the tail-end of 1890, Jenkins wrote to Dale in his capacity as a Barrow Director, offering "to entertain an application from the Barrow Steel Co. for say 500 tons per week of Langley Park coke, commencing say the second week of 1891." (59)

During the period 1864-1914 Consett evolved a sales policy based upon the production of reliable product, sold to a fairly wide range of customers, of good credit standing. It extended normal trade credit when times were good, but required regular cash payments during slumps. Wherever possible its coal and coke sales were complementary to the importation of Spanish iron ore. However, it is apparent that the markets in Cleveland and on the West Coast, were in themselves, quite sharply

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(57) Wm. Jenkins to David Dale, 16 May 1891. (DCRO:D/CO/76).
(58) Wm. Jenkins to D. Dale, 3 February 1893. (DCRO:D/CO/83).
(59) Wm. Jenkins to D. Dale (C/o Barrow H.S.Co.), 31 October 1890. (DCRO:D/CO/74).

competitive, and so the profits earned in this branch of Consett's activities were not derived from any position of monopoly.

3. The Acquisition of Coal Royalties*

In the previous two sections the expansion and diversification of output was examined, and Consett's market position analysed. Expansion necessitated the acquisition of additional coal royalties, whilst the study of marketing involves a parallel analytical approach, as to whether Consett was a monopsonist in the acquisition of coal leases. In this section the process of royalty acquisition will be traced and the presence of monopsonist power assessed.

Negotiations with royalty owners were often protracted, sometimes going on over a number of years, and often involved a number of mineral owners. This was peculiar to Britain and the U.S.A.. Firstly, in the north eastern coalfield, the colliery company had to establish a 'certain' rent which it would pay whether coal was extracted or not. Secondly, a 'tentale' rent was fixed for each 'ten' of coal above some fixed quantity allowed in consideration of the 'certain' rent. A 'ten' was normally 50 tons during this period. Should the colliery company extract less than the allowed quantity in a particular year, it was usually allowed to make up such 'short workings' or 'shorts' in subsequent years without the payment of 'tentale' rent on them. Besides these basic rents, negotiations had to be undertaken with neighbouring royalty owners

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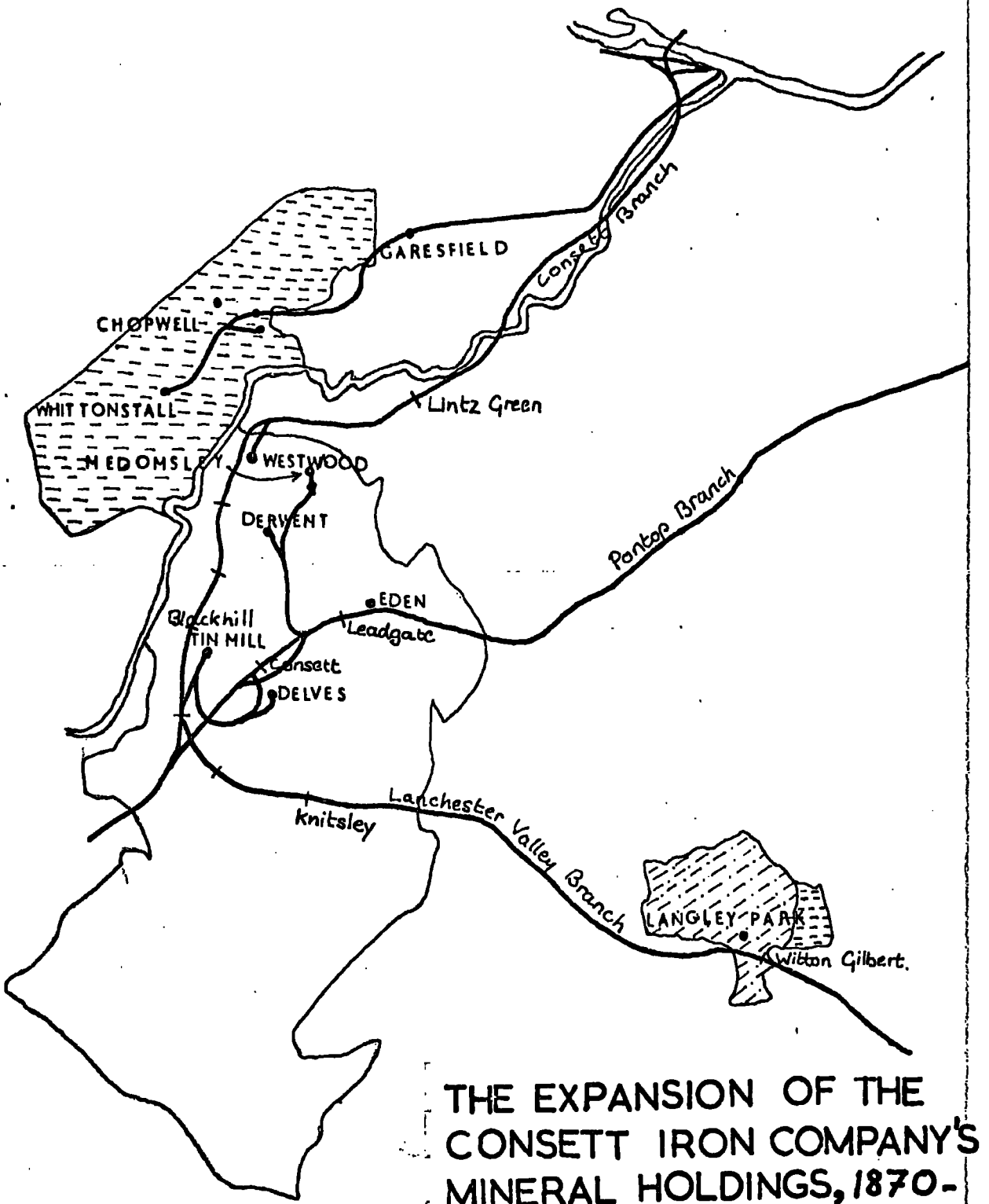
*. See the map of Coal Royalties.



THE EXPANSION OF THE CONSETT IRON COMPANY'S MINERAL HOLDINGS, 1870-1914.

1870 ; 1870-1880;

POST 1880. Railway and Stations.

for privileges incidental to the main working. If another royalty was penetrated underground, whether for working coals or for carrying them, an 'outstroke' rent had to be negotiated, and a 'shaft' rent was payable for the privilege of raising coals up a shaft in a neighbouring royalty. If the coals were carried across the land of a landed proprietor other than the immediate owner of a colliery's royalty, he was entitled to wayleave rents.(60)

The fragmentation of the coalfields between landlords in this way was judged by the Sankey Commission of 1919 and the Samuels Commission of 1925, to be a major cause for the prevalence of second-best locational decisions and pits of sub-optimal size in the British coal industry. In the history of Consett, the costs of long drawn-out bargaining, and of co-ordinating and timing the acquisition of variously owned pieces of adjoining land, must be considered as a consequence of the institutional context of the day. But the Company's location provided a certain degree of built-in monopsonist power, enabling it to squeeze out advantageous terms from the local mineral owners, and the location had its origins rooted in the principal activity of the Company, manufacturing iron.

Since coal was a vital raw material to an iron and steel company, the long term provision of sufficient coal was an important item on the Directors' Agenda. The Board was kept informed as to the long term outlook by occasional reports on estimated coal resources, which were produced by the Chief Viewer or mineral agent. In 1867 Mr. Boyd estimated that the Company's reserves were 30,893,000 tons in easily worked seams,

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(60) G.C. Greenwell, A Glossary of Terms used in the Coal Trade of Northumberland and Durham (London, 1888).

and 26,663,600 tons in more difficult seams.(61) When in 1889 the firm was completing its negotiations for the royalties north of the Derwent, the reserves in that district were estimated at 13,850,000 tons of coal in royalties already held by the Company, and 13,370,000 tons in adjacent royalties which could be worked in conjunction.(62) Five years later William Hedley, the Chief Viewer of the 'Consett Home Collieries' reported that the resources for consumption by the ironworks were 20,000,000 tons of coking coal and 15,000,000 tons of milling coal, or forty and fifty-eight years supply respectively.(63)

In Britain the law relating to the ownership of minerals made the process of negotiating for land in which to sink a colliery, complex and even exasperating. Even where a large estate was being purchased or leased as in the case of Langley Park and Chopwell, there were invariably smaller adjacent tracts that had to be acquired to make the holding complete. While the Board were proposing to take the Earl of Durham's Langley Royalty of 1470 acres in 1871, they had concurrently to bargain for J. Darling's royalty of 81 acres which was adjacent. The completion of the Darling negotiations was not reached until 1883,(64) ten years after the Earl had leased the Langley Royalty to the Consett Iron Company.

Negotiations were bound to be difficult given the institutional structure, for once the royalty owner became aware of the plans of the

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(61) Directors' Minute, 29 January 1867. (DCRO:D/CO/29).
(62) Directors' Minute, 12 February 1889, pp. 79-89.(DCRO:D/CO/34).
(63) Directors' Minute, 4 August 1894, p.220.(DCRO:D/CO/35).
(64) Directors' Minute, 18 August 1883, p.106. (DCRO : D/CO/33).

Company his bargaining hand was inevitably strengthened. This could lead to the paradoxical situation where coal in a tract furthest from the shaft was subject to the highest royalty payments solely because of the bargaining power of the royalty owner. Such a situation was illustrated in 1890 by William Hedley's evidence to the Royal Commission on Mining Royalties. The example he drew upon, though unnamed, was probably one of the pits within the 'Consett Collieries' group, of which he was the Chief Viewer.(65) Hedley emphasised the difficulty of securing a reduction on royalty rent as compensation for increased easement charges, such as underground wayleave and 'instroke' rent.(66) He maintained that the prospective leasee pressed hard for consideration of easement charges in the negotiations of royalty rent - however, more often than not only partial allowance was granted since the mineral owners, and their agents, expected to receive the average royalty for the district, irrespective of the easement charges.(67)

Even when the coal was brought to the surface the coal company was often confronted with payments of surface wayleave if it traversed adjoining land by a private railway. This commonly amounted to between 3d to 6d per ton.(68) Consett had to pay such amounts on coal taken from the Chopwell and Garesfield Collieries to Derwenthaugh.

The position of the Consett Iron Company was not as critical as that faced by some coal companies, for its location in North-West

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(65) R.C. on Mining Royalties, p.p. 1890 [c.6195] XXXVI 1. Q.Q. 700-701.

(66) 'Instroke' rent is payable where the coal from one leasor's property is drawn to the surface on the land of another leasor - it was paid to the first party in compensation for foregone 'shaft' rent.

(67) R.C. on Mining Royalties, p.p. 1890 [c.6195] XXXVI. 1. Q.712.

(68) Ibid., Q.718.

Durham gave the Directors the strength of a monopsonist in their dealings with royalty owners in the immediate vicinity of Consett. Most of the leases affecting the 'Consett Collieries' had been negotiated by the end of the 1860's, before there was a railway link to the Tyne at Blaydon. This meant the coal mined in and about Consett had to be exported by the North Eastern Railway's Pontop branch and was thus at a serious disadvantage when set beside the Tanfield Moor collieries in the matter of shipping coal to the Tyne for export. The situation as far as Consett was concerned was aggravated by the North Eastern Railway's pricing policy, which favoured the Crook-Bishop Auckland collieries. Coke could be transported thirty-six miles to Cleveland from these collieries 8d. per ton cheaper than Consett could put its coke f.o.b. in the Tyne, a distance of only twenty-two miles.(69) This view of the uncompetitiveness of Consett's 'Home Collieries' was substantiated by Edward Williams who concluded that the Company's mining properties were not well sited for sales on the open market.(70) This remained the case throughout the fifty years until 1914.

The Consett Iron Company were therefore the only sizeable market for coal in the locality, and so when bargaining with royalty owners began they had the option of accepting Consett's offer or continuing farming the land, or at the most to operate small pits supplying local domestic needs.(71) However the royalty owners were often firm in their dealings and occasionally extravagant with their

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(69) Directors' Minute, 8 May 1869. (DCRO:D/CO/29).

(70) Edward Williams, "Report on Iron-making at Consett," Directors' Minute 13 March 1869. (DCRO:D/CO/29).

(71) Mr. Coupland, from whom Consett purchased two leases at Sherburn and Westwood for £5,500 appears to have been such a small coalmining operator. Since the payment included plant and Stock his operations could not have been very large. Directors' Minute, 3 February and 10 March 1866. (DCRO:D/CO/29)

demands. In one instance the owners of some freehold and copyhold land in Iveston asked £9000 for thirty-two acres in 1867, but the Company did not entertain such a proposal, and held back until the owners accepted £4,500 in 1871.(72)

The proposal to build a railway between Blaydon and Consett also had an adverse effect on the Company's negotiating position, for it encouraged royalty owners in the belief that they could extort better terms. Negotiations for the Hamsterley estate were suspended when Elizabeth Surtees wrote:

> "I have come to the conclusion not to entertain any application for the Coal mines at present.
>
> "It will not be long before my son can judge for himself and the Consett Railway may in some degree improve our property and the District materially."(73)

Fortunately most of the Iron Company's coal leases, which affected the supply to the ironworks, had been renegotiated before the interference of the new railway, and the even more disturbing boom in coal prices in 1872-73. Advantageous leases were held by the Company from Sir Frederick Bathurst on the Lanchester Common; the Tin Mill Colliery acquired with the Shotley Bridge Ironworks was subject to tentale rent of 15s.6d per ten (50 tons) until 1870, whereupon it became 18s.6d until the expiry of the lease in 1884.(74)

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(72) Directors' Minute, 7 March 1871, p.102.(DCRO:D/CO/30).

(73) Elizabeth Surtees to the Directors of the Consett Iron Company Directors' Minute 12 November 1864. p.27.(DCRO:D/CO/29).

(74) Directors' Minute 16 August 1866. (DCRO:D/CO/29).

The main new acquisitions of leaseholds in the late 1860's were in the area east of the Derwent, around Ebchester. This scheme was related to the construction of the Consett-Blaydon line, and it was proposed to sink a shaft on the Sherburn tract adjoining the line.(75) The Westwood scheme was completed in 1867 by the acquisition of Okey and Graham's holdings in the Westwood estate, and a lease with the Trustees of Sherburn Hospital. This formed the basis of Consett coke sales plans embodied in Armstrong and Boyd's Reports.

At the beginning of the 1870's the Company diverted its attention from those royalties in its immediate vicinity, and began to explore the possibilities of acquiring the Earl of Durham's Langley Royalty. In 1871 it offered the Earl a certain rent £1,250 on his 1,470 acre royalty with a tentale rent of 25s.0d rising in fourteen years to 30s.0d. per ten.(76) The Earl held out until the peak of the boom in 1873 when he proposed a counter-offer to Consett of one shilling per ton royalty rent. This was unheard of for an unproven coal tract and the Board initially rejected it.(77) Subsequently, however, the Consett Directors gave way and accepted the terms, which meant the payment of a royalty rent nearly double that of the average for the Company's other collieries. By the time exploratory borings had been made and the pit sunk, four years had elapsed. The ascertained price of coal had fallen from a peak of 15s.10d in January of 1873 to 5s.8d in 1876 and finally to the lowest price of 4s.3d per ton in October of 1879. The dramatic deterioration of the coal market induced the Directors to apply to Lord Durham for a reduction

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(75) Directors' Minute, 7 April 1866.(DCRO:D/CO/29).
(76) Directors' Minute, 6 November 1871. pp. 135-137.(DCRO:D/CO/30).
(77) Directors' Minute, 4 March 1873. pp. 218-219.(DCRO : D/CO/30).

in the royalty rent. The persistence of low prices eventually persuaded his Lordship to grant a temporary 10 per cent reduction during 1884 and 1885.(78) In 1887 another reduction in rent and royalty was obtained on the late Joseph Laycock's Whittonstall Royalty. In this case it was a permanent reduction of certain rent from £500 to £300, and tonnage rent from 7d. to 5d.(79)

However, pleas for reductions and threats of lease termination were an unsatisfactory way in which to conduct business affairs. While the royalty owners persisted in trying to extract onerous royalty payments even during depression, they often inadvertently harmed themselves, and invariably imperilled the coal companies. In trying to maximise the price they received they often forced the coal companies to curtail or limit their operations, and thus they failed to maximise their revenue.(80) Sliding scales relating elements of cost to ascertained prices were very much in vogue during the 1870's and it is therefore only natural that this principle should have been extended to negotiation of mineral leases. Royalty payments related to the price of coal were customary in Scotland but still exceptional in the North of England. The Consett Iron Company negotiated its first sliding scale on a mineral lease in 1875, when it bought Mr. Carr's Milkwellburn Royalty for £29,500. Carr held the royalty on lease from the Duke of Northumberland and when Consett arranged a new forty-two years lease in 1875 it embodied the principle of a sliding scale.(81) From this

(78) Directors' Minute, 21 October 1884, p.171. (DCRO:D/CO/33).
(79) Directors' Minute, 2 May 1887 p.8. (DCRO : D/CO/34).
(80) Royal Commission on Mining Royalties, P.P. 1890 [c.6195] XXXVI.1. Q. 739.
(81) Directors' Minute, 5 October 1875, p.129. (DCRO:D/CO/31).

time on the Company attempted to have the principle inserted in all its new leases.

The 1880's were a period of consolidation, and the renewal of several important twenty-one years leases made during the 1860's. The most important lease was on Sir. F.H.H. Bathurst's land and 1884 this reverted to a direct lease of minerals by the Iron Company from the Ecclesiastical Commissioners who were the original royalty owners. This continued a lease between the Bishop of Durham and Sir F.H.H. Bathurst made in 1850 and renewed in 1868.(82) Consett renewed the lease with Sir. F.H.H. Bathurst in 1869.(83) Under the new 1884 lease the tentale rent was 22s.0d per ten between 1884-1900, and then 24s.0d. per ten until the lease expired in 1926.(84) Another important renewal was on the Allgood's Medomsley coal for a further twenty-one years on the same terms; the only alteration to the conditions of this lease was the addition of a sliding scale to govern the tonnage rent.(85)

In securing new leases the 1880's were probably most important for the consolidation of workings north of the Derwent. Expansion there had taken its first crude shape almost by chance in the mid 1870's when John Carr had offered a royalty and some coke ovens at Westwood to the Consett Iron Company. Though Carr apparently saw his offer as a supplement to the Westwood development, the Consett Directors did not find it attractive in that context. However, they did perceive that if Carr's lease from the Duke of Northumberland could be renewed and the adjacent royalties of the Marquis of Bute and Elizabeth Surtees obtained, then a new

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(82) Lease of Coalmines &c. in the Parish of Lanchester, the Bishop of Durham to Sir. F.H.H. Bathurst, 1850. (Church Sommissioners MSS. 209/125771; University of Durham).

(83) Directors' Minute, 2 November 1869. (DCRO:D/CO/29).

development worthy of consideration would emerge.(86) After eight months negotiations the Company secured Carr's lease, but more important renewed the lease with the Duke of Northumberland. The terms were £500. certain rent for the first three years and then £1,000 per annum for the remaining thirty-nine years; the royalty rent was set at a basic 9d per ton, but was governed by a sliding scale.(87)

In 1878 the Company began to negotiate in earnest for the Marquis of Bute's estates in Durham. At first it concentrated its attention on the Ravenside Royalty, but in July 1878 Armstrong advised the Board that before committing themselves to the Ravenside Royalty alone, they should consider "the advisability of treating for the Garesfield Colliery and the adjoining Royalties of the Marquis..." The Directors agreed with Armstrong's reasoning but were "somewhat averse to engage with a Colliery so far removed from their other operations as Garesfield..."(88) William Hedley's investigation into the quality and the price fetched by Garesfield coal proved unfavourable, allowing the Directors to reject Armstrong's advice, and continue bargaining for Ravenside alone.

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(84) Reversionary lease of Coal, Ironstone and Fireclay underlands at Lanchester in the County of Durham. Ecclesiastical Commissioners of England to the Consett Iron Company, 1884. (Church Commissioners MSS 261/214265: University of Durham.)

(85) Directors' Minute, 14 June 1869, p.10. (DCRO:D/CO/29).

(86) Directors' Minute, 2 February 1875, p.91. (DCRO:D/CO/31).

(87) Directors' Minute, 5 October 1875, p.129. (DCRO:D/CO/31).

(88) Directors' Minute, 2 July 1878, p.88. (DCRO:D/CO/32).

Talks between Lord Bute's representatives and Consett dragged on until 1881, largely because of a disagreement over who was responsible for the construction of a railway line to Stocksfield; the Marquis refused to make any contribution. Finally in June 1881 the royalty was offered for sale and Consett's bid of £10,000 was insufficient.(89) The next move of significance occurred in 1884 when Mr. Green, Lord Bute's agent, offered Ravenside and West Chopwell for sale at £50,000 but this proved in excess of the valuation placed on the property by W.H. Hedley. However, from 1885 it became apparent that Lord Bute wished to sell his property outright, rather than lease it, for he would not entertain an offer of leasing terms put forward by Consett.

The year 1885 may be taken as the critical turning point in these negotiations, for besides Lord Bute's apparent anxiety to sell his Durham property, Mrs. Surtees also became willing to let the Woodhead Royalty.(90) Optimistic that the outstanding royalties of Woodhead and Ravenside would be ultimately secured, the Directors drew up their first comprehensive plans for the development of the royalties north of the Derwent in 1886.(91) Such plans could only be tentative, for much depended upon land and concessions secured from Lord Bute.

A final settlement was eventually reached in 1889; once again Consett proposed to take out a lease but Mr. Geddes, who was now representing Lord Bute, declined the offer. He did however make counter-offer of a sale for £120,000 and on this occasion the sale price fell below William Hedley's valuation of the property.(92) The offer included Chopwell Estate,

(89) Directors' Minute, 2 August 1881, p.274. (DCRO:D/CO/32).
(90) Directors' Minute, 20 January 1885, p.183.(DCRO:D/CO/33).
(91) Directors' Minute, 4 May 1886, p.255-256.(DCRO:D/CO/33).
(92) Directors' Minute, 1 June 1889, pp.102-103.(DCRO:D/CO/34).

Garesfield Colliery and the Ravenside Royalty. The agreement reached in July 1889 included property at Derwenthaugh on the Tyne; the wayleave belonging to the Winlaton Partnership Estate; Garesfield wayleave subject to lease; the Thornley Estate wayleave; and all moveable plant and stock belonging to the Garesfield Colliery. These extras cost Consett a further £20,000.(93) The completion of this scheme of royalty acquisition established the basis for the dramatic growth of Consett's coal output in the years leading up to 1914. In this respect it was probably one of the Directors' most farsighted and remunerative policies.

From 1890 onwards the physical structure of royalties held by the Consett Iron Company was altered little by the acquisition of new leases. Throughout the 1890's much of the Company's negotiating was concentrated upon Laycock's Whittonstall Royalty which formed an integral part of the Chopwell scheme in its physical location, but could only be worked from a new sinking. In 1892 the 1887 agreement which had secured a reduction in royalty and rent came up for renewal. Laycock was not prepared to acquiesce to Consett's proposals and in 1893 the Company gave notice that it would terminate the lease on the 13 May 1895. Consett was matching Laycock's stubbornness with its bargaining strength. In 1896 it was intimated to it that the Mickley Coal Company, the only likely competitors for the Whittonstall Royalty, were not interested.(94)

With his bargaining position thus weakened, Laycock submitted to a reduced royalty of 5d. per ton, and the Board decided to retake the Royalty on terms to be decided. However, all did not go smoothly, for Consett insisted upon the right to work 10,000 tons of 'shorts' which had accrued to it under the previous lease, while for his part, Laycock stubbornly refused.

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(93) Directors' Minute, 2 July 1889 pp.107-109. (DCRO:D/CO/34).
(94) Directors' Minute, 9 June 1896 p.63. DCRO:D/CO/36).

The impasse was not overcome until 1906, when along with the renewal of the Duke of Northumberland's Chopwell lease, the Company drew up a very favourable lease with Laycock, paying only 4½d per ton royalty on all coals.

The only other significant acquisition occured in 1901 when the Ecclesiastical Commissioners for England took over and renewed a lease formerly held under the Dean and Chapter of Durham. The new lease included 120 acres of land adjoining Lord Durham's Langley Royalty. An interesting feature is the divergence in royalty paid to the Church as compared to that paid to the Earl; the new lease set a royalty of only 6d. per ton,(95) whilst the renewal of the Langley Royalty in 1910 was at 10d per ton on Busty and Hutton seams, and 4d. to 6d. on all others.(96) In 1904 a further sixty-seven acres were added to Langley Park by an additional lease from Lord Durham.

Besides these relatively minor additions to the overall size of the Consett Iron Company's mineral holdings, the last years leading up to the First World War were devoted to the important task of renewing certain crucial leases. The most urgent renewal was on Langley Royalty, the lease of which ran out in 1915; it was successfully extended for forty-two years on terms in effect not substantially different from the original lease. The main difference was a higher certain rent, and a variation in royalty depending upon whether the coal was for coking and also on the ease with which the seam could be worked.(97)

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(95) Directors' Minute, 9 February 1901, p.23.(DCRO:D/CO/39).
(96) Directors' Minute, 6 December 1910 p. 108.(DCRO:D/CO/42).
(97) Ibid.

Equally important but less urgent was the renewal of the extensive Ecclesiastical Commissioners' lands which were the basis of the 'Home Collieries'. Though this was not due until 1926 the Company was contemplating extensive capital investments, both on a new colliery at Crookhall and on plant for the blastfurnaces. Before undertaking the expenditure of £600,000 the Directors wanted to be assured of a new long lease.(98) The lease was renewed without hitch for forty-two years in 1913, on terms only slightly more demanding than previously.(99) The management was overjoyed at the terms, forecasting "that in 13 years time, coal will probably be of a greater value than it is now, and we would not be able to get such terms as are now offered to us....." (Mr. Kirkup) (100)

4. The Cost of Royalties.

The preceding section has traced the acquisition of coal royalties by the Consett Iron Company, and to some extent that has thrown some light upon the extent of the Company's monopsonist power.

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(98) Directors' Minute, 1 November 1910, pp. 97-98.(DCRO:D/CO/42).
(99) Directors' Minute 3 June 1913,pp.59-61.(DCRO:D/CO/43).
(100) Ibid.

TABLE IV.5

Tonnage rents paid in Northumberland and Durham c. 1890

Type of Rent	Maximum	Minimum	Average
Royalty	10d	2½d	5d
Underground Wayleave	0.62d	0.26d	0.39d
Shaft Rent	0.62d	0.26d	0.39d
Surface Wayleave	0.62d	0.26d	0.39d

Source: R.C. on Mining Royalties, P.P. 1890 [c.6195] XXXVI.1. Appendix B. p.203.

In this section Consett will be compared with Bell Brothers who owned collieries in the Wear Valley not too far from Langley Park, in the heart of the area supplying coke to Tees-side. Over the period 1885-89 Consett's 'Home Collieries' paid an average royalty of 5.02d per ton, whilst Bell Brothers paid 9.54d per ton at their South Brancepeth Colliery. Since this cost is equivalent to the price which had to be paid to the royalty owner for the right to mine minerals, it gives some indication of the different conditions prevailing in the market for mineral rights in these two districts. That competition for the purchase or acquisition of leaseholding in the Browney and Wear Valleys was more keen than that in the locality of Consett is further borne out by the royalty paid at Langley Park which averaged 7.87d per ton over the period 1885-89.

TABLE IV.6

Royalty paid per ton of coal, at five yearly intervals

1870-1914

Year	CONSETT IRON COMPANY Home Collieries'	Langley Park[a]	Garesfield[a]	Bell Brothers S. Brancepeth
1870	3.38d			
1875	4.15d			8.0d
1880	3.79d	8.06d[b]		9.5d
1885	4.92d	9.25d		9.5d
1890	5.58d	13.68d	12.58d	8.6d
1895	5.51d	8.19d	6.05d	9.2d
1900	5.90d	13.96d	6.21d	8.7d
1905	6.16d	6.62d	6.30d	8.8d
1910	6.66d	7.09d	6.26d	8.7d
1914	7.00d	8.04d	5.39d	8.4d (1913)

a. Average during the first six months of each year.

b. The Earl of Durham adopted a sliding scale.

Source: Private Cost Books 1868-1905; 1892-1909; 1910-1926 (DCRO : D/CO/97, 100 and 101); Bell Brothers, Cost Accounts 1873-1916. (North Riding Record Office: Dorman Long MSS.).

Whilst the royalty payments at Consett tended to move upwards throughout the whole period to 1914, being then more than double what they had been in 1870, Bell Brothers' cost were maintained more or less constant, between 8d - 9½d per ton. During the first half of the 1880's Langley Park's royalty payments were comparable with those of Bell Brothers, but then fluctuated widely during the 1890's, probably because of the adoption of the sliding scale. After 1902 the average Langley royalty fell to just over 6d. because of the revised terms for working non-coking coals. The constancy of Garesfield and Chopwell royalties is probably because the Company computed a charge, payable to itself, since it owned most of the royalties from which coal was taken by those collieries.

It is likely that Bell Brothers paid so much because they were operating in the prime coke producing area for Cleveland, and the Furness district of Lancashire. Other large coke producers in the area included Bolckow Vaughan, Pease and Partners, Sir Bernhard Samuelson, and the Carlton Iron Company. Since most of the development occured in the 1860's competition drove up the level to be paid in royalties. Consett on the other hand was generally badly sited for coke export, the other chief producers in the area, the Stella Coal Company, Priestman's and John Bowes and Partners being situated closer to the Tyne for shipment.

Assuming that Bell Brothers had a normal twenty-one year lease on their coal tracts, renewal would have been due in the depressed 1880's and then again after the turn of the century when the market for coke had stagnated. Under such circumstances they would have been in a favourable position for renegotiation. The Consett Collieries on the other

hand were the life blood of the ironworks, and thus the lessors were to some extent in a more favourable position at the time of renewal. However, they were by no means able to wring large concessions from the Iron Company, and the rise in royalty payments barely compensated for the decline in the value of money after 1900.

Since both Consett and Bell Brothers were working coal of a similar quality ie. for coking purposes, the royalty differential cannot be attributed to a variation in quality. Nor can the difference be put down to superior bargaining techniques of the Consett management, for when Consett leased land in the Browney valley it had to pay a similar royalty to that paid by Bell's at South Brancepeth. On the basis of the available evidence it seems legitimate to conclude that Consett did enjoy a certain amount of monopsonist power which depressed its cost curve below the level that would be expected under competitive conditions, such as those in the South-West Durham district.

However, one other factor bears consideration, and that is the marginal product of the coal seams; if labour productivity at Consett were significantly lower than that at South Brancepeth then labour costs, assuming a constant price for labour, would be higher at Consett. Given that price was determined by a competitive market, then rising labour costs would reduce the residual; if other costs and profit expectations remained constant, then royalties would decrease as labour productivity fell, signifying that as the facility with which the seams were worked decreased so would the rent. This gives royalties the characteristic of pure rent, but since coal seams are exhaustible they are also a price paid for the removal of a mineral. Overall, however, there was not a significant difference between labour productivity of Consett's collieries compared to South Brancepeth.

TABLE IV.7

Amount Paid Annually in Royalties by Consett

Year ending June	Home Collieries[a]	Westwood	Langley Park	Garesfield[a]	Chopwell[a]	Total
1868	£ 7424					£ 7424
1870	£ 6983					£ 6983
1875	£12186					£12186
1880	£11139		£ 4663			£15802
1885	£14660		£ 4709			£19369
1890	£18296		£ 8967	£ 2738		£30001
1895	£14513	£ 3964	£ 9024	£ 5852		£33353
1900	£17525	£ 4025	£22298	£ 5898	£ 4689	£54435
1905	£18281	£ 108	£14972	£ 6945	£ 9486	£49792
1910	£20246	£ 7958	£15086	£ 9631	£17647	£70568
1914	£19503	£ 9230	£15694	£ 7228	£17828	£69483

a. There is an element of royalty charged in the accounts which would in fact be paid to the Consett Iron Company itself. In the case of Chopwell and Garesfield almost all the royalty charged would in fact accrue to Consett as the mineral-owner. The Chopwell and Garesfield data also excludes wayleave paid.

Source: Private Cost Books 1868-1905; 1892-1909; 1910-1926. (DCRO : D/CO/97, 100 and 101.)

Finally Table IV.7 shows the total cost of royalties paid by Consett annually to the lessors. Between 1868 and 1914 it increased almost tenfold, whilst output increased by about six times. The difference is accounted for by the rising average cost of royalty especially after 1895. This can be largely explained in terms of price related sliding scales as the price of coal on balance rose during the Edwardian period.

In many respects the acquisition of coal royalties was a long term policy decision, requiring a mixture of intuition and experience to forecast demand and requirements ten or even twenty years ahead. Consett probably was lucky to achieve the growth that it did, but the luck was well harnessed by the skill and foresight of its Directors, several of whom brought their coal trade experience to the aid of the Company. The most notable was undoubtedly David Dale, who had a part in negotiating many of the Company's leases; he was also the Managing Director of Pease and Partners, Ltd. the largest coal company in Durham. There were others such as John and C.W.C. Henderson, and William and Frank Stobart,(101) who either chaired the Board meetings or served on the Coal Committee, a useful adjunct to the Board which utilized the experience and interests of the Directors. By their activity they were able to shade a map of north west Durham in Consett's colours by the outbreak of the Great War.

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(101) Frank Stobart was elected to the Board in 1905, on the retirement of William Stobart, was the intermediary who acted on behalf of the Earl of Durham and the Ecclesiastical Commissioners in their negotiations with Consett regarding royalties.

CHAPTER V.

COSTS AND PRODUCTIVITY

Since Consett was unable to control the demand side of its coal business, it remains to be seen whether it was able to manage the supply side to its advantage. In the previous section it has been shown that the Company enjoyed a certain amount of success in applying monopsonist powers to the business of acquiring coal royalties, particularly in the Consett vicinity itself.

More can be added to this examination by comparing the costs of raising coal incurred by the Consett Iron Company, and the Middlesbrough pig iron manufacturers, Bell Brothers. The latter firm was established at Port Clarence on Tees-side in 1854 to exploit the deposits of ironstone found during the 1840's. Having acquired a sound base of royalties for mining ironstone, the Company then turned its attention to securing coal royalties. These were situated in the triangular area bounded by Bishop Auckland, Spennymoor and Langley Moor.

The first half of the chapter will deal with the relationship between productivity and costs, and their impact upon the rate of technical innovation. From the comparative data with Bell's it will be shown that Consett's clear cut cost advantage was eroded by the mid-1890's, and was not regained before 1914. It will also be seen that Consett was slower in adopting by-product ovens in the early 1900's than its competitors, despite its record of adverse cost conditions.

In the second half of the chapter the supply of labour and its relation with management will be examined. In this area of supply Consett did not have any significant monopsonist power mainly because of the large demand for miners from the mid-1890's onward, and of the influence of the

Durham Miners' Association. It will also be seen that the settled labour relations at Consett became increasingly disturbed during the Edwardian era, especially after the death of David Dale in 1906.

Clearly Consett had no lasting monopsony powers in the supply of labour. and once productivity began to fail in the late 1890's, so too did the comparative cost advantage.

The following Table illustrates the trend in the average total costs of mining coal. This shows the steady upward trend in the cost of winning coal at Consett's Home Collieries,' compared with fairly constant costs at Langley Park until 1905, and declining costs at South Brancepeth Colliery, belonging to Bell Brothers' until the turn of the century. The costs at the two other 'Sale Collieries,' Garesfield and Chopwell, were consistently higher than those at Langley Park.

TABLE V.1.

Variable
Average Cost of Coal Production per ton[a] at the

Collieries of the Consett Iron Company and Bell Brothers

	CONSETT IRON COMPANY				Bell Brothers South
Year	Consett	Langley Park	Garesfield	Chopwell	Brancepeth
1870	3s. 3d				
1875	4s.11d				6s. 0½d
1880	3s. 9d	3s.9½d			4s. 9d
1885	4s. 1d	4s. 4d			5s. 3d
1890	5s. 0d	4s.10d	5s.11½d		5s. 0d
1895	5s. 0d	4s. 8d	5s. 1½d		4s. 6d
1900	6s. 1d	4s. 7d	5s.10 d	6s. 5d	5s. 9d
1905	6s. 6d	4s.10d	6s. 2½d	6s.0½d	5s. 2d
1910	7s. 9d	6s.5½d	7s. 9 d	7s.11d	7s. 4d
1913	7s. 1d	6s.9½d	8s. 7 d	8s. 3d	8s. 5d

a. To the near ½d per ton. Source.: Private Cost Books 1868-1905; 1892-1909; 1910-1926. (DCRO : D/CO/97, 100 and 101).
Bell Brothers Cost Accounts, 1873-1916.(NRRO : Dorman Long M.S.S.).
All the Consett costs in the accounts were variable.

An explanation of Consett's rise in costs in the 'Home Collieries' may be that after the establishment in 1869 of the Durham Miners' Association any control the Company had over its labour supply was eroded by the improved organisation of the miners.

Labour costs were the largest single component in total costs and as such had the greatest impact upon total costs.

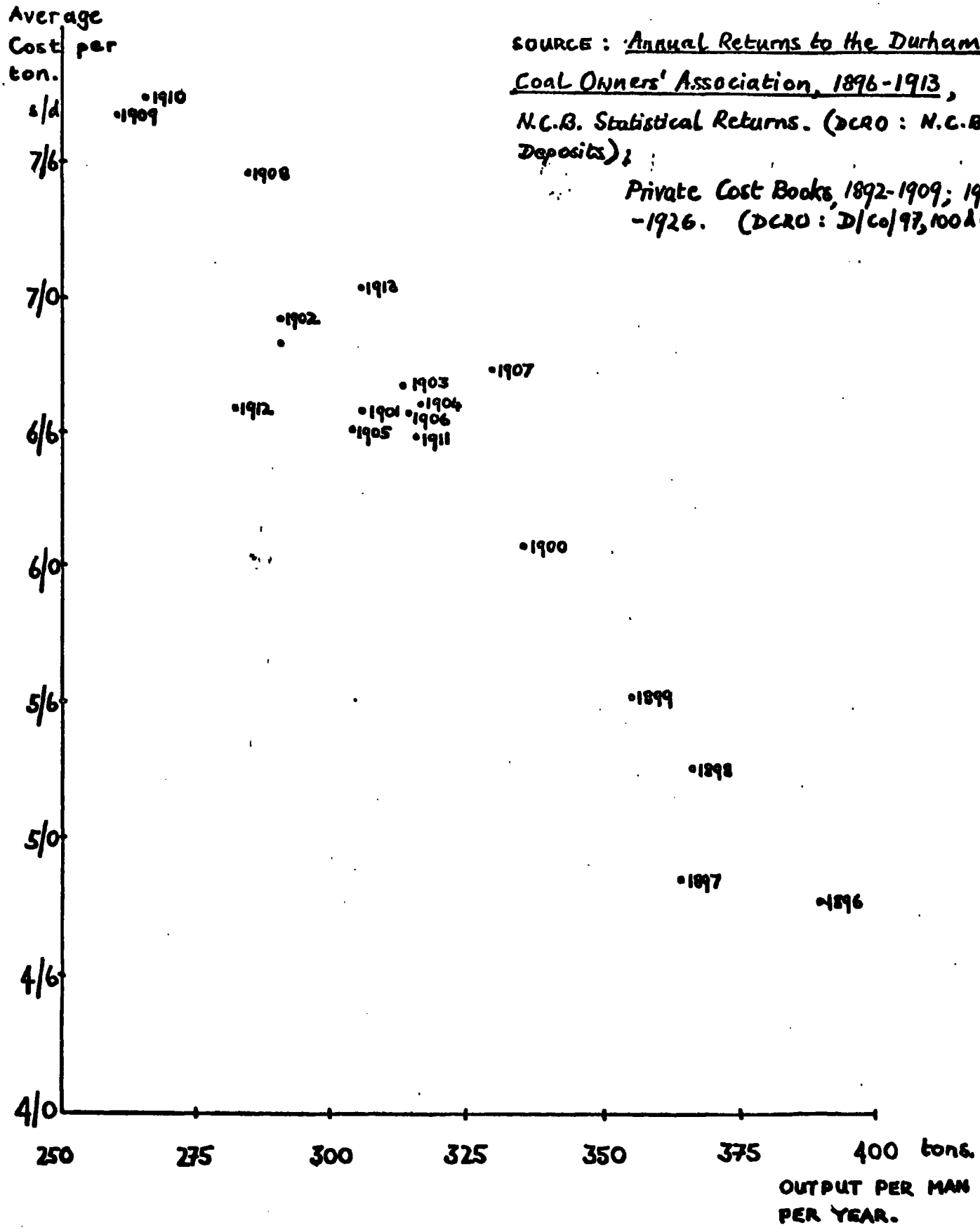
1. Labour Costs

In 1868 labour costs accounted for 52.3 per cent of total costs at the 'Home Collieries' and rose to 64.5 per cent by 1914; at South Brancepeth the figures were very similar, 57.1 per cent in 1871 and 67.3 per cent by 1913. Whilst total costs rose by fractionally over 100 per cent between 1868-1913 labour costs increased one and a half times, and accounted for three quarters of the monetary increase.

However labour costs varied between the collieries, and particularly between the 'Home Collieries' and Langley Park, the differential being greatest between 1897-1910. Between 1885-1907 South Brancepeth's labour costs were also consistently below those at Consett, but never as dramatically as Langley Parks'. Labour productivity was the crucial element in labour costs, the higher the productivity per man, the lower the level of costs. Chart V.1 shows the close correlation between productivity and cost at the 'Home Collieries'. Langley Park exhibited a similarly close relationship. The element of cost not explained by the level of productivity can be accounted for by varying prices for labour, and by the general decline in the value of the money. However, the fact that output per man year between 300-325 tons corresponds with a cost

CHART V.1

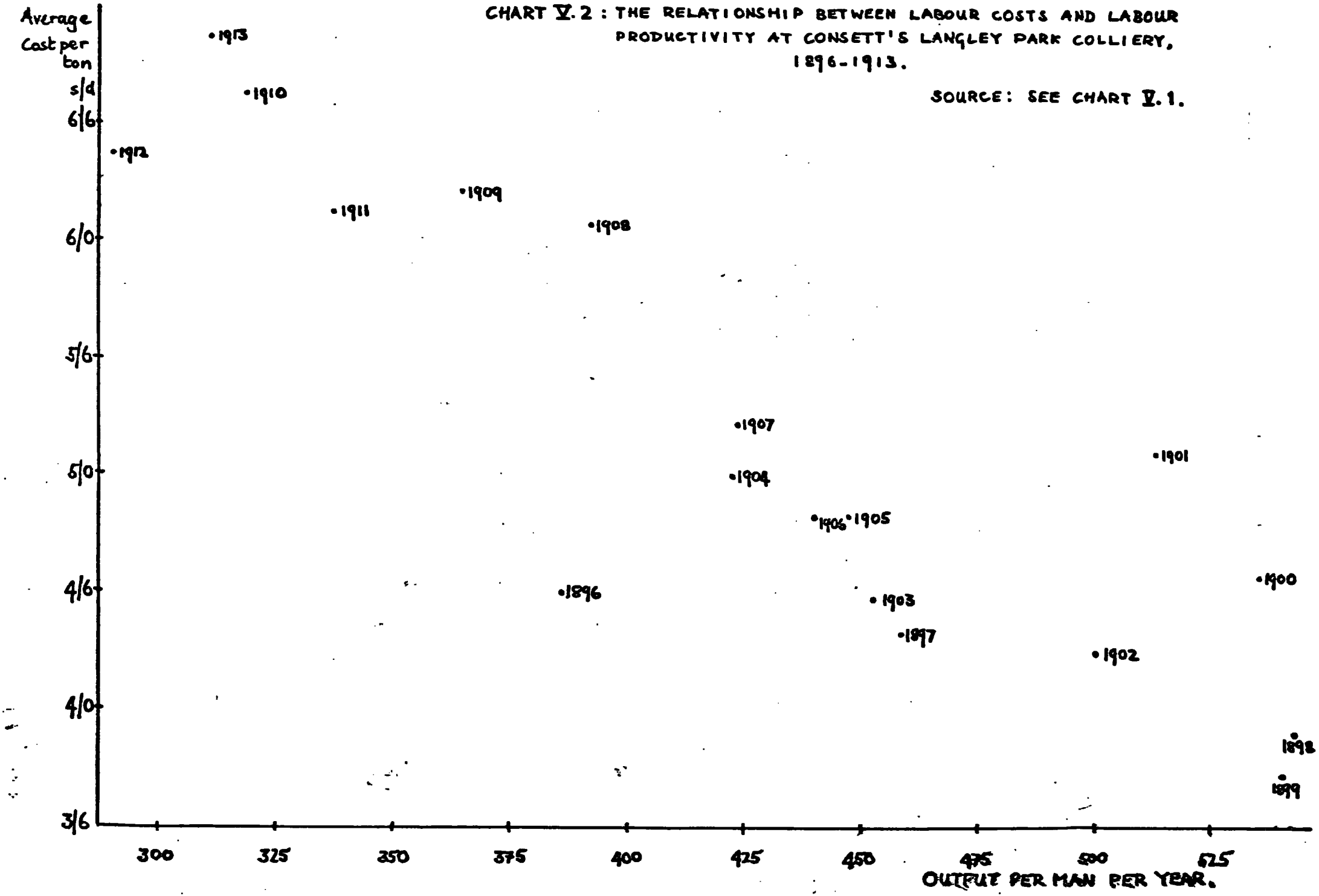
THE RELATIONSHIP BETWEEN LABOUR COST AND LABOUR PRODUCTIVITY AT CONSETT 'HOME COLLIERIES', 1896-1913.



SOURCE : Annual Returns to the Durham Coal Owners' Association, 1896-1913, N.C.B. Statistical Returns. (DCRO : N.C.B. Deposits); Private Cost Books, 1892-1909; 1910-1926. (DCRO : D/Co/97, 100 & 101)

CHART V.2 : THE RELATIONSHIP BETWEEN LABOUR COSTS AND LABOUR PRODUCTIVITY AT CONSETT'S LANGLEY PARK COLLIERY, 1896-1913.

SOURCE: SEE CHART V.1.



of 6s.6d to 7s.0d per ton at both collieries suggests that the prices paid for work were not significantly different between Consett and Langley Park. This adds further to the suspicion that Consett's isolation in north west Durham offered no compensating monopsony in the labour market.

In coal-mining, or any extractive industry, eventually diminishing returns will be encountered. However, it has been claimed that on the whole the declining productivity encountered by the industry was caused as much by ineffective management and recalcitrant labour as by diminishing returns.(1)

In 1925 the Samuel Commission claimed to find a marked correlation between size, labour productivity and profitability.(2) The Commission's reasoning was however at fault since their results were biased by the influence of the new large collieries opened in the recently developed Nottingham and South Yorkshire coalfields.(3)

More recently Professor Johnston has found that there is no correlation between scale and costs in operating a colliery.(4) Since costs are so dependent upon labour productivity, there is not likely to be any correlation between size and labour productivity either. The evidence within Consett's group of collieries supports such a null hypothesis. Productivity was in fact more dependent upon geological conditions, and the age of pits. A striking example in the Consett group was the difference between the Hunter Pit and Chopwell Colliery.

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(1) A.J. Taylor, "Labour Productivity and Technological Innovation in the British Coal Trade, 1850-1914" Economic History Review, 2nd ser. XIV (1961).

(2) Samuel Commission, P.P. 1925 (c.2600) XIV.1. III, pp. 216-217; I, pp. 259 et.se

(3) R.W. Dron, The Economics of Coal Mining (London, 1928) p.p. 111-112.

(4) J. Johnston, Statistical Cost Analysis (New York, 1960) p.p. 97-102.

TABLE V.2.

Coal Output per Man per Year at the Collieries of the Consett Iron Company

	Blackhill	Delves	Derwent	Eden Pit	Hunter	Medomsley	Chopwell	Garesfield	LP	Westwood
1896	390.6	324.1	361.0	486.2	492.0	325.3		303.9	386.3	313.1
7	345.9	280.6	348.4	450.9	444.7	312.6	133.1	298.8	458.5	324.0
8	339.9	313.1	348.9	453.6	525.8	285.4	204.0	262.0	547.4	320.1
9	332.3	286.3	372.7	406.0	421.3	304.8	291.6	285.7	543.8	325.6
1900	319.5	238.5	332.6	385.5	470.1	280.9	284.8	268.4	536.2	323.1
1	289.8	230.5	314.5	342.7	386.9	271.9	320.8	275.9	51.30	270.0
2	276.1	223.5	301.2	318.4	364.8	265.6	330.2	294.2	500.3	106.7
3	295.6	240.4	306.1	354.6	397.6	304.0	333.8	294.5	452.6	127.5
4	311.1	248.7	306.9	369.6	404.1	298.1	304.2	265.6	423.2	143.5
5	301.6	258.9	294.2	298.9	452.1	266.5	269.8	261.0	447.7	163.6
6	309.3	295.9	309.6	304.2	416.3	288.1	262.9	260.2	439.7	292.5
7	325.7	277.2	332.3	381.1	456.8	279.2	261.3	275.1	423.6	293.8
8	271.8	246.0	261.9	344.9	403.4	255.6	275.0	284.4	392.2	288.0
9	236.6	219.9	258.3	304.8	334.9	246.3	299.9	258.9	365.3	292.4
1910	242.4	223.0	265.7	327.3	336.4	241.3	293.3	241.2	319.2	248.0
1	-	253.0	326.3	440.5	-	279.0	295.9	251.6	337.3	264.9
2	-	263.6	278.4	358.2	-	248.7	274.6	222.9	290.6	225.3
3	-	300.5	283.8	396.7	-	274.6	266.3	248.2	312.7	262.1
4	-	-	280.7	336.9	-	292.5	267.7	228.1	279.3	354.2

Source: "Annual Returns of the Durham Coal Owners' Association, 1896-1914" National Coal Board Statistical Returns, Nos. 401, 406, 441; 482; 501; 526; 540; 555; 577; 586; 595; 612; 651; 673; 685. (DCRO : N.C.B. Deposits.)

Costs at Hunter Pit were consistently lower than those at Chopwell despite the pit being nine years older (opened 1888), and its size becoming progressively smaller relative to Chopwell. Inter-colliery comparisons may be unrepresentative, but changes in scale within one colliery, over time, do not produce any significantly differing conclusions. For instance Langley Park's output rose from 302,685 tons in 1898 to 494,295 tons in 1905, yet labour productivity fell from 547.4 tons per man per annum to 447.7 tons, and costs rose from 3s.10½d to 4s.10d. There is no positive statement that can be made about costs and size.

2. Innovation and Technical Change

Though the actual size of the pits seems to have been of little significance to cost functions, the size of the firm may have been important.

> "The small firm, controlling one or two medium-sized collieries, might wait many years to see a return on its investment; it faced certain prospect that in the perhaps not distant future its capital assets would steadily waste away, and in the meantime it was in the grip of market forces which might bring prosperity but could equally lead to loss."(5)

Consett was not a small firm, in fact the Company was consistently amongst the top ten producers of coal in Durham throughout the period. The size of the Company endowed it with certain advantages, as did its diversified activities. The tendency of trade in coal and steel to be somewhat offset, if not counter-

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(5) A.J. Taylor, "Labour Producivity...." p.64.

cyclical, enabled the Directors to show a good record of profitability, and so there was never any problem in obtaining capital. The Company's distribution of profits was fairly conservative by the standards of the time, and especially when compared the philosophy of some coal companies.

> "I think the best plan in managing a colliery.....is to hand to your shareholders the money that is made, keeping back a sufficient reserve fund for emergencies. In the concerns I have to do with we never put aside any redemption sum". (6)

A second advantage of size was the machinery that was purchased could be transferred from one pit to another, if and when necessary. Smaller firms did not have so much scope, thus incurring losses if a machine had to be sold or scrapped because it proved unsuitable to that colliery's needs.

Given that the size of Consett's operations were amenable to innovation and technical change, what was the response of management? On the whole Consett's management did show responsiveness whenever costs demanded factor substitution. Often the innovations implemented were not of a direct cost saving nature, as for example the installation of electric lighting at Langley Park, for though it was unlikely to be cheaper "the screening at night would be more efficiently done." (7) Two years later Mr. Logan anticipated that the introduction of electric lighting would bring about "no direct cost saving....., save that derived indirectly from a better quality of light."(8) The expenditure

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(6) R.C. on Coal Supply, .P.P. 1905 (c.2362) XVI,1. Emerson Bainbridge's Evidence.

(7) Directors' Minute, 7 July 1896, p.70.(DCRO : D/CO/36).

(8) Directors' Minute, 13 September 1898,p.53.(DCRO : D/CO/37).

on these two improvements was by no means extravagant; the Langley Park unit from the Corlett Engineering Company cost £563, whilst the unit at Garesfield from Scott and Mountain cost £740. The latter had sufficient power to supply part of the Blaydon Urban District Council.(9)

Once electricity was installed in the pits for lighting purposes it increased the scope for further innovations. In 1894 an electric hauling engine was installed at Westwood, replacing 14 pit ponies.(10) Not only was electric haulage more efficient than animal power, itwas also "better and cheaper than steam haulage."(11) After further piecemeal provision and expansion of electrical plant during the first decade of the twentieth century, the Board eventually drew up a comprehensive scheme of electrification of their coal mines in 1910. The scheme included a new generating station at Chopwell, with turbo-generators costing £13,148 from Belliss and Morcom; a second high tension line between Chopwell and Garesfield; new haulage plant underground; new electrical ventillating plant at Langley Park; and the electrification of screens and other apparatus.(12)

The installation of electrical power in their pits was the Consett management's one area of innovatory vigour. That they had a good deal of experience in this problem is indicated by the appointment of one of their viewers, Mr. Palmer, to the Home Office Departmental Committee on the supply of electricity in coal mines, in 1904.(13)

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(9) See footnotes (12) and (13).
(10) Directors' Minute, 6 November 1894, p.6. (DCRO : D/CO/36).
(11) Directors' Minute, 13 December 1898, p.78. (DCRO : D/CO/37).
(12) Directors' Minute, 1 March 1910, p.p. 25-28.(DCRO : D/CO/42).
(13) Directors' Minute, 3 March 1903, p.155.(DCRO : D/CO/39).

The introduction of electricity paved the way for another important innovation, the use of coal-cutting machinery and mechancial conveyance from the pit face. Electricity provided a more flexible and mobile source of power than compressed air, the alternative source of power for driving machinery underground. It was also more efficient, since the transmission of compressed air over long distances often led to a loss of pressure, and a subsequent decline in the working efficiency of the machines.(14) However, the availability of power was not the crucial factor in the introduction of coal-cutting machinery; of primary importance was the geological condition of the seam, its width, the texture of the coal, the condition of the floor and roof, and the incidence of faulting. Coal-cutters only became economically viable when either the hewer's productivity fell below between $2\frac{1}{2}$ - 3 tons per shift, or when the cost of getting coal by hand rose above 2s.0d per ton.(15)

By the turn of the century the Consett Iron Company was confronted by critically high costs in some of their 'Home Collieries', particularly Medomsley and Derwent.

TABLE V.3.

Hewers productivity per shift[a] at Medomsley and Derwent Pits, 1896 and 1901.

Year	Medomsley	Derwent
1896	3.29 tons per shift	2.90 tons per shift
1901	2.90 tons per shift	2.88 tons per shift

Source : The Returns of the Durham Coal Owners' Association Output and Employment, 1896 & 1901. N.C.B. Statistical Returns, Nos. 401 and 406. (DCRO : N.C.B. Deposits.)

a. Derived on the basis of 10 shifts per pay, and 26 pays per year.

$$\frac{\text{Output per year}}{\text{(Number of hewers) (Number of shifts per year)}}.$$

(14) A.J. Taylor, "Labour Productivity....", p.59.
(15) R.C. on Coal Supplies. P.P. 1905 (c.2363) XVI.1. Appendix VII pp. 44-46.

On the basis of the above Table, Medomsley was at the margin of feasibility for machine cutting in 1901. In November of that year it was reported to the Directors that Mr. Palmer and Mr. Greener, of Pease and Partners, had visited some Belgian mines to inspect electric coal-cutting machinery. Arrangements were made for two representatives of the Morgan, Gardner Company of Chicago to visit Medomsley and advise on the viability of applying such a machine to the thin coal seams there.(16)

The machine was tested at Blackhill, where there had also been a sharp rise in costs. The month long trial proved satisfactory and Consett ordered a 16 inch coal-cutter from Morgan, Gardner, costing £335. At the same time Palmer reported to the Board on the estimated labour saving by using mechanical coal-cutters; unfortunately no statistical evidence was recorded.(17)

The pressure on innovation at the 'Home Collieries' had been the rising cost of mining coking coal, which was having an adverse effect upon costs in the ironworks. Much of the success of the ironworks depended upon the availability of a cheap fuel.

A contemporary innovation at Langley Park was stimulated by increased demand for coal, which raised the price, especially of non-coking coal. In 1901 the Company had approached the Earl of Durham for a reduction of the tentale for non-coking coat at Langley Park. Up to that time Consett had only worked the Busty and Hutton seams at Langley Park, but in 1903 they began to work the Five Quarter and Low Main coal seams. Both of these were thinner than the Busty

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(16) Directors' Minute, 5 November 1901, p.64. (DCRO : D/CO/39).

(17) Directors' Minute, 26 August 1902, p.126.(DCRO : D/CO/39).

and Hutton seams, and the normal Durham bord and pillar method of working was inappropriate. During 1903 an award was made for hewing prices in the Low Main seam which stipulated that for any method other than longwall working, the hewing price was to be 2s.3d per ton. Once again the conditions were suitable for applying mechanical cutting, that is the opening out of a new seam and hewing costs above 2s.0d per ton.(18) At this time a Diamond Coal Cutter was put to work in the Five Quarter seam at Langley Park and gave a good account of itself. Shortly afterwards the Morgan Gardner 'Longwall' machine was transferred from Derwent Colliery, where the conditions had been found to be unsatisfactory, and was put to work alongside the Diamond Coal Cutter. The introduction of these machines necessitated a change in the method of working from bord and pillar to longwall. Although offering the opportunity of greater productivity, the longwall system was more susceptible to disruption through absenteeism which had "a disproportionate effect on output in the cyclical system of mining required on longwall faces."(19)

Consett was by no means the only colliery company in County Durham to introduce coal-cutting machinery at the beginning of the century. By 1905 ninety four machines were at work in various pits in the County; fifty-four driven by compressed air and forty by electricity.

Consett had five coal cutters altogether, four at Langley Park and one at Chopwell. This bore no comparison to the numbers at some other companies; Lambton's were using twenty-nine, Bolckow Vaughan's sixteen; and the Birtley Iron Company ten. However, Consett does seem to have made intensive use of its machines. The Siskol Compressed Air coal-cutter at Langley Park

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(18) R.C. on Coal Supplies, P.P. 1905 (c 2363) XVI.1 Appendix VII p.46.

(19) J. Johnston, op.cit., p.101.

was working a three shift day; only a similar machine at Mainsforth (Carlton Iron Company) was employed as intensively. Also the electrically driven machines worked two shifts, whilst the majority of collieries only worked their machines for one shift. Apart from such intensive use, Consett also did well in negotiating a low wage rate for working the machines, being undercut only by Murton, Houghton and Elemore collieries.

Earlier it was asserted that the economic threshhold for innovating coal cutting machinery was low labour productivity, or high piece rates at the coal face. To examine all the Companies listed in Table V.4: would be too extensive a task, and beyond the scope of this study. However Bolckow Vaughan's Byers Green Colliery was randomly selected for comparison with Langley Park. In this case a coal-cutting machine was introduced in the wake a newly negotiated rate of 2s.1d per ton in the thin Busty Seam (2ft. 4ins.). (20)

The introduction of 'long wall' working also made possible the adoption of coal conveyors. In 1903 the Company experimented with a Blackett's Patent Coal Conveyor in the Low Main seam, with startling improvements in productivity and costs. Mr. Palmer "estimated that the men can now fill 12 tons per man shift as compared with 4¼ tons under ordinary conditions..." This led to a saving of almost 1s.4d per ton compared with the previous mode of working in the seam. The machine had an additional non-cost advantage in that it made for an increase in the percentage of large coal, which was more valuable and marketable than small.(21) In 1904 two more conveyors

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(20) Awards and Agreements: Byers Green Colliery, (DCRO : N.C.B. Deposits.)
(21) Directors' Minute, 19 January 1904, p.207; Directors' Minute, 15 March 1904, p.217. (DCRO : D/CO/39).

TABLE V.4.

Coal-cutting machines at use in County Durham in December, 1905.

Company	Colliery	No. of Machines	Driven By:
Consett Iron Co.	Langley Park	4	3 Electrical 1 Compressed Air
	Chopwell	1	Electrical
Weardale Stell, Coal & Coke Co. Ltd.	Tudhoe	3	Electrical
	Wheatley Hill	6	Compressed Air
Ryhope Coal Co. Ltd.	Ryhope	3	Compressed Air
Framwellgate Coal & Coke Co. Ltd	Framwellgate	1	Electrical
	Durham Main	1	Compressed Air
Charlow & Sacriston Co.. Co.	Kimblesworth	1	Electrical
Edmondsley Coal Co.	Edmondsley	1	Electrical
	Edmondsley	1	Compressed Air
Lambton Collieries Ltd.	Sherburn Hill	7	Electrical
	Houghton	6	Compressed Air
	Lady Ann	3	Compressed Air
	Herrington	4	Compressed Air
	Lambton 'D'	5	Compressed Air
	Margaret	4	Electrical
Hetton Coal Co.	Elemore	1	Electrical
	Elemore	1	Compressed Air

TABLE V.4. CONTINUED

Company	Colliery	No. of Machines	Driven By:
Bolckow Vaughan and Company Ltd	Shildon Lodge	1	Compressed Air
	Shildon Lodge	6	Electrical
	Leasingthorne	3	Compressed Air
	Westerton	2	Compressed Air
	Byers Green	4	Electrical
Birtley Iron Company	Ouston 'A'	3	Electrical
	Ouston 'E'	7	Compressed Air
South Hetton Coal Company	South Hetton	3	Compressed Air
	Murton	4	Compressed Air
Pease & Partners	Eldon	2	Compressed Air
	Eldon	2	Electrical
Priestman Collieries Ltd.	Chester South Moor	1	Electrical
Bearpark Coal & Coke Co. Ltd.	Bearpark	1	Electrical
Carlton Iron Co.	Mainsforth	1	Compressed Air
Hamsterley Colliery Ltd.	Hamsterley	1	Electrical

Source : National Coal Board Statistical Returns No. 567 (DCRO : N.C.B. Deposits.)

were bought by Consett; one for work in the Three Quarter seam at Derwent Colliery; and the other for conveying small coals in the Hunter Pit. The Blackett conveyor was also operated with the 'longwall' system in the Townley seam at Chopwell.

Where the seams remained thick the adoption of the 'longwall' system, coal-cutters and conveyors was inappropriate. At Chopwell and Garesfield the seams were still relatively thick, about four feet, and only in the Brockwell seam at Chopwell was the hewing price close to the critical 2s.0d per ton.(22) Furthermore the texture of the coal militated against machine working; the splint coal of the Townley seam was brittle and negated any advantages a coal-cutter might have bestowed in that thin seam.

The examination of innovation in Consett's collieries tends to under-line the influence of geological factors upon the introduction of new working techniques. The case of Langley Park provides a disturbing paradox of rapidly declining labour productivity after 1903 (Chart V.2), concurrent with both an expansion of scale and technical innovation. An explanation for this is that the upward trend in coal prices, particularly for non-coking coals, permitted the exploitation of marginal deposits, and this had repercussions upon aggregate labour productivity. If this was the case, then Professor Taylor's assertion that demand was not pressing upon supply requires a review.(23) For Consett's collieries diminishing returns were probably more significant than inadequacies of management, at least with respect to innovation. There may still have been management inefficiencies, particularly

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(22) It was 17s.6d per score (1 score = 20 tubs of 9 cwts,) or 1s.11d per ton.

(23) A.J. Taylor, "Labour Productivity...." p.55.

in the organisation of work, but at present these are impossible to assess.[24]

The upward trend in the cost of mining coal was of critical importance to the Consett Iron Company, for it threatened the basis of the firm's iron and steel activities. Whilst the market for most types of coal, and their derivatives, continued to grow after 1890, that for coke levelled off, leading to a relative stabilisation of price, marginally above cost. During the 1890's Consett's coke costs were rising at a faster rate than those of Bell Brothers, as the following Table shows.

TABLE V.5.

Average Cost per ton of Coke: Consett Iron Company and Bell Brothers, 1889-1899

Year	Consett Iron Company Av. Cost per Ton	Bell Brothers Av. Cost per Ton
1889	8s. 0d	8s. 1½d
1890	9s. 1d	8s. 5d
1891	9s.10d	8s. 5½d
1892	10s.10d	8s. 7½d
1893	9s. 6d	8s. 1½d
1894	9s. 4d	8s. 0d
1895	9s. 3d	8s. 0d
1896	8s.10d	8s. 1d
1897	8s.11d	8s. 1d
1898	9s. 9d	8s. 3d
1899	10s. 3d	10s. 0d

Source: Private Cost Book, 1868 - 1905 (DCRO : D/CO/97); Bell Brothers, Ltd., Cost Accounts 1873-1916 (NRRO : Dorman Long MSS).

see page 159 for footnote 24.

Consett's costs during the first part of the decade were both higher than Bell's and increasing more quickly. However, by 1899 the cost of coke was comparable. Consett could ill-afford expensive coke since the location already placed it at a disadvantage with regard to the importation of iron ore.

The reason for the dramatic increase in the cost of coke production was brought about because of the sharp rise in the price of coal. The Company's alternatives in attempting to remedy this situation were either to economize on the use of coal in the coke ovens, or to reduce the cost of coal. In 1891-92 both were being considered by the management.

Both William Jenkins and William Logan were exploring the possibilities of reducing labour costs and installing by-product ovens.(25) The defeat of the miners in 1892 settled the issue, and traditional bee-hive ovens were erected at several pits where the waste gas could be used for raising steam.(26)

As a short term solution this was not unreasonable, because Consett could convert coal into coke more efficiently than any other company in Durham, except North Brancepeth.

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(24) An interview with Mr. E. Farbridge, of Stanley, June 1972. Mr. Farbridge who worked in British and American pits asserted that the American method of working 'longwall' was less labour intensive than in Britain, because of the practice of allowing the roof to 'cave in' behind as the face moved forward, whilst in Britain the space left by worked out coal was filled in by waste rubble.

(25) See p. 161

(26) Directors' Minute, 5 July 1892. p.49. (DCRO : D/CO/35).

TABLE V.6.

Cost of Converting Coal Into Coke in 1880, 1887, 1894.

	1880	1887	1894
Consett Iron Company	1s. 1.67d	1s. 2.17d	1s. 5.64d
Bell Brothers	1s. 4.96d	1s. 3.61d	1s. 6.43d
North Brancepeth	1s. 1.50d	1s. 0.40d	1s. 2.40d
Pease and Partners	1s. 10.61d	2s. 0.33d	2s. 3.67d
County Average	1s. 8.29d	1s. 8.57d	1s. 11.19d

Source: "Return as to the cost of converting coal into coke"
National Coal Board Statistical Returns, No. 361a
(DCRO : N.C.B. Deposits.)

It may also be noted that Pease and Partners, the only company to have installed by-product ovens (Simon-Carves) in 1887 had significantly higher conversion costs, though no account is taken of the rebate through sales of by-products.(27)

A number of factors probably combined to persuade Consett against the adoption of by-product ovens. In 1892 Jenkins was planning an increase in output of pig iron for use in the New Angle Mill; he estimated an increased demand for coke of 700-1,000 tons per week, certainly enough to justify a by-product plant. Jenkins was not convinced of any clear cut advantage in by-product ovens.

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(27) R. Mott, The History of Coke-making and of the Coke Oven Managers Association (Cambridge, 1936) p.69.

"I will at a convenient moment confer with my Directors upon it, but I really do not entertain any hope of their taking up these patent ovens. We have so much in the way of manufacturing work going on that it will be difficult to persuade us at present to divert our attention in the way you suggest. It is all very well to proceed upon the presumption of a definite price for coke and the profit upon it, but I do not believe in the present inflated condition of things, and the probability is that coke will come to its former old level soon. Of course I may be wrong in my judgement, but these are pretty much the Consett feelings just at present."(28)

However when costs refused to fall as readily as price in 1892 Jenkins thought that in view of Consett's "large operations in Coke making we ought to aim at giving this Coppee oven a trial."(29) What finally militated aginst the adoption of by-product ovens? The stickiness of costs was removed by the strikes - but there were also other factors. The capital cost of installing a by-product oven was measured in hundreds of pounds, as opposed to tens for the bee hive. The colliery management felt there would be a greater advantage in small batches of bee hive ovens at the 'Home Collieries' for raising steam.(30) By-product ovens would only be feasible in one large plant. Finally David Dale was also Managing Director of Pease and Partners where he was presumably instrumental in innovating the Simon-Carve ovens. Had they been a success Dale's influence on Consett's Board would probably have been sufficient to over-ride all other objections. That Dale remained silent, and Consett in fact only considered the Coppée ovens

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(28) Wm. Jenkins to J.R. Breckon, 13 March 1890. (DCRO : D/CO/72).
(29) Wm. Jenkins to Wm. Logan, 5 February 1892. (DCRO : D/CO/79).
(30) Directors' Minute, 5 July 1892, p.49. (DCRO : D/CO/35).

suggests that Pease and Partners were less than overjoyed by the success of their ovens. The decision to forego the chance to install by-product ovens was based upon rational considerations and not blind prejudice.(31)

The cost crisis of 1892 should however have been a warning signal, as it was to a number of other iron companies with their own collieries. When costs took another leap upwards during 1900 another crisis confronted Consett. The rise in costs was about thirty per cent in eight years as the Table below shows.

TABLE V.7.

The Increased Costs of Working the Pits, 1895 and 1903.

Year / Company / Item	1895 Wages	Stores, Royalty Rent	Average Cost Per Ton	1903 Wages	Stores, Royalty Rent	Average Cost Per Ton
Consett	3s. 1d	1s.11d	5s. 0d	4s. 1d	2s. 7d	6s. 8d
Bell Bros.[a]	2s. 7d	1s.11d	4s. 6d	3s.11d	1s.11d	5s.10d
Bolckow Vaughan[b]	3s. 8d	1s.11d	5s. 7d	4s. 9d	2s. 3d	7s. 0d

a. South Brancepeth only.

b. Bolckow Vaughan commented on their return: "Best seams in many of our pits are practically exhaused, thinner and more expensive seams are being worked. Workings are much further away from shafts causing increased cost."

Source: "The Increased Cost of Working the Pits". National Coal Board Statistical Return, No. 523. (DCRO : N.C.B. Deposits); Private Cost Book, 1868 - 1905 (DCRO : D/CO/97); Bell Brothers, Cost Accounts 1873 - 1916 (NRRO : Dorman Long M.SS.).

(31) D.L. Burn, Economic History of Steelmaking, pp. 204-207; Burnham & Hoskins, Iron and Steel in Britain, pp.122-123.

The three companies above all responded by economizing upon their coal input. This was achieved by the introduction of by-product ovens which gave both a greater yield and a marketable by-product. However, whilst the other companies installed their ovens simultaneously, Consett lagged by two years.

Introduction of By-Product Coke Ovens by North Eastern Iron Companies.

Company	Type & Number of Ovens		Year of Introduction
Newport Ironworks	Simon - Carvés	70	1894 - 96
Newport Ironworks	Otto	50	1898
Newport Ironworks	Otto	80	1900 - 02
Carlton Iron Coy, Ltd.	Semet - Solvay	60	1896 - 99
North-Eastern Steel Coy.	Semet - Solvay	50	1900
Bell Brothers	Hussener	120	1901 - 04
Cargo Fleet Iron Coy.	Koppers	100	1903
Bolckow, Vaughan & Coy.	Otto	96	1903
Consett Iron Coy.	Otto - Hilgenstock	50	1905

Source : R.A. Mott, History of Coke-Making , pp. 80-81.

Consett was slow in adopting new ovens, this in part may have been due to the time and care taken in assessing the relative merits of the various types of by-product ovens. In 1896 David Dale reported to the Consett Board "that such information as he possessed in reference to the working of the patent ovens at Pease and Partners Colliery was quite at the disposal of the

Company. Within a short time further important information would probably be available from the Carlton Co. and from Messrs B. Samuelson and Co." (32)

Between 1896-1902 Consett appears to have let matters slip for no further action was taken upon the matter of by-product ovens. Then in 1902 George Ainsworth and Mr. Palmer paid several visits to companies operating by-product ovens, both in Durham and on the Continent. Evance-Coppee, Simplex Patent, Kopper and Otto-Hilgenstock ovens were examined, and finally in 1903 Messrs. Ainsworth and Palmer recommended the installation of fifty Otto-Hilgenstock ovens at a cost of £50,000. An estimated saving of 1s. 0d per ton was forecast, and this could be increased by the addition of a similar number of ovens in the future; a clear case of economies of scale.

TABLE V.8

Comparison Between Beehive Coke Costs and Otto-Hilgenstock costs, 1906 - 1913

Year ending June	Otto - Hilgenstock Ovens			Bee - hive Ovens		
	Output	Av. Cost per ton	Yield%	Output	Av. Cost per ton	Yield%
1906	9,240	13s. 1d	66.68	250,925	11s. 6d	67.84
1907	77,882	9s. 8d	77. 3	230,027	12s. 2d	66.44
1908	91,301	10s.10d	77. 5	194,505	13s.10d	66.13
1909	86,646	11s. 9d	77. 7	141,376	13s.11d	66.29
1910	87,883	10s.11d	76.1	191,971	14s. 7d	64.38
1911	91,092	9s. 3d	75. 1	186,587	11s.5½d	67.66
1912	93,666	7s. 8d	74. 0	143,367	12s. 2d	62.90
1913	178,817	8s. 2d	74. 3	112,521	13s. 0d	65.62

Source: Private Cost Books, 1892-1909; 1910-1926. (DCRO : D/CO/100,101).

(32) Directors' Minute, 1 August 1896, pp. 84-85.(DCRO : D/CO/37).

The Table V.8. above shows that the forecasts were more than justified. The question remains however, whether Consett's delay in adopting the new by-product ovens was justified by their performance when compared with ovens adopted by other north eastern companies.

Bell Brothers' Hussener ovens could not compare in the Yield, or cost. (see TableV.9.), with those of Consett. The Hussener ovens at Port Clarence with a benzole plant cost £101,116.12s.0d between 1899-1904, or £842.12s.0d per oven.(33) By 1911 Consett's plant of 105 ovens cost £91,800, including a benzole plant of 400,000 gallons capacity per annum, or £874.05s.0d.(34)

TABLE V.9.

The Average Cost per Ton of Coke from Bell Brother's Hussener Ovens, and the Coke Output as a percentage of Coal Input.

Year	Average Cost Per Ton	Yield %
1906	16s. 4d	64.5
1907	18s. 8d	62.9
1908	17s. 1d	63.5
1909	14s.10d	64.9
1910	15s. 6d	63.9
1911	15s. 7d	61.3
1912	17s. 1d	63.2
1913	19s. 6d	65.8

Source: Bell Brothers, Cost Accounts, 1873-1916. (NRRO : Dorman Long MSS.)

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(33) Bell Brothers, Profit and Loss Accounts 1899-1916 (NRRO : Dorkan Long MSS).

(34) Directors' Minute, 9 March 1911. p.142. (DCRO : D/CO/42).

The Carlton Iron Company who had installed sixty Semet-Solvay ovens by 1901 expended £60,000, and there is no record of a benzole plant.(35) In view of the inflation of the Edwardian decade Consett's capital outlay per oven was not significantly greater than Bell Brothers, but was conspicuously less than the Carlton Iron Company.

In addition the output per oven was much greater at Consett than that at Port Clarence, and also marginally greater than Semet-Solvay ovens used by Bolckow Vaughan and Company at Auckland Park.

TABLE V.10.

Comparative Output of Otto-Hilgenstock, Semet-Solvay and Hussener by-product Ovens, 1910 and 1914

Type of Ovens, Installation and Company	Number of Ovens		Output of Coke	Annual Output Per Oven
Otto-Hilgenstock at Templetown	1910	55	86,389	1570. 7
Consett Iron Company	1914	105	195,927	1865. 9
Hussener, at Port Clarence	1910	120	152,008	1266. 7
Bell Brothers.[a]	1914	120	150,937	1257. 8
Semet-Solvay, Auckland Park	1910	100	153,904	1539.04
Bolckow Vaughan and Company	1914	100	161,923	1619.23

a. Bell Brothers, Cost Accounts, 1873 - 1916 (NRRO : Dorman Long MSS)

Source: National Coal Board Statistical Returns, Nos. 614, 684. (DCRO : N.C.B. Deposit.).

(35) Carlton Iron Company, Private Ledger, pp. 208-209. (NRRO : Dorman Long MSS).

In view of this evidence Consett's care in selecting the type of ovens to be installed was justified. There were certainly important improvements in the design of by-product ovens between the early 1890's and 1903 which led to more consistent quality and a larger output.(36) Nevertheless by 1902 when Consett actively began to investigate by-product ovens most of its competitors had either had them installed or were in the process of doing so. Although Consett responded to the economic stimulus of high costs, it should, reasonably, have foreseen the advent of such a crisis. Labour productivity had been declining continuously in the 'Home Collieries' since 1896 with a subsequent rise in costs. The quality of Consett's final decision was indisputably good, but the delay in reaching it was indicative of declining standards of alert management.

At an earlier date the Company had been nearer the front runners in innovation. During the 1860's and 1870's they were one of a number of coke makers attempting to minimise the loss of waste heat. In 1867 David Dale made an agreement with J.R. Breckon, that on the payment of £300 the Company should have the benefit in perpetuity of all coke patents taken out by Mr. Breckon, or his co-patentees.(37) The following year the firm built sixty-six Breckon and Dixon ovens. Though the coke from these ovens was considered inferior they could be drawn three times weekly and had an increased yield, compared with the more common Stobart patent ovens.(38)

When during 1874 coal costs remained high whilst prices began to fall, Messrs. Boyd and Hedley reported upon the practicability of utilizing the waste heat from the coke ovens for generating steam for the Colliery engines. The waste

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(36) R.A. Mott, History of Coke making----, p.76.

(37) Directors' Minute, 21 December 1867. p.172. (DCRO : D/CO/29).

(38) Directors' Minute, 11 January 1868. p.178. (DCRO : D/CO/29); R.A. Mott, History of Coke making ---, p.51.

gas at Delves was already used for drying and burning bricks in the Company's brickworks, and it was also applied at the recently opened Westwood Colliery. Since it was being successfully utilized at these two installations, the Board decided to extend its use to Medomsley and Derwent.(39)

The improvement in efficiency brought about by the application of waste heat for raising steam can be seen in the following Table. This measures the decline in the real cost of coal to colliery engines per ton of coal raised. It is both an indicator of fuel economies and technical improvements in the colliery engines.

TABLE V.11.

The Real Cost of Coal to Colliery Engines per Ton of Coal Raised, at ten Yearly Intervals 1868 - 1905; Consett 'Home Collieries.'

Year Ending June	Coal to Engines Per Ton of Coal Raised	Total Average Cost Per Ton of Coal	Cost Index	Price Index [a]	Real Cost of Coal to the Engines [b]
1868	1.07d	3s. 6.36d	100	100	100
1875	0.84d	4s. 11.22d	78.5	139.8	56.2
1885	0.60d	4s. 1.03d	56.1	115.7	48.5
1895	0.81d	5s. 0.03d	75.7	141.7	53.4
1905	0.89d	6s. 6.26d	83.2	184.7	45.0

a. The price index assumes that coal to the engines was charged at a price marginally above the total average cost of mining the coal. Thus the total average cost has been taken as the price of coal for colliery consumption.

b. Real Cost Index = Cost Index/Price Index.

Source : Private Cost Book, 1868-1905. (DCRO : D/CO/97).

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(39) Directors' Minute, 6 October 1874 pp.63-64. (DCRO : D/CO/31). The conversion at Derwent Colliery was postponed until the mineral lease with the Allgoods had been renewed. Thus in some instances the nature of mineral ownership could retard innovation.

The greatest savings in real cost concur with the utilization of waste heat in the early 1870's and then again in the decade between 1895-1905 when electrical haulage equipment was introduced into Consett's mines. The improving efficiency of colliery engines was concurrent with periods of rapid growth of output. This is the opposite to the situation with regard to the innovation of by-product ovens, for the market for coke had stagnated whilst the adoption of by-product ovens was relatively late. With respect to the mechanisation of operations underground it is impossible to distinguish between geological conditions and poor management in its slow adoption.

3. Labour : Supply and Relations with Management

Besides criticising management for the decline in labour productivity, Professor Taylor also draws attention to rising absenteeism, increased frequency of industrial disputes, deliberate output restrictions and legislation reducing the hours of labour.(40) These assertions will be examined in the following pages, along with some other problems encountered by Consett in deploying its labour force, such as the existence of a competitive labour market, the influence of raw recruits in the labour force, and finally the quality of colliery management.

A pattern emerges of generally very good labour relations at Consett until the Edwardian decade when a noticeably widespread deterioration set in. This coincides with the death in 1906 of David Dale, who had done so much to bring enlightenment to the management of labour. In the years immediately preceeding 1914 the attitudes adopted by both labour and management hardened. This was reflected in the everyday operations of the pits by the speed with which small disputes blew up into stoppages.

One explanation, that partially exonerates labour from any part in the decline in labour productivity, was the suggestion that the decline was due to the rising proportion of the labour force which was new to the industry after 1900. The rapid growth of output necessitated a great swelling in the numbers employed in coal-mining. In the case of the single colliery company the validity of this suggestion is difficult to establish since the proportion of raw recruits in the labour force cannot be estimated. In 1900 it was decided to

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(40) A.J. Taylor, "Labour Productivity...." p.55.

lay-in Westwood Colliery and this released almost 600 men. At the same time employment was being increased at Chopwell, Garesfield and Langley Park, whilst productivity was falling. It is not improbable that many Westwood men were absorbed into the labour force of these expanding collieries. In general the extent of the decline in labour productivity in the Durham Coalfield while the numbers employed grew at a fairly constant rate reduces the strength of the inexperienced labour argument.

TABLE V.12

Employment and Labour Productivity in the Durham Coal Field.

Year	Numbers Employed	Output per Man Year
1895	83,336	301.127 tons
1896	85,850	307.563 tons
1897	85,697	316.025 tons
1898	88,084	320.803 tons
1899	91,015	314.463 tons
1900	101,804	305.536 tons
1901	102,722	296.309 tons
1902	106,064	295.029 tons
1903	110,125	296.129 tons
1904	112,471	293.670 tons
1905	116,046	295.500 tons
1906	120,099	296.693 tons
1907	126,784	289.126 tons
1908	131,357	278.816 tons
1909	135,725	280.592 tons
1910	144,039	254.438 tons
1911	148,235	261.770 tons
1912	153,649	237.680 tons
1913	164,395	253.953 tons
1914	149.390	254.150 tons

Source : "Annual Returns of the Durham Coal Owner's Association, 1895-1914", National Coal Board Statistical Returns. (DCRO : N.C.B. Deposit).

If the declining labour productivity is not explained fully by the growth of the labour force, it may be caused partly by their employment in seams which were increasingly difficult to work. This was probably an explanatory factor where a large part of the increased labour force was employed in the newly opened and less productive coal seams, at the turn of the century.

Not only did the Consett labour force increase rapidly during the late 'nineties and early twentieth century, but also there was a steady growth of demand for labour in the County as a whole. This presented the Company with difficulties in recruiting colliery labour. In the early 1870's during the 'coal famine' the Consett Company had encountered similar problems. In this instance they had tried to recruit men from as far afield as the South of England, but with little success.(41)

At the turn of the century when the Chopwell Colliery was being expanded difficulty was encountered in attracting labour to work there because of the isolation of the village.(42) In an effort to alleviate the shortage, the North Eastern Railway was induced to provide a temporary station between Westwood and Lintz Green to break down the community's isolation. The management hoped that such a facility would attract a better class of workmen to Chopwell than was already there! (43)

Since the provision of housing for hewers was customary in County Durham, empty cottages were reasonable indicators of labour shortage. There were ten such empty cottages at Chopwell in July 1899. Some years earlier Wm. Jenkins had enquired of his Chief Viewer:

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(41) Directors' Minute, 12 October 1871, p.129.(DCRO : D/CO/30).
(42) Directors' Minute, 17 July 1899, p.134. (DCRO : D/CO/38).
(43) Directors' Minute, 5 December 1899, p.161. (DCRO : D/CO/38).

"Is there a difficulty now in getting hewers? I find by my weekly return of the occupied cottages that there are today absolutely 14 good cottages empty at Leadgate." (44)

In this last case ten or a dozen cottages were vacated in the space of a few days, and this may imply that a group of hewers had moved en bloc to a more remunerative colliery. The implications of all this are that Consett was by no means a monopsonist in the labour market, firstly, because its growing labour requirements necessitated an influx of immigrants to the district, a process not likely to occur if wage rates were depressed artifically in the locality. Secondly, the County union organisation and system of arbitration produced a uniformity of bargaining power throughout the coalfield.(45)

The supply and mobility of labour within the coalfield was such that despite its location on the westerly fringe, Consett was still effectively competing for labour with other collieries all over the region. Companies not only competed for labour on a price basis but also by providing amenities, the most fundamental of which was housing. In 1864 the Company owned over 1000 freehold cottages, by the 1890's it had 2700, and this was further increased by the opening of Chopwell and expansion at Langley Park.

By the early 1900's the Company had to expend large sums on alterations and improvements to many of its older cottages. At the outbreak of war in 1914 Consett owned approximately 3000 cottages for its workers. Less costly, but probably more indicative of the ferocity of the competition for labour was the provision of social amenities such as reading rooms, social clubs, schools and even public houses; a rare concession in view of David Dale's strict temperance.

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(44) Wm. Jenkins to W.H. Hedley, 8 April 1890. (DCRO : D/CO/73).

(45) H.A. Clegg, A. Fox and A.F. Thompson, A History of British Trade Unions since 1889, I (Oxford, 1964) p.103.

The tightness of the labour market in North west Durham around 1900 was not only felt by Consett. On a number of occasions the Chief Viewer at South Moor Colliery Company complained of difficulty in attracting men, and then keeping the better types of workmen.(46) Consett obviously could not hope to exploit any monopsonist powers in such a competitive labour market, because of the mobility of some sections of the labour force.

Having attracted the labour to their pits, how successful was Consett in keeping them content? The evidence is weightily on the side of very good labour relations at Consett through most of the period, 1864-1914. However after 1897 a canker seems to have taken hold, namely Chopwell Colliery which was opened in that year. Up to 1888 when returns about disputes and stoppages were begun, there is no record in the Directors' Minutes of any serious stoppages at Consett's pits, other than the General County Strike in 1879. After 1888 the situation is much the same with only one half day lost through an industrial dispute at a 'Home Colliery' between 1888-1913 except for general County action in 1892, 1910 and 1912. The 'Sale Collieries' were almost as quiet, apart from Chopwell where there were no fewer than eleven disputes between 1898-1913, two of them lasting more than ten days. However, after 1910 there was a marked increase in disputes at collieries other than Chopwell.

Though disputes did occur they did not lead to hostile industrial action in most instances. At Derwent Colliery there were outbursts against non-unionists in 1880 and then again in 1897, but in neither case was any stoppage of work reported, or any restriction of output.(47) In 1891 a dispute at Langley Park

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(46) I am grateful to Dr. R.H. Britnell for passing on this information to me.

(47) Directors' Minute, 14 June 1897, p.180. (DCRO : D/CO/37); Directors' Minute, 5 February 1880, p.190. (DCRO : D/CO/32).

over the question of hewers being required to remove the coal from the face to the main tramways (work normally done by youths), led to a restriction of output by the hewers. This was the only recorded incident of deliberate restrictive practices being employed at Consett's Collieries, though there were some references to possible restriction.(48)

Reference to increasing absenteeism is also noticeable by its absence from the Company's records. The stoppages on Boxing Day and New Year's Day were normally expected, though not welcomed by the management, but apart from these special days when the whole labour force might absent itself there was no record of disruptive absenteeism during other times of the year. If it had been at all serious at Consett, one would have expected comment upon it when the Company began to operate the 'longwall' system in some of its pits. It is more than likely that output restriction during depression and absenteeism during booms were accepted as facts of mining life, in the north-east, and not just phenomena that appeared in the 1890's and after. Such practices were not condoned by either unions or management,(49) but at least in the case of Consett there seems no reason to put much emphasis upon any relation between the declining labour productivity and these two practices.

Since on the whole Consett enjoyed such relatively peaceful labour relations, it is all the more startling that one colliery should have stood out so prominently as troublesome. It was unlikely that Consett's labour policy would have differed greatly between collieries, so the causes of the disturbances at Chopwell can probably be attributed to either the miner's militancy or

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(48) cf. footnote (44).

(49) H.A. Clegg et al., op.cit., p.19.

failings of individual managers at the Colliery. During the 1920's the Colliery became a hotbed of communism, and the foundations for this seem to have been laid by a number of active Independent Labour Party men in the pre-war years. The gound was fertile for such activists as Vipond Hardy, and later William Lawther. Between 1901-1911 the population of Chopwell doubled because of the inflow of workmen to work in the new pits. Men were attracted from all over the north; Cumberland, Lancashire, Yorkshire as well as Northumberland and Durham.(50) Some, like the Lawthers, probably made their livings by moving from one new colliery to the next, because of the attractive wage rates paid.(51) Such a community had few roots and no identity, and was therefore most likely to be impressionable by activists. The size of the Colliery also militated against amicable relations. In the smaller pits there was more contact and mixing between the men and colliery viewers , especially through the Church or Chapel.

The seeds of prolonged trouble at Chopwell were sown from the outset in 1897. William Logan, the Chief Viewer for Consett's Collieries was not satisfied with the labour productivity, and attributed this to the fact the men were being paid day rates. At first the Men's Association was reluctant to accept tonnage rates, but they finally stepped down and earnings and productivity began to rise.(52) Logan was anxious however to have wages fixed by the score (20 tubs of 9 cwts), and so the normal procedure of arbitration was entered upon. When the arbitrators could not agree on terms an Umpire was

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(50) Interview with Sir William Lawther, 31 May 1972.

(51) Ibid.

(52) Directors' Minute, 13 April 1897, p.157. (DCRO : D/CO/37).

appointed,(53) and he made an award in December 1897. The award was 17½% above the County standard rate but William Logan was not satisfied that sufficient data had been consulted to make an award. He complained to John Wilson M.P., the most influential person in the Durham Miners' movement, and he agreed to review the award after it had operated for twelve weeks. However, at an informal meeting between John Forman, the Umpire, Mr. Gilchrist, the Chopwell Viewer and Mr. Mackay the men's arbitrator, Gilchrist was informed that no ground would be given by the men, who were prepared to get their way.(54) At the same time the men prevented volunteers from working in the Three - Quarters seam, at terms agreed upon prior to the award.

The matter had now developed into a serious dispute; the miners were adamant about maintaining the Award rates, whilst the Company claimed that the Award put it at a grave competitive disadvantage with neighbouring collieries.(55) Mr. Logan recommended the closing down of operations at Chopwell, and the Board agreed even though the dispute might have imperilled labour relations at the Company's other pits.(56) So began the strike/lock-out which lasted for ninety-nine days. The Company offered arbitration and withdrew their notice, but the men remained determined to maintain Forman's Award. The firm even offered to continue working the colliery at the existing rates whilst the arbitration was being proceeded with, so that it could at least take advantage of the rising tide of optimism in the coal trade, but the men were either unaware of such an

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(53) Directors' Minute, 7 September 1897, p.205. (DCRO : D/CO/37).

(54) Directors' Minute, 8 March 1898, pp. 9-10. (DCRO : D/CO/38).

(55) Directors' Minute, 3 May 1898, pp.25-26. (DCRO : D/CO/38).

(56) Directors' Minute, 14 April 1898, p.18. (DCRO : D/CO/38).

offer, or suspected treachery.(57) Staying out was certainly a sacrifice on the men's part for strike pay amounted to only 10s.0d per week, plus 1s0d per child per week, and a further 1s.2d a week from miscellaneous contributions. This compared very unfavourably with the 6s.0d per day earned by the men in 1897.

Finally on 6 September the men conceded, returning to work on terms offered by Wm. Logan and accepting an arbitration, but the acrimony between the two sides continued through the arbitration, the men making new demands one after another. It soon became clear that the arbitrators would not agree and so the men nominated Thomas Lambert, a Gateshead solicitor, as the Umpire; Logan had no reasonable grounds for objection. Finally on 20 January 1899 an acceptable settlement was proposed by the Umpire. Consett claimed that in some instances "the price fixed were what they had been contending for during the last twelve months."(58) There was no recorded disagreement about the Award from the men, but after such a protracted struggle they cannot have been overwhelmingly happy, but since Lambert was their choice, they had no grounds for complaint, and continued resistance would probably have aroused the hostility and withdrawal of support by the Durham Miners' Association.

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(57) Directors' Minute, 24 June 1898, pp.33-34.(DCRO : D/CO/38).

(58) Directors' Minute, 24 January 1899, p.86.(DCRO : D/CO/38).

TABLE V.13.

Awards at Chopwell 1897 and 1899

Award	Date	Price [a] Townley Seam	Stone Coal Seam	Five Quarters
Forman	2/11/1897	14s. 0d p.sc.	17s. 0d p.sc	15s. 0d p.sc
Lambert	20/1/1899	9s. 3d p.sc.	9s. 9d p.sc	9s. 4d p.sc

a. Price per score

Source : Awards and Agreements :Chopwell Colliery. (DCRO : N.C.B. Deposit.)

This bad start probably ensured a receptive audience for the more militant activists. There were further disputes at Chopwell in 1899, 1904 and 1910-13, culminating in a seventeen day stoppage during 1913.(60)

The final dispute at Chopwell illustrates the depth to which labour relations at the Colliery had sunk. The original cause of the dispute was a confrontation between two groups of workmen over which conveyor they would work. However, when the men came out, it transpired that numerous grievances had arisen. The men claimed that Harry Imrie, the Chopwell manager, had tried to "filch all the privileges from us that we have had outside of any agreements."(61) The Consett Board, however, backed up Imrie and told the men that they should return to work and settle the dispute through the normal channels.

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(60) "Returns of Stoppages Caused by Disputes with Workmen," National Coal Board Statistical Returns. (DCRO : N.C.B. Deposit.).

(61) Directors' Minute, 2 December 1913, pp.109 - 110. (DCRO : D/CO/43).

Imrie was generally well respected by the men, more so than the under-managers, many of whom had not got their 'ticket' (qualifications). Will Lawther's own opinion was that Imrie laid the foundations for the men's radicalism by an enlightened approach to dealing with labour. For instance Imrie had agreed with the men that they should have control over house allocation, and granted them the power, a rare privilege.(62)

Apart from Chopwell the only other strikes to seriously affect Consett were the general County wide strikes in 1879, 1892, 1910 and 1912. The first County strike in 1879 was brought about by the Durham Coal Owners' Association's refusal to renew the sliding scale subject to an 'open arbitration,' in spite of the efforts by David Dale and J.W. Pease to persuade them otherwise.(63) The Owners demanded a 15% reduction on the rates of underground labour, and 10% for surface labour. At first some of the Consett Collieries which were unaffiliated to the union seemed prepared to accept the terms, but there was a change of heart and all the men came out, unionists and non-unionists, even the men at Iveston who had been in open dispute with the union.(64) This led to an immediate curtailment of operations in the ironworks, and rumours became rife that Jenkins was preparing to bring in 300 'scab' labourers from Wales.(65) There was little foundation for such fears because of the influence of David Dale.

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(62) An Interview with Sir William Lawther, 31 May 1972.

(63) Durham Chronicle, 2 May 1879, p.8.

(64) Consett Guardian, 11 April 1879.

(65) Ibid.

The 1879 strike was brought to an end when the Owners accepted arbitration, a victory for the persistence of Dale, Pease and Wm. Crawford, the Miners' leader. Nevertheless the men returned to work at a reduction, though it was not as severe as the Owners had originally proposed, the underground workers' rates being reduced by 8¾% and the surfacemen's by 6¾%. The strike had lasted six weeks, and Consett had to damp down the blastfurnaces for the last month.(66) However, the most lasting repercussion was probably the co-operation of the Consett pitmen with the County union, thus destroying any base for the exploitation of labour at Consett.

The stoppage in 1892 had similar origins; an attempted reduction of wages by the Durham Coal Owners' Association emphatically refused by the mineworkers. This time however, it was the men who took the intransigent position rejecting a modified reduction, and arbitration. Consett was better prepared, having put 50,000 tons of coal to stock, sufficient to keep the ironworks going for three months if the blastfurnaces were damped down to half blast.(67)

The coal stocks at Consett proved to be one of the most troublesome areas during the strike. A large contingent of police had to be moved to Consett to give protection to those men employed in moving coal from stock. Jenkins attacked the picketing of the miners bitterly, in a letter to David Dale.

> "They (the police) are completely inadequate to cope with the present emergency, and it would seem to me that at places similar to Consett where legitimate stocks of coal are held for consumption by peaceable men who have nothing to do with the Strike the proper plan would be to get the strongest possible legal force either a troop of

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(66) Consett Guardian, 25 April 1879.

(67) Durham Chronicle, 18 March 1892.

dragoons or of infantry to check this barbarous progress. It is monstrous that while we have coal on our own premises here ready to be transported into mills we are debarred by a lot of men like barbarians pelting stones &c. from doing this."(68)

That the activity of the Company and the picketing did not lead to long term deterioration in industrial relations at Consett, may be due to the fact that some of the more militant picketing was done by men from Watson's Collieries.(69)

As the strike dragged on into May the Owners pressed for an even larger reduction of 13½% and as the intransigence of the men melted, the bloody-mindedness of the Owners increased.(70) Newspaper reports that Consett would accept a return to work on the Owners' terms were denied by Jenkins, who thought the report irresponsible.(71) The dispute was finally resolved by the intervention of the Bishop of Durham, who felt the Owners had gone too far with their demands, His influence prevailed and the men returned to work at a 10% reduction on the 7 June.

The strike had several effects upon Consett; most obviously it disrupted operations in the ironworks through the damping down of the blastfurnaces. Efforts to import pig iron from Maryport proved abortive because of the poor quality of the metal.(72) The Company had to bear the cost of lodging and feeding the immigrant police detachments.(73) The interruption of work at the coke ovens

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(68) Wm. Jenkins to D. Dale, 21 March 1892. (DCRO : D/CO/80).

(69) Wm. Jenkins to D. Dale, 28 April 1892. (DCRO : D/CO/80).

(70) The Federation Board were prepared to accept a 10% reduction but the Owners held out for 13½%. Durham Chronicle, 27 May 1892.

(71) Newcastle Chronicle, 24 May 1892; Wm. Jenkins to D. Dale, 24 May 1892. (DCRO : D/CO/81).

(72) Durham Chronicle, 20 May 1892.

led to a dispute between Consett and the Durham Cokemen's Association, and finally there was curtailment of output at Langley Park because of damage to the pit through a failure in pumping equipment.(74) Consett, however, does not appear to have suffered from the post-strike disputes about re-employment, which plagued some collieries. Bolckow Vaughan suffered particularly in this respect.(75) From 1892-1898 Consett's pits were free from stoppages caused by labour disputes.

The 1879 and 1892 disputes had been intimately connected with the customary framework of industrial relations in Durham, that is the sliding scale and the principle of arbitration. The two strikes in 1910 and 1912 reflect acceptance by the County Association of the policies of the Miner's Federation of Great Britain. The 1910 stoppage was caused by grass-root resentment about the new three shift system introduced to facilitate efficient working under the Eight Hours Act. At Consett, only the 'Home Collieries' came out on strike, at the others the hewers' hours were unchanged and the putters were prepared to work the system after being granted an advance in their piece rate. At Chopwell the Company granted a further concession of no rate reductions for one year. Consett put the blame for the stoppage fairly and squarely upon the shoulders of the union executive who failed to refer the matter, for general consent, to the men.(76) The Durham Miners' Association had agreed terms for working the mines with the Owners on 13 December 1909, but they were not approved by the lodge.

The eventual solution of the Eight Hour question enabled the D.M.A. and M.F.G.B. to move closer together and devote their energies to pressing for a

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(74) Wm. Jenkins to P.Williams, 10 June, 1892. (DCRO : D/CO/81).

(75) Durham Chronicle, 17 June 1892.

(76) National Coal Board Statistical Returns, Nos. 602 & 613. (DCRO : N.C.B. Deposits).

minimum wage. At the beginning of 1912 the Company began to consider the miners' demand for a Minimum Wage and "it was decided that the action of the Coal Trade of Durham in resisting the demand for a Minimum Wage made by the Miners generally be supported by this Company to the extent of a strike....."(77) Unrest had been growing in the pits during 1911, especially at Langley Park, and there generally appears to have been a deterioration in labour relations at Consett's collieries, beginning during the 1908 depression. The miners at the 'Home Collieries' had grown resentful of their irregular working when the steel trade was in recession.(78) The new system of shifts introduced at the beginning of 1910 further alienated labour and management. The Company's pits were plagued during 1910-1912 with a series of petty stoppages, the nature of which seems to confirm the impression of worsening relations. This trend culminated with the General Coal Strike between 29 February and 10 April 1912, when all the Company's collieries were stopped. The miners were for once successful, and Consett suffered a sharp upturn in labour costs during 1913 and 1914, when the Minimum wage was introduced.

For their part the management were taking an ever more intransigent position against labour, making anonymous contributions to the Trades Disputes Act Reform League.(79) The harmonious labour relations which had once existed within the Consett collieries had, by the outbreak of the Great War, evaporated. The spirit of co-operation had finally passed away from Consett with the death of David Dale in 1906, and the Company suffered the disruption of industrial strife as acutely as any other firms.(80)

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(77) Director's Minute, 19 January 1912. p.208. (DCRO : D/CO/42).
(78) Directors' Minute, 8 June 1909. pp.204-205. (DCRO : D/CO/41).
(79) Directors' Minute, 19 January 1912. p.206. (DCRO : D/CO/42).
(80) Wm. Jenkins to D. Dale, 25 January 1892. (DCRO : D/CO/79). When it was decided to close the Iveston pit, Jenkins proposed to keep the pit at full capacity until the termination of notice, so that the men would expect a full wage. Then by with-holding the wage, pressure could be exerted upon the men to vacate their cottages. Dale advised against such a course and persuaded Jenkins of the folly.
"I confess I feel rather as you do that for the sake of 3s.0d per week

4. Conclusion

Consett had no apparent monopsony power in the market for the major input in coal-mining, labour. It did have a strong bargaining position in the acquisition of royalties in North west Durham. Labour was in fact scarce, especially in the boom years 1870-73 and 1899-1900 when the Company's remoter collieries had, in common with other collieries in the area, difficulty in attracting labour.

Throughout the period there was an upward trend in labour costs, caused mainly through falling labour productivity, and probably in the earliest stages by spreading unionisation. However, there are no conclusive grounds to support Professor Taylor's hypothesis that the decline was greater than could be expected by the operation of diminishing returns. The higher costs were made possible by the rising demand of the market, and growing sales themselves brought the marginal seams into production at an increasing rate. By 1914 approximately sixty million tons had been worked out of Consett's royalties. In 1867 W.H. Hedley had estimated thirty millions tons of easily worked coal and twenty-six million tons in more difficult seams. Twenty-two years later in 1889 he estimated there was a further twenty seven million tons in the Chopwell Estate and its adjoining royalties. Unfortunately there were no records of the extent of Langley Parks coal reserves. However, it is clear that by 1914 Consett had worked out a significant part of its estimated coal reserves, and presumably like Bolckow Vaughan it was finding the seams more difficult to work.(81) Geological conditions rather than an unwillingness to innovate, or deliberate restriction by the labour force,

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(80 cont.) or so per house it is hardly worth while bringing about an amount of hostility that will in the end probably do us no good. "Of course we must aim at recovering possession of the houses, but this need not be done by needless force."

(81) cf. page 162 , Table V.7.

except possibly during the unsettled years 1910-1912, dictated the level of labour productivity. By 1914 the mines had been extensively electrified, and the Company had its own grid system, in some cases supplementing the supply of the local authorities. Only in the adoption of by-product ovens can the clues of the receding drive of Edwardian management by detected. In this instance the market for coke had stabilised with little prospect of any further rapid growth.

Although the Company's record of innovation was far from exciting, it was adequate, being tempered more by the careful deliberations of a well established management structure, than by the adventurous exploitation of new avenues by an entrepreneur.

The one area in which there was a clear deterioration after 1900 was in the conduct of labour relations. This was in part due to the growing militancy of the miners' union, but also to more specific factors such as unhappy labour-management relations at Chopwell from 1897, inexperienced assistant managers, and large bodies of men thrown together in new communities.

However, overall the Colliery operations were conducted with adroitness, particularly the acquisition of royalties which laid the foundation for the growth of coal sales, and their contribution to the overall profitability of the Company.

The supply of management personnel was not scarce or inexperienced since the coalfield was well established, and had a self-generating class of colliery viewers and engineers. Indeed, Consett never had to go beyond the boundaries of the coalfield to recruit colliery managers, in fact the Company rarely went beyond their own personnel to fill senior vacanies. Mr. Palmer was the last senior appointment in the colliery division, for almost from the outset promotion to the position of Chief Viewer

was from within, W.H. Hedley being succeeded by Wm. Logan, then Palmer and finally in 1910, Kirkup. In the beginning the Company also appointed a Mineral Agent, Edward Boyd, who also held a similar position with the Ecclesiastical Commissioners. However after his death in 1889, this role seems to have been undertaken by the Chief Viewer. By that time most negotiations about minerals were for the renewal of leases. During their mineral expansion period the Directors also had recourse to a consultant, Wm. Armstrong, who was frequently called in on negotiations during the 1860's and 1870's.

Besides their executive management the Company's Board of Directors was rich in men with experience of the Coal Trade. Needless to say foremost amongst them was David Dale, whose position of Chairman of Consett, Managing Director of Pease and Partners, and a Director of the North Eastern Railway gave him access to a wide range of information on the Northern coal trade. Numerous other Directors also had interests in other colliery concerns.(82)

On the lower echelons of management were the competent if unimaginative colliery managers, and their assistants. These men formed the stratum of middle-management and were for the most part unlikely to rise any further; they had reached the limits of their ability. Probably because of this they were conservative and risk minimizers in the decisions they took and the advice they gave. Wm. Jenkins observed in a letter to David Dale:

> "There is however a good deal of conservative feeling on the part of the colliery managers in the way of unwillingness to attempt anything new...."(83)

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(82) See pages 314-315.

(83) Wm. Jenkins to D. Dale, 6 March 1891. (DCRO : D/CO/75).

Caution became the keynote of Consett's Colliery management as time passed by, and profits were made through the exploitation of the extended royalties acquired by the enterprise of the Directors in the 'seventies and 'eighties.

CHAPTER VI

A Description of the Consett Iron Company's Iron and Steel Making

The Consett Iron Company, which under Vice-Chancellor Kindersley's order of 18 March 1864 bought up the properties of the Derwent and Consett Iron Company, found itself the owners of a plant which in terms of physical extent was the largest in England; but the interrupted operations between 1857-1864 obviously took their toll on the efficiency of the works. Though the expectations expressed in the new Company's Prospectus were not unreasonable,(1) the production of 150,000 tons of pig iron in a year was not achieved until 1881 when the blastfurnace plant had been completely renewed. The similarly sanguine expectations for the production of finished iron were not fulfilled until 1870, when just over 57,000 tons were produced.

The Prospectus also spoke of the Company's reputation in the "most important and extending branch - plates for iron shipbuilding."(2) However during the first dozen years of the new firm's existence the production of iron rails remained as important as plates, as Consett was caught up in the boom in railway building which accompanied the cessation of the American Civil War and the Franco-Prussian War. With the collapse of the iron rail trade in 1876 Consett turned the whole of its iron-making facilities over to the production of iron plates, and from then up to 1914 the metallurgical side of the business was intimately bound up with the fortunes of shipping and shipbuilding.

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(1) Shipperdson MSS, No. 1729.(University of Durham, Department of Paleography).

(2) Ibid.

The capacity of the Consett Iron Company continued to expand; by 1883 the blast furnaces were capable of producing over 200,000 tons of pig iron annually, when all were in blast together, and by the turn of the century this had been raised to almost 250000 tons per annum. The erection of a new modern 'type' of furnace in 1908-09 eventually put the firm's pig iron capacity beyond 250,000 tons.

The puddling capacity grew to a peak of over 110,000 tons in 1881, whereafter it levelled off and finally began to tail off in the late 1880's as the firm changed over to the production of steel. Iron plate production followed a similar course after achieving a peak of 86,019 tons in 1881.

The first output of steel in 1883 was only 393 tons; but by 1888 over 100,000 tons was being produced annually, and by 1894 this had been doubled to 200,000 tons. The 300,000 ton mark was eventually achieved in 1904. The output of steel was at first devoted solely to plate production, but then in 1893 an Angle Mill was opened for the rolling of sectional and structural steel. After this the output of steel was split in the ratio of 2:1 between plates and angles.

The course of production at Consett fell into four phases of development. The first was characterised by self-doubt and examination caused by the obsolete plant which made economical operations most difficult. This period ended in 1870 with the departure of Jonathan Priestman as resident Managing Director, and his replacement by William Jenkins.

The viability of Consett ironworks having at least been theoretically established, Jenkins began to convert the theory into practice. However the second phase between 1870-1886 was no less trying, for the Company was confronted by rapid technical change which first destroyed the economic feasibility of the

iron rail trade, and then threatened to undermine Consett's staple trade, plate manufacture. This change was the substitution of steel for iron. In the early 1880's the Company rose to the challenge, and by 1886, steel had established its ascendancy overiron at Consett.

The third phase was one of intensive investment activity in new steel producing plant, and also in consolidating the Company's position as a supplier of shipbuilding materials. The rolling mills were remodelled to handle steel, and new melting furnaces were built, and finally an Angle Mill was added. This period terminated in 1894 with William Jenkins' retirement from management. The feverish activity between 1886-1894 had two repercussions upon the future of Consett. Most immediately it took a heavy toll upon senior management, which meant the Company entered the final phase with new men at the helm. Less obvious at first was the finality of this investment, for Consett had exhausted its reserves of space for expansion. Future expansion of output was only possible by the radical reconstruction of the plant.

Finally between 1894-1914 the Company was caught up in the euphoria of the Edwardian Decade. Its profits were unprecendented but their plant was deteriorating. The constraint upon spatial expansion posed the problematic choice between foregone profits and reconstruction. Renewal was either postponed or carried out piecemeal, so that the iron and steel plant of Consett must have been a very sorry sight by 1914.

1. <u>1864-1872: The emergence of the Consett Iron Company</u>.

When the property of the Derwent and Consett Iron Company was taken over in 1864 it was proposed that the Bishopswearmouth works should be disposed of. Originally Vice-Chancellor Kindersley's Order permitting the sale of the Consett works excluded Bishopwearmouth Iron Works, which were under offer of

sale.(3) However it is not clear whether this sale was ever carried through, for a year later, in 1865, the Consett Directors decided to offer the Works for sale.(4) The logic behind the ownership of Bishopswearmouth by the Consett Works had always been doubtful and its disposal in 1865 to Henry Ritson for £13,000 was advantageous in that it provided Consett with capital to make improvements in its North-West Durham works.(5)

The first alterations to the plant were proposed in August 1864 when the expediency of expanding forge capacity at Consett, to bring it into line with that of the Finishing Mills was agreed upon. By December it had been decided to purchase two horizontal high pressure engines from Messrs. Cowan, Sheldon & Co. for £760, and two 3 ton hammers from Tannett, Walker & Co. of Leeds for £844.(7) This was the only major improvement undertaken in the first year of the firm's life but there were portents of future developments to be found. At the beginning of 1865 Jonathan Priestman agreed to supply pig iron to the nearby Shotley Bridge Iron Company, Ltd. (8) This company had no blast furnace capacity but did have a medium size forge and finishing department, and some coal royalties. Whilst Consett unloaded Bishopwearmouth it was eminently sensible that it should merge with the Shotley Bridge Iron Company. The first move for an amalgamation was made by the Shotley Bridge Directors in mid 1866.(9) This was probably initiated by David Dale who was a director of both companies, and effectively Managing Director of both.

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(3) Vice-Chancellor Kindersley's Order, 18 March 1864, in Directors' Minute, 26 March 1864. (DCRO : D/CO/29).
(4) Directors' Minute, 11 March 1865.(loc. cit.).
(5) Directors' Minute, 2 September 1865.(loc.cit.).
(6) Directors' Minute 6 August 1864.(loc.cit.).
(7) Directors' Minute, 10 December 1864.(loc.cit.).
(8) Directors' Minute, 11 February 1865.(loc.it.).
(9) Shotley Bridge Iron Company Ltd., Directors' Minute, 25 July 1866. (DCRO:D/CO/1)

The Shotley Bridge Iron Company had been formed on the 29 July 1863 when it took over the works and property formerly belonging to J.B. Richardson from the Trustees. Its origin was not very different from Consett's, and it had as its Directors some of the North's leading ironmasters, David Dale, James Morrison and Isaac Wilson.(10) Under the direction of Dale the firm set about expanding its capacity and improving the quality of the plant. The boilers were waste heat fired and patent hammers had replaced the cruder helves;(11) in all the Shotley Bridge Company expended £21,420.04s.6d. on capital plant between 1863-66. In addition, in 1864 the company had entered into an agreement with Messrs. J. Backhouse & Co., the bankers, to acquire the East Consett Estate and the Royalties of Jonathan Richardson. The Bank would pay Richardson £30,000 and then resell them to the Shotley Bridge Company at the same price, to be paid with 5% interest by instalments of £1,500 per half year.(12)

During the first couple of years the firm prospered on an upturn in trade and an absence of competition, there being only two other firms making iron plates in the North of England. The summer of 1864 brought about a break in the prosperity: the price of plates fell, and Shotley Bridge was stuck with fixed price raw material contracts. What profits were made, were cut down by a spate of bad debts, and the imprudent distribution of profits in previous years left the firm without any reserves.(13) 1865-66 proved to be no better and this convinced the Shotley Bridge Board of the advisability of a merger with the Consett Iron Company, the alternative of a large capital infusion to extensively expand the works being considered unwise. Since the formation of the Company

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(10) Shotley Bridge Iron Company Ltd., General Meeting Minute, 29 July 1863. (DCRO : D/CO/2).

(11) A helve was a heavy cast iron hammer, pivoted at one end, lifted by cams and allowed to fall by gravity. W.K.V. Gale, The Iron and Steel Industry: A Dictionary of Terms, (Newton Abbott 1971) p.105.

(12) Shotley Bridge Iron Company, Ltd. Directors' Minute, 28 June 1864 (DCRO : D/CO/1).

(13) Shotley Bridge Iron Company, Ltd. General Meeting Minute, 7 August 1865. (DCRO : D/CO/2).

competition in iron plates had become intense the number of firms in the North-east increasing from three to eleven.(14) Isaac Wilson and James Morrison were appointed to produce an offer to the Consett Iron Company and carry through the negotiations. They valued the property at £64,802.15s.9d which included the £30,000 owed to J. Backhouse and Co. but Consett was not prepared to pay so much,(15) and made a counter-offer at £55,000. It was Consett's good fortune that a buyer's market prevailed and the Shotley Bridge Directors were anxious to be rid of the Company. Because the Directors and Edward R. Whitwell, the Secretary, held £8,455.10s.0d of the £13,041 share capital, they were able to carry the decision to sell at below value.

Consett thus aquired a very valuable addition to its forge and mill capacity, alleviating some of the imbalance between the departments which had existed in 1864. Before Shotley Bridge was aquired Jonathan Priestman was active in making improvements at Consett. In 1865 he proposed that reversing motion be adopted in the No. 4 Plate mill.(16) The installation was completed by the end of the year, since expenditure was shown in the Company's half-yearly accounts.(17) This was before Ramsbottom installed the technique at the railway steelworks in Crewe, and he and Dowlais are generally considered the pioneers of the technique.(18) At the same time a new steam hammer was installed in No. 2 Forge, enabling another 7 or 8 puddling furnaces to be added.(19) Six months later Priestman produced a plan to convert the No. 1 Plate Mill into a Puddling Mill with 20 furnaces with waste heat boilers, and a steam hammer from R. Morrison & Co., Jonathan Priestman was anxious that waste heat boilers should be installed

(14) Shotley Bridge Iron Company, Ltd., General Meeting Minute, An Extraordinary General Meeting, 8 October, 1866. (DCRO : D/CO/2).
(15) Directors' Minute, 1 September 1866. (DCRO : D/CO/29).
(16) Directors' Minute 8 April 1865.(loc.cit.).
(17) Directors' Minute 3 February 1866.(loc.cit.).
(18) A. Birch, The Economic History of the British Iron & Steel Industry, p. 194-5.
(19) Directors' Minute, 8 April 1865.(loc.cit.).

throughout the works, replacing the labour and material intensive hand-fired boilers. The scale of saving was appreciable, 44 waste heat boilers, costing about £16,000, would save 30,000 tons of coal per annum.(20)

At the same time as they were overhauling their forges the Board commissioned Thomas Whitwell to produce a report and recommendations for the remodelling of the blast furnace plant. This was of high priority since there had been important advances in blast furnace technology during the late 1850's and early 1860's. Since most of Consett's plant had been laid out and erected in the 1840's it was rapidly made obsolete.

The chief weaknesses of Consett's plant were, the non-utilisation of waste heat and gases to warm the stoves; the Player's stoves which heated the blast in old fashioned cast iron pipes; the laborious hand charging of the furnaces by wheeling the raw materials over gantries to the furnace tops from a ridge running parallel to the row of furnaces; and finally the small dimensions of the Consett furnaces.(21)

TABLE VI.1

The Dimension of the Consett Iron Company's Blastfurnaces in 1866.

Furnace	Height from the Hearth to Charging Stage	Diameter of the Bosh +	Width of the Hearth
I	44ft.	13ft.	4ft.
2	44ft.	13ft.	4½ft.
3	44ft.	13ft.	4½ft.
4	44ft.	13ft.	4½ft.
5	50ft.@	20ft.	8ft.
6	45ft.	20ft.	8ft.
7	45ft.	13ft.	4½ft.

Source: "Thomas Whitwell's Recommendations", Directors' Minute, 6 January 1866. p.7 (DCRO : D/CO/29).
+ The bosh is the part of the furnace which tapers outwards from the well or crucible to join the stack. It is the widest part of the furnace. (W. . . Gale op.cit. p.28.) @No. 5. furnace in process of rebuilding.

(20) Director's Minute, 11 Novrmber 1865.(DCRO : D/CO/29) loc.cit.
(21) Journal of the Iron & Steel Institute, 1871 i. pp. 142-144.

On Teeside the ironmasters using the local Cleveland ironstone had by the mid 1860's raised their furnaces to 80ft. and even 90ft. in height and introduced closed top furnaces so that the waste heat and gas might be utilised.(22) Whitwell however was not convinced as to the value of such high blastfurnaces to Consett since they made a mixed Cleveland and Hematite pig iron. At Whitehaven where hematite ore only was used, the furnaces were between 50-60ft. high to prevent fusion of the minerals to the furnace lining and the choking of the burden which stopped the blast penetrating throughout. In view of these difficulties the Consett Directors opted for a compromise; they would remodel only one blastfurnace, No. 5, and raise it to about 70ft.(23)

During the next 20 months progress with new technical developments at Consett appears to have been slow. After the purchase of the Shotley Bridge works in 1866 no further improvements or extensions were authorised in the finishing departments by the Board, and the proposal to install stack (waste heat) boilers did not materialise. It was not a propitious time for capital expenditure because of the prolonged Ironworkers' Strike in 1866 and the depressed condition of business.

However in August 1867 the Company lurched forward again in the programme to renew its blastfurnace plant. No. 5 had been completed and the board authorised £5,950 for improvements to No.6. and auxiliary plant. Its dimensions however were not to be finalised until No.5. had been reduced to 55ft. in height and tested.(24)

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(22) Thomas Whitwell's Recommendations, Directors' Minute, 6 January 1866, p.76. (DCRO : D/CO/29).

(23) Ibid.

(24) Directors' Minute, 21 August 1867 p.158. (loc.cit.).

Thomas Whitwell was still acting in the capacity of advisor to the Company, and since it was proposed to build six new stoves for No.6. furnace, he suggested that the Consett Iron Company try a new type of stove patented by himself.(25) The management at Consett were always wary about new inventions with grand claims, and at first were sceptical about the Whitwell stoves, which at that time were only installed at Thornaby. Nevertheless Whitwell was anxious to get his idea accepted and offered one set of stoves to Consett without charge, and any subsequent sets at £625.(26)

Whilst these alterations were being made to the plant, the financial performance was deteriorating because of losses incurred in the manufacture of rails and plates. For the six months ending 31st December 1868 £4,528.18s.3d was lost by the ironmaking side of the business, whilst £18,996.16s.3d profit was made on coal, coke, royalties and rent. There were clearly serious operating inefficiences in the ironmaking departments. In an effort to remove the problems the Board decided upon the desirability of employing a practical ironmaster to examine the manufacturing operations of the Company. David Dale had already secured the services of such a man, Edward Williams, the General Manager of Bolckow Vaughan and Co., Ltd.(27) His report was of fundamental importance to the future policy of the Consett Iron Company, for its objective was to examine whether Consett was feasible as an iron making concern or whether the firm could better carry on as a coal and coke producer.

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(25) Directors' Minute, 11 January 1868 pp.175-176.(loc.cit.).

(26) Directors' Minute, 18 April 1868 pp. 195-196.(loc.cit.).
Whitwell had to pay £250 per set of stoves to the holders of Cowpers and Siemens patents. He priced the units at £500, and since the Consett plans were for five furnaces the cost of stoves would be £2,500. The set offered to Consett were thus on a free trial basis since the Company would pay £2,500 for a complete system of Whitwell Stoves.

(27) Directors' Minute, 6 February 1869.(loc.cit.).

Williams produced his first report in March and dispelled at once any notion of Consett as a coal vendor only. If Consett relinquished the ironworks it was unlikely that anyone else would buy them and thus the Company would lose its most important market for coal and coke. If this happened it was not well placed to compete on the open markets, and Consett's lower grade coke and ordinary coal would not find ready markets in Darlington and Middlesbrough. For this reason Williams felt it was desirable to continue the ironworks since if the Company charged its coal at 4s.2d per ton and coke at 9s.0d per ton it would make a fair overall profit, even if there were a small loss in ironmaking. Williams' second conclusion, was that the ironworks were grossly inefficient, but that if properly managed they ought to be able to produce wrought iron rails and plates at less than the average for Cleveland and Durham works.(28)

Williams confirmed the calculations of the founders of the Derwent Iron Company that the works were not well located to compete in the sale of pig iron with the Cleveland and West Coast makers. The firm ought to have been able to produce a goodish quality pig iron at a moderate cost, but this was thwarted by the obsolescent nature of the blastfurnaces and stoves. They were hopelessly wasteful of fuel, using as much as 26 cwts. of coke and 10 cwts. of coal per ton of pig iron, whilst in Cleveland the best practice adopted by the makers had reduced the consumption of coke to about 21owts of coke and barely any coal. The reduction in the use of coal was achieved by the utilisation of waste heat and gas from the blastfurnaces; only a little coal was necessary for the calcining of ironstone. In money terms this was adding 4s.4d per ton to the cost of making pig iron.(29)

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(28) Edwards Williams First Report, Directors' Minute, 13 March 1869.(loc.cit).

(29) Ibid.

In Williams' view No.5. blastfurnace was of the correct design, and he approved of the Whitwell stoves, if only because they were superior to the ones currently at work. He also recommended the installation of Lancashire or Cornish boilers which would eliminate the need for coal. If the cost of pig iron were reduced, then Williams believed that Consett should be able to produce a puddled bar as cheaply as anywhere in England. Before this end could be achieved it would be necessary to reduce the coal consumption of the Puddling Mills by as much as 25%. Consett was indulging in one of the cardinal sins of the ironmaster, producing a quality of metal which was unnecessarily better than was required, and this had pushed up fettling and labour costs.(30)

If these improvements were undertaken Consett would become a viable integrated works yielding a very good return on the moderate capital outlay. Such was Williams' prophetic conclusion. This attack on inefficiency by an outsider galvanised the Board into action; they immediately authorised the reconstruction of a third blastfurnace and asked Edward Williams to produce more detailed recommendations on certain aspects of the Company's activities.(31)

In his second report he was more sanguine about the production of pig iron, estimating that Consett could probably produce pig iron more cheaply than the Cleveland and most favoured Welsh makers, if for a weekly output of 1,350 tons of pig they used mill cinder, Cleveland and Hematite ores in the ratio of 12:20:25. He was however more explicit about the inefficiences in the forge and rolling mills: in the former 31cwts. of coal were used per ton of puddled bar, fully 10 cwts. in excess of the optimum; fettling was three times the acceptable level because of

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(30) Ibid.

(31) Directors' Minute, 3 April 1869.(loc.cit.).

the production of the unnecessarily high quality iron; and labour costs of 16s.2d were fully 4s.0d per ton above the best practice. In the rolling mills the piles were being hammered before blooming, a process which yielded no advantage. Williams was also critical of the process introduced by James Radcliffe, the Assistant Manager, since it was neither economical nor superior.(32)

The introduction of an out side authority was in itself an undermining influence upon the resident management at Consett, but Edward Williams' final conclusion left no doubt as to his opinion of the management:

> "I am however convinced that there should be added to your present staff someone skilled in forge and mill operations, and able to take a comprehensive practical view of both - Such a man having also notions of economy, would be able to correct numerous details, in which serious loss is occurring to you at present."(33)

Priestman was left in the unenviable position of answering the criticism, whilst conscious of the insecurity of his own position. His main defence was that Williams had in fact examined an unrepresentative year (1867-68) when experiment had been going on with mixtures of ore in the blastfurnaces. Furthermore, although the Cinder Pig was not approved of by Edward Williams, it was the only pig iron that Consett were able to sell at a profit. In the forges the cost of fettling had been reduced by 25% since 1867, but it was likely to remain higher than that which Williams was accustomed to since the 'Grey Pig' for plates required more fettling than the mixtures of pigs used for rail-making.

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(32) Directors' Minute, 8 May 1869. (loc.cit.).

(33) Edward Williams' Second Report, Directors' Minute, 8 May 1869. (loc.cit.).

The high coal consumption was due to the non-completion of the replacement of boilers which Priestman had recommended as a major cost reducer in 1865,(34) and not to the use of high quality irons. Priestman produced further evidence contradicting, or at least modifying Mr. Williams observations, but he was clearly on the defensive and concluded by being agreeable to work in conjunction with a 'more practical man'. (35)

Williams had suggested sweeping changes and the Consett Board on balance accepted them, but many of them had been under consideration since 1865. It is difficult to lay all the blame for the inefficiency upon Jonathan Priestman because he had made positive suggestions for improvement which at best had been only partially implemented. Priestman however took the report as a personal attack and offered his resignation, as did the Assistant Manager James Radcliffe. The Company presumably accepted Williams' interpretation and accepted the resignations.(36)

The Company immediately advertised "for a Gentleman thoroughly competent to undertake the Practical as well as the Commercial Management of their extensive Iron Works..."(37), and received sixty-four applications. A short-list of half a dozen was drawn up by David Dale and John Henderson (Chairman), and the post was offered to William Jenkins, at a salary of £1,500 p.a. plus £1 per cent on the amount paid as dividend. Though no mention of Edward Williams is made in the appointment process it seems very likely that he was consulted. William Jenkins, like Williams came from the Dowlais works, and his daughter married Edward's son Illtyd, several years later.

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(34) See note (19).
(35) Directors' Minute, 22 May 1869.(loc.cit.).
(36) Directors' Minute, 5 June 1869.(loc.cit.).
(37) Directors' Minute, 3 July 1869.(loc.cit.).

The two reports of 1869 thus set the policy direction for Consett during the next twenty years or so. Jenkins' recommendations on the use of Cumberland ore increased the consumption almost immediately, eventually causing Consett to look to Spain for its supply. The doubts he expressed about Consett's ability to survive as a coal producer prompted the vigorous expansion of the Company royalties and the opening of special sale collieries at Westwood and Langley Park in the 1870's, and Garesfield and Chopwell in the 1890's.

The Board immediately speeded up the expenditure on reconstruction of the blastfurnaces, and one of Jenkin's first tasks was to report on progress. He recommended that the remaining 3 small furnaces be pulled down and replaced by two large furnaces with Whitwell stoves which had proved their efficiency at Consett.(38) The budget for the completion of the programme was £40,000, but certain important ancillaries were necessary, such as calcining kilns, new locos, railway lines and slag roads, and these increased the expenditure by an estimated £19,500. Jenkins sought Williams' opinion,(39) and he recommended John Row, an engineer who was later employed by Consett and designed the staithes and loading facilities for the Orconera Company in Spain. Roe revised Jenkins' estimate upwards, but stated that "the contemplated expenditure is likely to effect a considerable ultimate saving".(40) The locomotives would replace horsedrawn carts in removing the slag, enabling a reduction in costs through saving fodder and labour.

The business of the Company was increasing so quickly during the early 1870's that there was a continual pressure upon the blast furnace capacity. No sooner were the five new model furnaces constructed than Jenkins approached the Board,

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(38) Directors' Minute, 3 July 1869. (loc.cit.).
(Priestman found that the Whitwell stoves consumed 18-21 cwt. of coke per ton of pig, compared to 22 cwts. consumed by the Player's stoves.
(39) Directors' Minute, 31 January 1871. (DCRO : D/CO/30).
(40) Directors' Minute, 7 March, 1871 pp.99-101.(loc.cit).

proposing to build a sixth furnace, to cover the Company in the event of a furnace breakdown. He was also anxious to blow out No.3. and replace the wasteful cast iron piped stoves by Whitwell's.(41) Within another eighteen months the Board had approved the addition of a seventh blast furnace, which completed the major investments in this department until the first decade of the twentieth century.

Consett had completed its first phase of development by the end of 1873, with the reconstruction of the blastfurnace plant and expansion of the other departments. Important advances had also been achieved. Within the limits of contemporary technology the decision to build the furnaces to only 55ft. appears wise: other firms using hematite also opted for lower furnaces than those of Cleveland. The Barrow Hematite Steel Company had experimented with a 75ft. furnace but then reduced it to 61ft.(42) and although the Furness Iron and Steel Company, at Askam had a 75ft. furnace, Whitwell claimed its coke consumption was 20.75 cwts. per ton of pig as compared to under 20 cwts. at Consett where less rich materials were produced.(43)

The Consett Works became a show place for the operation of Whitwell's stoves. In a paper given to the Iron and Steel Institute in 1871 Whitwell used data from Consett as evidence that by increasing the temperature of the blast from 1200-1250F a saving of 2cwts. of coke per ton of pig iron could be obtained.(44) Jenkins himself became an avid supporter of the Whitwell stoves, almost to the

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(41) Directors' Minute, 5 March 1872 p.154.(loc.cit.).
(42) Journal of the Iron and Steel Institute, 1871 I, pp.145-6.
(43) Journal of the Iron and Steel Institute, 1871 II, pp.408-409.
(44) Journal of the Iron and Steel Institute, 1871, II, p.223.
T. Whitwell, "Further Results from the use of Hot Blast Fire Brick Stoves," Iron and Coal Trades Review, 5 January 1870 p.4. In advertisements in this trade paper Thomas Whitwell advised interested parties to see his new patented Hot Blast Fire Brick Stoves in operation at Consett.

extent of blind loyalty, but this rare excursion by Consett into pioneering innovation was an unqualified success.

As the discussion about blastfurnace practice died down the debate switched to an effort to find a mechanised puddling technique which could compete with the new Bessemer process. Many papers at the 1872 meeting of the Iron and Steel Institute were devoted to examine the merits and drawbacks of various rotary puddling machines, particularly Dank's machine. Consett was involved in this debate since its laboratory facilities under the direction of George Ainsworth,(45) the chemist, were used to test samples of wrought iron made in Spencer's revolving converter.(46) However there is no evidence that Consett followed the lead of some north-eastern firms in adopting mechancial puddling.

Thus the first eight years were very eventful. After Williams' close scrutiny of the operations of the Company, it was able to survive a crisis of self doubt about the course of development it should follow. As a direct result of the Reports there was a change in senior management, bringing together the very effective team of David Dale and William Jenkins. However one cannot help feel that Jonathan Priestman was shabbily treated and that a considerable portion of the blame for the inefficiency was shifted on to his shoulders, when it might more justly have been placed upon the Directors' who were tardy in the adoption of new investment. It may have been that the Directors had little faith in the new concern until Williams clearly illustrated to them its immense potential. His expectations were fulfilled more than amply during the ensuing forty years.

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(45) George Ainsworth employed at £120 per annum as a chemist, later became blastfurnace manager and eventually in 1894 successor to William Jenkins.

(46) A. Spencer, "Spencer's Revolving Converter of Puddling Machine" Journal of the Iron and Steel Institute, 1872, II pp. 321-22.

2. 1872-1886: Adjustment and Change

This period was marked by two fundamental changes in the activities of the Consett Iron Company. The first of these was the collapse of the iron rail trade in 1876, and this was attended by the question of whether to introduce steel making; the second was the rapid introduction of steelmaking after 1881, so that by 1886 steel had established its pre-eminence over iron as the major product of the Company.

In 1872 David Dale withdrew from activity management of the firm leaving the control solely with William Jenkins,(1) whose first two years at Consett had been so successful that the Directors revised his contract in appreciation.(2) The void left by Dale was filled by the appointment of committees for Coal and Finance matters and also a Company Secretary to look after commercial aspects of the Company's business. The first Secretary was an internal appointment, Richard Latimer, the firm's cashier and accountant, but he resigned in 1873 and was replaced by Richard Evans. He was a compatriot of Jenkins and had also begun his career at Dowlais though he came to Consett from the ironworks at Maryport in Cumberland.

The years 1872-74 were ones of feverish activity and full production and in view of this there was little renewal to plant. However in December 1874 it was decided to blow out No. 3 and 4 blastfurnaces for relining; the opportunity was also taken to replace the inefficient cast iron pipe stores still in operation at No.3 furnace. During 1875 as trade eased off first No.3

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(1) Directors' Minute, 3 August 1872. p.187. (DCRO : D/CO/30).

(2) Directors' Minute, 9 April 1872 pp.171-172.(Ioc.cit.).

and then at the tail end of the year No. 4 was blown out.(3)

By the summer of 1875 concern was expressed about the condition of trade. The Company began to sell Cinder Pig and stock puddled bars, a sure sign that trade was in a state of slump. Worse had yet to come; in November Jenkins reported to the Board that orders for rails were exhausted. In an effort to keep the Rail Mill operative Jenkins was authorised to sell rails for immediate delivery at 2s.6d per ton below cost including all fixed charges.(4) The collapse was more fundamental than can have at first been realised for the sharp fall in steel rails had by the end of 1875 made iron rails obsolete. Wrought iron rails wore out so quickly that even whilst the price of steel was significantly greater a market could be found for steel rails. With the proliferation of Bessemer steel plants in the early 1870's and the expiry of Bessemer's royalty the cost of Bessemer steel tumbled down relative to wrought iron.(5)

TABLE VI.2.

Production of Iron & Steel Rails in Great Britain 1870-1880
Figures published by Sir David Dale. ('000 tons).

Year	Wrought Iron	Steel*
1870	1350	-
1871	1370	200
1872	1270	250
1873	1005	300
1874	1005	350
1875	865	400
1876	855	470
1877	820	565
1878	775	700
1879	675	560
1880	350	810

Source : Burnham and Hoskins, op.cit. p.158; A. Birch The Economic History of British Iron and Steel Industry, pp. 354-5.

(3) Directors' Minute, 2 February 1875, p.90.(DCRO:D/CO/31).
Directors' Minute, 29 November, 1875, p.146. (loc.cit.).
(4) Ibid., p.145.
(5) A. Birch, o.cit. pp.354-355.

Duncan Burn observed that 'by 1876 it was recognised in England that the iron rail-trade was dead'.(6) At Consett the realisation had also sunk in by 1876, for by June the firm had only 2000 tons of iron rails on order for the North Eastern Railway, and there was a total absence of any further rail enquiries.(7)

Rather than have the plant lying idle Wm. Jenkins proposed that "to meet the increased demand for ship-plates.....the present Rail Mill/be altered/ into a plate Mill, which might be made interchangeable for rails at a short notice."(8) For many small firms in the North east the depression of 1876-77 was fatal. The Iron and Steel Institute reported that 33% of all pudding furnaces and rolling mills were idle in the North of England for a considerable part of 1877.(9) However though the market for rails had collapsed, the returns of the Board of Arbitration showed that plate and angle sales were maintained.

Consett had moved into ship-plates and the shipbuilding industry remained its most important single customer until the 1920's. However no sooner had it taken this most important decision, largely through force of circumstance, than the threat of steel began to encroach into ship-plates. On 7 November 1876 the Board requested Wm. Jenkins in conjunction with Edward Williams to look into the question of "the comparative position of Consett as a site for a steel producing concern together with the probability of such trade being remunerative."(10)

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(6) D.L. Burn, Economic History of Steelmaking, (London, 1940) p.28.
(7) Directors' Minute, 17 June, 1876. p.204 (DCRO:D/CO/31).
(8) Directors' Minute, 3 October, 1876 p.232. (loc.cit.).
(9) Journal of the Iron and Steel Institute, 1877 p.477.
(10) Messrs. Williams & Jenkins Steel Report, Directors' Minute, 6 March 1877. pp.4-13. (DCRO:D/CO/32).

The previous year Nathaniel Barnaby, the Director of Naval Construction in Britain had visited Lorient in France to see the developments made by the French metallurgists in improving steel for shipbuilding purposes. The new mild steel made by the addition of ferro-manganese was ideal for ship-building purpose in Barnaby's view.(11) The technique was taken up by the Bolton Steelworks, a Bessemer plant, and Landore Works in South Wales, an open hearth plant. The sucess of the process lay in the latter method of steel production, and James Riley the manager at Landore subsequently moved to the Steel Company of Scotland where the new process proved a salvation.(12)

Williams and Jenkins however were not immediately interested in steel as a substitute for iron in plate making. As far as they were concerned there were no advantages to be gained in producing steel plates because of the existing price differential. Their chief concern was whether Consett should build a steel plant for the manufacture of rails and they concluded that the Company was well located to compete with other steel railmakers, because of its cheap fuel and access to plentiful hematite supplies.(13)

In addition the Report contains information which highlights one of the ironmasters' chief complaints at this time, the level of railway freights. The North-Eastern Railway were accused of charging excessively high rates on raw materials which put the manufacturers of Durham and Cleveland at a disadvantage. The complaints became all the more vociferous as trade collapsed in 1875, and the North Eastern Railway's monopoly was so much resented that it was proposed to introduce a Bill in Parliament to build an additional railway in Durham and Yorkshire.(14) The pressure was successful to a degree, in that the North Eastern

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(11) Transactions of the Institute of Naval Architects, 1876, p.149.
(12) Journal of the Iron and Steel Institute, 1884, II. p.223.
(13) "Messrs Williams & Jenkins Steel Report," Directors' Minute, 6 March 1877. pp.4-13. (DCRO:D/CO/32.)
(14) Iron and Coal Trades Review, 5 March 1875, p.264.

Railway were at last forced to take notice of their customers' grievances and acknowledged the need to improve their handling facilities; they also eventually announced an abatement in their charges for materials used in the manufacture of iron at works on their system.(15) Such concessions wrung from the railway were more important to Consett than to many of the other makers, thus the remonstrations of Jenkins and Williams about rail freights were well founded as was Williams' compliment about the well integrated nature of the Company's works which reduced railway dues. As he observed this alone was "of enormous importance and enables you, even in times like the present, to make a profit upon the plates sold".(16) Consett kept up almost a continuous correspondence with the Railway Company's officials in an effort to get rates reduced and services improved. However in 1881 David Dale was elected to the Board of the North Eastern Railway, which enabled him to put the case of ironmasters and coalowners more forcibly.(17) Amongst the iron companies Consett was probably the best represented, having five Directors in common with the North Eastern Railway between 1864-1914. At most times there were effectively two Directors in common as can be seen from Table VI.3. below.

TABLE VI.3.

Directors in Common: Consett Iron Co. and the North Eastern Railway Company.

Director	Period of Directorship	
	Consett	North Eastern Railway
Joseph Whitwell Pease	1864-1867*	1863-1902
John Fogg Elliot	1864-1881	1862-1881
David Dale	1864-1906	1881-1906
Henry Thomas Morton	1869-1893	1881-1898
Frank Stobart	1905-1918	1902-

* Though Joseph Whitwell Pease retired in 1867 from his Directorship at Consett he continued as a large shareholder, and was closely associated with David Dale.
Source : W.W. Tomlinson, The North Eastern Railway: Its rise and development, pp.768-770.

(15) Iron and Coal Trades Review, 23 July, 1875, p.892.
(16) "Messrs Williams and Jenkins Steel Report," Directors' Minute, 6 March 1877. p.6. (DCRO : D/CO/32).
(17) Sir Edward Grey, Sir David Dale: Inaugral address delivered for the Dale Memorial Trust (London 1911) p.21.

The factor which seems to have deterred Consett from undertaking any investment in Steel at this point was the estimated cost of the necessary plant. A 50,000 ton capacity plant would have cost £250,000 whilst a 30,000 ton plant would have been in the region of £170,000 - £180,000.(18) By the end of 1877, however, Wm. Jenkins had noted that steel was becoming a demanded product for shipbuilding. He drew the Boards attention to this development and was advised to keep a close watch on the progress of steel plates and formulate means whereby Consett might meet the demand.(19)

By 1877 Consett's connexion with the Bilbao iron ore producers was being established on a more regular footing with the conclusion of the Carlist War and the consummation of Consett's investment in the Orconera Mines.(20) Williams and Jenkins had both stressed the importance of non-phosphoric ores for the current methods of steelmaking. Progress in this direction laid the vital foundation for the Company's eventual switch over to steel. The shrewd decision to seek an alternative ore supply in 1870-71 when West Coast Hematite began to show tell-tale signs of short supply also proved fortunate for the Company's later development.

By 1878 James Riley had established the Steel Company of Scotland as the sole producer of mild steel for private shipbuilding.(21) Jenkins had kept in touch with developments; during 1879 he and Williams visited several shipyards and steelworks to obtain information on the feasibility of substituting steel plates for iron. Their investigations were spurred on by a strong demand for steel plates during the early part of 1879.(22) It is likely that the two

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(18) "Messrs Williams & Jenkins Steel Report" Directors' Minute, 6 March 1877. p.13. (DCRO:D/CO/32).
(19) Directors' Minute, 14 December, 1877. p.59. (loc.cit.).
(20) Directors' Minute, 1 May 1877. p.29. (loc.cit). Jenkins concluded an agreement for the shipment of 30,000 - 40,000 tons of ore in the following year, from Bilbao to Sunderland at a rate of 11s.0d per ton.
(21) Journal of the Iron and Steel Institute, 1884 II. p.443.
(22) "Messrs Williams and Jenkins Second Joint Report on Steel," Directors Minute, 6 September 1879. pp.157-58. (DCRO:D/CO/32).

men visited the Blochairn and Landore steelworks for both were mentioned in some detail in their second report. Landore was producing between 200-300 tons per week of excellent steel mainly for Government contracts; this meant they secured a higher price than they would otherwise get for private contracts, thus avoiding some of the competition with iron plates. On the other hand the Steel Company of Scotland was expanding its capacity at its Blochairn works to produce 400-500 tons of Siemens-Martin steel per week for sale to private shipbuilders. From what they saw they were convinced that Consett could undertake the manufacture of steel with little difficulty and at very little cost.(23)

They did, however, consider the possibilities of the utilization of phosphoric ores, in light of the Gilchrist-Thomas breakthrough, and concluded that Consett would be able to hold its own. Most important in this respect was the observation that the "best judgement is that the abandonment of the Consett Works either wholly or in part.....would be very unwise."(24)

The report thought that the process of the future would be that of Bessemer which was "much the most economical while it is capable we believe of producing any wished for quality of steel", but some Siemen's regenerative furnaces were to be installed for working scrap. However, to begin with it was recommended that two 10 ton Siemens-Martin furnaces, with a weekly capacity of 100-150 tons should be installed with the necessary hammering and rolling facilities. The report ends with the warning that it would be unwise for Consett to "be behind hand in its special business."(25)

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(23) Ibid., p.616.

(24) Ibid., p.162.

(25) Ibid., p.164.

The Board took heed and arrangements were made for the installation of two 10 ton furnaces upon a site adjoining No.2. Plate Mill with the necessary gas producers, hydraulic apparatus &c. (26) Consett was the first works in the North of England to take the initiative and go forward into steel production for ship-plates. Contrary to Richardson and Bass's assertion that Consett was very slow in adopting steel production,(27) given the market situation the firm were in fact very responsive. 1878 was probably the turning point when the lighter construction possible with steel, which gave greater dead-weight cargo capacity, began to offset the higher initial cost.(28) Such a reaction proved sound management even if it lacked the entrepreneurial initiative shown by James Riley in 1876 at Landore. However, the advantages of original innovation in a heavy industry such as iron and steel are unproven.

The Board's decision was timely, for by 1880-81 the controversy over the merits of iron or steel was swinging firmly in the favour of the latter. In August 1880 the plans of the "S.S. City of Rome" were examined by the Institute of Mechanical Engineers who were critical of the non-use of steel in parts of this very large ship. Though the engineers were largely won over to steel the owners who made the initial specifications were still bucking under the extra expense.(29) The following year Wm. Denny the Clyde shipbuilder argued the economic superiority of steel built over iron built ships, in terms of their deadweight cargo capacity.(30) In the same year William Parker

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(26) Directors' Minute, 2 December 1879, p.177. (loc.cit.).

(27) H.W. Richardson and J.M. Bass, "The Profitability of the Consett Iron Co., Limited before 1914" Business History, VII (1965) p.75.

(28) Carr and Taplin, op.cit., p.112.

(29) J.D. Marshall, Furness and the Industrial Revolution (Barrow, 1958) pp.388-9.

(30) Wm. Denny, "The Economical Advantages of Steel Shipbuilding" Journal of the Iron and Steel Institute, 1881.

dispelled any notions that steel was more susceptible to corrosion than iron before the Iron and Steel Institute.(31)

In April 1880 the Consett Board budgeted £10,000 for the construction of their experimental steelworks, considerably less than they had estimated the cost to be in 1877.(32) Agreement was reached with Dr. C.W. Siemens, whose licence was still current, though about to expire for a payment of £2,250 for the first two furnaces and thereafter on terms equal to his most favoured licensee.(33) The furnaces were eventually started in June 1883.

Within five months the Board authorised further expenditure on four new furnaces because of the success of the two prototypes.(34) Demand for steel continued to grow and before the four new furnaces were even completed sanction had been given for the addition of a further two open-hearth furnaces. By 1886 output exceeded 40,000 tons per annum and the production of wrought iron was in decline.

Whilst such fundamental changes were taking place to the finishing departments, impressive strides were being made at the blastfurnace plant. In the early 1870's the capacity of the blastfurnaces was about 350 tons per furnace per week, by the end of the seventies the average output of the furnaces had risen to about 700 tons per week whilst No.1 was able to produce over 800 tons a week.(36) This was in every respect comparable with the best practice used in the United States. This was largely achieved by the improved handling facilities around the blastfurnaces and the increased power and heat

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(31) Wm. Parker, "The Relative Corrosion of Iron and Steel", Journal of the Iron and Steel Institute 1881.

(32) Taken for the first year the 1880 plant could produce a projected 5,000 tons per annum, or £2. per ton of steel, whereas the cheapest 1877 plant was £5 per ton of steel.

(33) Directors' Minute, 3 April 1880 p.201.(DCRO : D/CO/32).

(34) Directors' Minute, 6 November 1883. (DCRO: D/CO/32).

(35) Journal of the Iron and Steel Institute, 1883 II. pp.622-24 Journal of the Iron andSteel Institute, 1880 I & II, pp. 219, 636.

footnotes (36) and (37) on following page.

of the blast. In 1880 a seventh furnace was added to the plant at an estimated cost of £22,000; this was part of a larger scheme of expenditure which included the steelworks and additional Lancashire double-flued boilers to improve the power of the blast-engines.(37)

Apart from the spectacular increase in the output of the blastfurnaces, efforts were made to raise the productivity of the rolling mills. Wm. Jenkins advised the Board to convert one of the mills to a reversing mill, the principle which Priestman had first introduced in 1865-66.(38) The facilities of the mills were further improved by the installation of larger plate shears in No.4. during 1880 and by the purchase of lifting, hauling and turning gear for No.2 mill in the same year.(39) The introduction of steel manufacture led to the more general use of cogging to produce slabs rather than hammering, which was more costly. At Blochairn James Riley had endorsed this innovation because of the repeated disputes with the hammermen, clearly an instance of labour militancy leading to the adoption of superior techniques as a substitute for labour.(40)

The substitution of steel for iron progressed at a rapid pace between 1883-86; in the latter year only 48,033 tons of No. 1 puddled bar was produced compared with 109,206 tons in 1883, whilst 40,184 tons of steel were produced compared with 9,454 tons of steel in 1884, the first year of full production. (41) For the country as a whole 1886 marked the year in which

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(36) Journal of the Iron and Steel Institute, 1887, II. pp.163-166. Ibid., 1877 I. pp.163-166. In 1882 the blastfurnaces of the South Chicago Works of the North Chicago Rolling Mill Co. had an average weekly output of 900 tons with coke consumption of about 25 cwt. per ton of pig iron.
(37) Directors' Minute, 2 December 1879. p.178. (DCRO:D/CO/32).
(38) Directors' Minute, 2 July 1878 p.87. (loc.cit).
(39) Directors' Minute, 3 April 1880. pp.202-203. (loc.cit.).
(40) E.J. Hobshawm, Labouring Men, (London, 1964) p.172.
(41) Private Cost Books, 1868-1905, (DCRO:D/CO/97).

the tonnage of shipping constructed of steel exceeded that made of wrought iron.(42) Although the years 1883-86 were ones of sharp depression for shipbuilders and so also for the companies which supplied them, Consett maintained the pace of innovation set during the 1870's. The mill was in fact used to carry out maintenance and repairs, and even to project expansion, a policy comparable to that followed by Andrew Carnegie;(43) but as Carnegie observed, this policy required substantial reserves and in this respect Dale's financial planning and wisdom served Consett well.

In 1884 Jenkins was asked by the Board to explore the opportunities for rolling steel angles at Consett, but he was unable to offer any encouragement since none of the existing mills could be adapted to steel angle rolling.(44) Before anything further was done on this count the steel plate mills were expanded to even greater capacity. In February 1886 Wm. Jenkins produced a report on proposed extensions - the plan envisaged the construction of a further ten Siemens-Martin furnaces and the remodelling of the Plate Mills, No. 3, 4 and 5. In the weeks before the report was prepared the Heads of the various steel making departments visited the works at Jarrow, Barrow, Workington and Tudhoe to ascertain the best process for steelmaking and the most up-to-date methods.(45) The two West Coast works were Bessemer plants whilst Jarrow and Tudhoe were open-hearth steel plants. The Weardale Iron and Coal Company had only recently changed over to the Siemens process, replacing the Bessemer converters which had been installed in 1861.(46)

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(42) J.C. Carr and W. Taplin, History of the British Steel Industry (Oxford, 1962) p.110.
(43) D.L. Burn, op.cit., p.261.
(44) Directors' Minute, 21 October, 1884. p.173. (DCRO : D/CO/33).
(45) Wm. Jenkins' Report on the Steelworks Extensions," Directors' Minute, 16 February, 1886, pp.233-239. (loc.cit.).
(46) H.W. Hollis, "The Tudhoe Works of the Weardale Iron and Coal Co. Ltd.," Journal of the Iron and Steel Institute, 1893. II. pp.144-153.

The result of these investigations was that Jenkins revised his opinion expressed in his 1879 Report, that the Bessemer process was the steelmaking method of the future. By 1886 he was convinced that the Siemens-Martin process was more suitable for ship-plates manufacture than either the acid or basic Bessemer processes.(47) In this decision, apart from Weardale's change over, he was probably aided by the opinion of George Snelus at the Workington works of the West Cumberland Iron Company, who in 1877 had admitted "that there might be a little more trouble" in applying the ferro-manganese process to Bessemer than to Siemens steelmaking.(48)

The new extensions would cost between £75,000 - 100,00 and the Board anticipated that this would be written off within eight to ten years. This was not at all unrealistic, and if anything, given the pace with which technological progress was being made in the industry at the time, it was possibly even conservative. Up to the end of 1885 £67,945.04s.1d had been expended on the steelworks and had been written off at the rate of about £10,000 per annum. However the Company was making profits over £1. per ton of plate sold, £33,859.04s.10d profit on only 28,210 tons of plate in the two and a half years up to December 1885.(49)

During the first decade of his control at Consett Wm. Jenkins had been faced with two difficult problems; after the halycon days of 1873 the iron rail trade collapsed completely under the pressure of declining trade and intense competition from steel. Fortunately Consett was able to switch fairly painlessly to its other important branch of manufacture, ship-plates

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(47) "Wm. Jenkins' Report on the Steelworks Extensions," Directors' Minute, 16 February, p.234. (DCRO : D/CO/34.).

(48) Journal of the Iron and Steel Institute, 1877. p.91.

(49) "Wm. Jenkins' Report on the Steelworks Extensions," Directors' Minute, 16 February p.239. (DCRO :D/CO/34).

a market which was growing rapidly during the 1870's.

The triumph of steel in the rail industry was a portent of a similar substitution in the production of plates, and Jenkins was absorbed in the problem in the last half of the 1870's. In 1879 it was resolved to adopt steelmaking, by the open-hearth process, just at the time when shipowners and shipbuilders began to appreciate the advantages of steel over iron. This period was a triumph of careful and considered management, which produced good financial results whilst other makers were in difficulty. It was little wonder that the Board were appreciative of William Jenkins' contribution.

3. 1886-1894: The Zenith of Consett's Enterprise.

Between 1886-1894 Consett added a new melting shop, with nine furnaces, remodelled their plate mills, and finally constructed a new Angle Mill with additional steel melting capacity. There were signs however that Consett had reached the limits of its growth. Space and the legacy of past technologies began to exert a considerable influence upon future investment decisions before 1914.

During these eight years there was a great deal of activity in the North of England as 'erstwhile ironmakers' such as Consett reorganised their plant to make steel. In 1886 Bolckow Vaughan and Company increased the capacity of their Eston plant, whilst in 1889 Palmer's added an Angle mill to their facilities meanwhile both Parkgate in Rotherham and John Brown's in Sheffield were undertak-

ing extensive remodelling of their plant.(50)

Though the decision to change over to steel had been taken by Consett in the early 1880's the period between 1886-1894 was when the decision was carried through, with a resultant strain upon the personnel of the Company, for as well as the development programme for the steelworks, after 1890 there was the increased capacity of the Company's coal interests to be developed north of the river Derwent. The result of the strain disrupted the management of the Company, for in April 1894 Richard Evans died suddenly, then in August William Jenkins offered his resignation after many months of intermittent illness. The following year W.H. Hedley, the Chief Viewer, also retired owing to ill health, thus removing the three men who had had a great influence in building Consett up since the early 1870's.

The period is also particularly well documented because the Company's Letterbooks have survived for most of the period between 1887-1894. It is therefore possible to discern more vividly the tension and pressure inflicted upon Jenkins and Evans in particular, in carrying through the changes.

Apart from the construction of additional melting furnaces in the new East Shop it was necessary to improve the Plate Mills by introducing cogging for hammering, installing a more powerful shear, capable of cutting hot slabs 30" by 9", and to increase the pressure and quantity of steam for the engines in the Mills. The steelworks were designed by J.P. Roe, the engineer who designed the ancillary equipment for the blastfurnaces and the staithes at Bilbao, after several trips to other works in the North-East.

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(50) W.A. Sinclair, "The Growth of the British Steel Industry in the Late Nineteenth Centry," Scottish Journal of Political Economy, VI. (1958) p.36.

The work was carried out by a number of contractors, who also were engaged later to do similar work for the Angle Mill. All presented their problems; slow progress, poor workmanship and late delivery, and this all took its toll on the energy of the men who had to co-ordinate the whole project.

Most of the excavation, brickwork and masonry was undertaken by a Redcar contractor, T.D. Ridley. In May 1886 his firm were given the contract for the excavations for the steelworks; once on site however, the firm got more work merely because of their availability. In 1887 Jenkins wrote to T.D. Ridley, Snr.

> "The prices which I have assented to are more than those given to me by another tender, but looking at the fact you have your foreman and your plant already on the ground and the inconvenience which would arise from two or three sets of contractors and their men being present I have readily assented to the amended terms." (51)

Ridley's men, however, had to be constantly pressed in order to keep the work going at the necessary speed. In 1887 Jenkins complained to Dale that whilst he had been away little progress had been made; however, on his return and overtures to Ridley work was speeded up.(52) Four years later, on the Angle Mill contract, Ridley was making such slow progress with the brickwork and masonry that he was summoned before the Consett Board, to have impressed upon him the urgency of the work.(53)

The superstructure for the mills was mainly erected by the Teesside Iron and Engine Works Company of Middlesbrough, though Hawks, Crawshay and Sons

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(51) Wm. Jenkins to T.D. Ridley, 15 March 1887. (DCRO : D/CO/68).

(52) Wm. Jenkins to D. Dale, 28 April, 1887. (DCRO : D/CO/69).

(53) Directors' Minute, 1 September, 1891, p.270. (DCRO : D/CO/34).

of Gateshead did some. The Teesside firm also undertook some of the castings for ladles, carriages, and furnaces. This firm too were a source of concern to William Jenkins: in 1887 a casting received for the mill from Teesside broke, causing the stoppage of the mill. The work was of such poor quality that Jenkins was very disturbed about outstanding orders - his faith was exhausted.(54) Yet in spite of this at a later date Jenkins expressed the hope that the Teesside Iron and Engine Works should get a Consett contract in face of competition from Scotland and Hawks, Crawshay.(55) The link between Consett and Teesside appears to be yet another instance of the importance of inter-linking directorships in securing work. The chain was slightly extended in this case, through Pease and Partners, where David Dale was able to pressure or be solicited by Henry Fell Pease, a Director of the Teesside Iron and Engine Works.(56) The necessity to supervise closely the work done by Teesside, however, was yet another burden placed upon Jenkins and his staff.

This was not the only contractor with whom Consett had difficulties over poor quality workmanship. Miller and Company of Coatbridge who were supplying the cogging mill were possibly even worse. They sent parts in which the defects had been deliberately concealed,(57) but as Jenkins pointed out to Dale:

> "Our old experience here and especially that of our two mill engineers Mr. Roe and Mr. Scott, is quite able to cope with the doings of those who supply us with material, and we must be firm and get what we want."(58)

(54) Wm. Jenkins to M.W. Proudlock, 16 March, 1887. (DCRO : D/CO/68).
(55) Wm. Jenkins to David Dale, 28 April, 1887, (DCRO : D/CO/69).
(56) Wm. Jenkins to David Dale, 11 February, 1887. (DCRO : D/CO/68).
(57) Wm. Jenkins to Messrs. Miller & Co. 31 May, 1887. (DCRO : D/CO/69).
(58) Wm. Jenkins to David Dale, 11 June, 1887. (DCRO : D/CO/69).

Nevertheless, the effect of these delays and deceptions were cumulative and drove Jenkins to complain that the "extensions and reconstructions are giving me much anxiety. The contractors for machinery, castings &c. at all points are day after day requiring pressure and watching as to the details, while the contractors on the ground are slow to move."(59) It was little wonder that one of Consett's competitors, Palmers Shipbuilding and Iron Company complained in the Iron and Coal Trades Review of the delays in the delivery of machinery in 1889, by which time engineering firms were fully employed and delays at their maximum.(60)

The additional nine melting furnaces were completed during the latter part of 1887, and the mills several months later in 1888. There was no let up in the pressure upon Wm. Jenkins for in March of 1888 the Board gave the go-ahead on the programme to construct a steel Angle Mill, on a site left when the Puddling plant was demolished. It was also decided to further curtail iron plate production and limit it to Shotley Bridge works.(61) However before any work could start a suitable large site had to be found, a problem that persistently interfered with Consett's desires to reconstruct plant. Wm. Jenkins complained to David Dale,

> "The fixing of the site, the difficulties surrounding it, and the extraordinary efforts requisite for concentrating the (gas) producers melting furnaces and mills in a suitable manner has been a work of considerable labour and anxiety. I am assuming now that the difficulties as regards defining the site are surmounted."(62)

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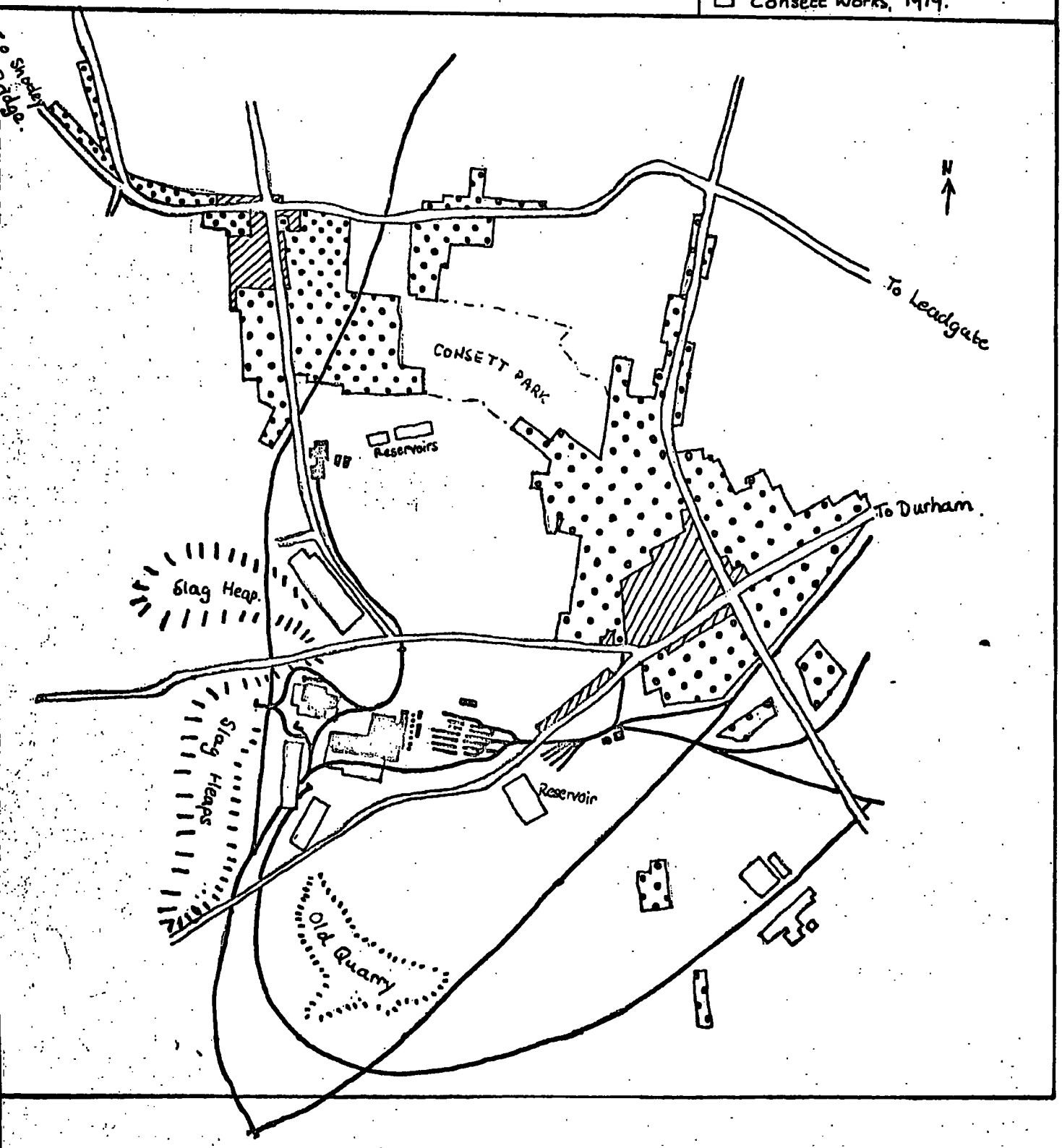
(59) Wm. Jenkins to David Dale, 18 June, 1887. (DCRO : D/CO/69).
(60) Iron and Coal Trades Review, 6 September, 1889.
(61) Directors' Minute, 6 March, 1888. p.40 (DCRO : D/CO/34).
(62) Wm. Jenkins to D. Dale, 6 March,1890. (DCRO : D/CO/72).

The Spatial Development of Consett And Blackhill Between 1861-1919.



Before the First World War this probably proved a greater handicap to the development of the Company than its distance from the Coast. Eventually a site was found between the General Offices and the Tin Mill and the Board gave authorisation to Jenkins to commence the scheme. In all the Angle Mill would consist of seven melting furnaces, a large cogging mill, a 32" Angle Mill, a 22" Angle Mill and a 12" Guide Mill, costing an estimated £150,000. (63)

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(63) Directors' Minute, 3 September 1889, p.125.(DCRO : D/CO/34).

During the early part of 1890 James Scott, the engineer in charge of Mill construction, visited several works, particular Palmer's new Angle mill and the relatively new works of the North Eastern Steel Company.(64) After such preliminary fact finding investigations the designs were probably drawn up and offered out for tenders. The first contracts were made by the end of April with T.D. Ridley for brickwork and masonry, and with the Leeds' engineering firm, Joseph Booth and Bros. who were to supply the overhead travelling cranes. Many of the contractors engaged upon the earlier extensions were successful in winning further work from Consett, with the notable exception of Hawks, Crawshay and Sons - the cogging mill engine was ordered from Lamberton and Company of Coatbridge. The Teesside Iron and Engine Works probably got the largest single contract, £20,400 for the erection of all the ironwork for the roofs.(65) Miller's of Coatbridge were also doing well out of the steel companies' investment, for they won the contract for the Bar mill engines from Consett, and also about the same time a contract for the new cogging mill at the Weardale Iron and Coal Company's Tudhoe works.(66)

The Consett Angle mill was commissioned in March 1893, twenty-one months after the first contracts had been put out. By this time, however, William Jenkins was worn out, and during 1893 he had to have two long absences from his duties. Apart from the two major projects and the problems of organising, planning and co-ordinating them, he had several other problems of major importance to contend with.

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(64) Wm. Jenkins to John Price, Palmer's Shipbuilding & Iron Co., 29 January, 1890. (DCRO : D/CO/71).
Wm. Jenkins to A. Cooper, North Eastern Steel Co., 10 March, 1890, (DCRO:D/CO/72).

(65) Directors' Minute, 13 September, 1890 p.204.(DCRO:D/CO/34).

(66) H.W. Hollis, "The Tudhoe Works of the Weardale Iron and Coal Co. Ltd.," Journal of the Iron andSteel Institute, 1893 II. pp.144-153.

After the completion of the seventh furnace in 1880, little had been done to improve the blastfurnace plant, but this was an area still alive with debate and controversy. In the North East it was centred around the relative merits of the Whitwell and Cowper stoves. In 1883 Jenkins defended stoutly the merits of the Whitwell hot blast stove, mainly on the count of their easy maintenance, but there was little doubt that Cowper's could attain greater heats; as E.P. Martin, the Dowlais manager pointed out, however, the average heat was lower because of the difficulty and time taken in cleaning them.(67) On a broader front there were revolutionary advances being made in blastfurnace practice in the U.S.A. In 1887 E.C. Potter reported upon the new practice adopted at the South Chicago Works, which had increased the output of the furnace to about 1400-1500 tons of pig iron per week with a coke consumption of 17.1 cwts.(68) However such practice necessitated more frequent lining of the blastfurnace, and this was a possible obstacle to the long run efficiency, but this had been overcome by Potter who claimed his furnaces could be relined in sixty days. Commenting upon the paper Jenkins lamented to Illtyd Williams, of Linthorpe, that relining at Consett took six months at least and thus such hard driving was not feasible until the relining procedure was improved.(69)

Jenkins was concerned about the neglect to the blastfurnace plant; one furnace had been operating eight years by 1887, without relining, but was showing signs of wear. As Consett had been doing its own relining for ten to twelve years Jenkins was unsure about the current views on lining s and so asked Williams

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(67) Journal of the Iron and Steel Institute, 1883, II, pp.622-25.

(68) E.C. Potter, "The South Chicago Works of the North Chicago Rolling Mill Co.," Journal of the Iron and Steel Institute, 1887, I, pp.163-66.

(69) Wm. Jenkins to I. Williams, 3 June 1887. (DCRO : D/CO/69).

advice, particularly as to Bolckow Vaughan's suppliers.(70) All the blastfurnaces were showing signs of deterioration in 1887 and there was generally an unsatisfactory consumption of fuel. In an effort to right this Jenkins remained loyal to his Whitwell stoves, negotiating for a licence from Thomas Whitwell to adopt improvements. The Board approved the payment of £500 to secure the licence for Whitwell's Patent improved stoves.(71) However the weight of opinion was by the later 'eighties swinging clearly in favour of Cowper's stoves.

By 1891 Jenkins was on the verge of conversion, but still had to contend with the loyalty of the blastfurnace manager to the Whitwell stoves. The main change which altered his opinion was the rising cost of cleaning Whitwell stoves and the falling cost for Cowper's stoves. His doubts were summed up in a communication to David Dale.

> ...."We are not doing as well as we ought to at Consett with our stoves i.e. we do not maintain the high standard of heat, nor do we get the uniform equable current of hot blast from our stoves, and we here at Consett are now concluding that this regularity of heat is an item of as great importance as the maximum heat itself.....
>
> One serious defect we find in the Whitwell stove is that it has to be cleaned at a greater cost than the Cowper - that the Whitwell stove after being cleaned continues to gradually accumulate dust for six weeks until the cleaning operation is repeated..."(72)

Since it was proposed to repair some of the blastfurnace plant Jenkins began to accumulate details and statistics on the performance of the Cowper stoves, and

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(70) Ibid.
(71) Directors' Minute, 20 August, 1887. p.24. (DCRO : D/CO/34).
(72) Wm. Jenkins to David Dale, 20 March, 1891. (DCRO : D/CO/75).

of Consett's own Whitwell stoves. George Ainsworth, C.P. Douglas and E.G. Kirkhouse, the managers of the blastfurnaces went to Middlesbrough to see the stoves at Linthorpe, Port Clarence and the Teesside Company, and by June, Jenkins had decided to give the Cowper stoves a trial. He continued to seek the valuable assistance and advice of Illtyd Williams but also circularised the other Cleveland makers in order to get more information on the nature of their blastfurnace plant and the type of stoves used in relation to this.(73) Since Cowper's original patent had lapsed Consett decided to install his early type of stove for the trial, neglecting some of his most recent innovations.(74) Three stoves were to be erected for No.5. furnace replacing the four Whitwell stoves;- characteristically the reconstruction took almost a year but when complete the results were conclusively in favour of further adoption of Cowper's stoves:

....."I may mention that our new Cowper stoves, three of them erected at our No.5. furnace which has recently been blown in made 767 tons of Bessemer pig last week with a consumption of 18¾ cwts of coke whereas our No.3. furnace, a very old one with inferior stoves, consumed 24¾ cwts of coke per ton for 630 tons of Bessemer pigs made - a saving as you will see in one week of 190 tons of coke. You will thus observe what prompt action should be taken constantly year after year in bringing up the efficiency of our blast furnace plants to the best condition."(75)

Such savings were at this time critical for the cost of coke had become 'most seriously high' during 1891, furthermore the harder driving of the furnaces during 1891 had pushed them past their optimal capacity with a

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(74) Wm. Jenkins to E.A. Cowper, 24 August 1891.(DCRO : D/CO/77).

(75) Wm. Jenkins to David Dale, 1 August 1892.(DCRO : D/CO/81).

(73) Wm. Jenkins to: Sir Bernhard Samuelson & Co. Ltd., Teesside Iron and Engine Works Company; Bell Brothers; Gjers, Mills and Co.; Dowlais; Palmer's Shipbuilding and Iron Company, 3 August 1891.(DCRO:D/CO/77).

consequent deterioration in fuel economy.(76) A policy of substitution of Cowper stoves for Whitwell's was adopted from 1891 onwards, whenever a furnace was blown out for repairs. Fuel economy was not the only sphere in which attention was directed in the interests of cost reduction; in 1893 much was being done in an effort to minimise costs at the blastfurnace pig beds, in removing the pigs, breaking them and loading them into trucks.(77) After a decade of neglect the blastfurnaces were restored, and their productivity began to rise.

The increase in the cost of coal, which had made the inefficiency of the blastfurnaces critical in 1891, also led to cost problems in the melting shops and mills. The hand-fired boilers, which were used for raising steam, and reheating ingots, were extravagant in both fuel and labour, and the price of both was rising. To contain or reduce costs some method of using these inputs more productively had to be sought.

In 1890 Jenkins was interested in the substitution of capital for labour; he wrote to D. Evans of Barrow Hematite Steel Company:

> "I note also that you refer again to your heating furnaces and boilers, and your mechanical arrangements for feeding the gas producers and that you will be so good as to send me a tracing of these in a few days.."(78)

During 1891 devices for saving labour and coal were being actively marketed - Consett was approached by a James Procter who had patented a mechanical stoker which had been installed at the works of Bolckow Vaughan.

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(76) "I have been going through a process of economising the coke used per ton of hematite pig iron, but this has entailed a diminished product of pig iron" Wm. Jenkins to David Dale, 9 October, 1891.(DCRO:D/CO/78).

(77) Wm. Jenkins to C.P. Douglas, 3 August, 1893.(DCRO:D/CO/84).

(78) Wm. Jenkins to D. Evans, 29 October, 1890.(DCRO:D/CO/74).

However, after an enquiry to Franklin Hilton, the manager at Bolckow's, Jenkins was disappointed to find that there was not the saving he anticipated, especially in manual labour.(79) Fourteen months later, however, Jenkins was more favourable toward mechanical stoking, probably because of further increases in labour costs and the cost of coal. He enquired of W.H. Hedley, the Chief Viewer, the feasibility of supplying 700 tons of small coals per week, as he was considering the question of applying mechanical stokers to a range of twelve new boilers at the Angle Mill. His conversion had been achieved because of the performance of four mechanically stoked double-flued Adamson boilers which consumed inferior coal in smaller quantities and gave larger volumes of steam than hand-fired boilers using a better class of coal.(80)

Since all the ingots and slabs had to be heated, before being cogged or rolled, in furnaces fired by coal, any savings here were actively sought. A patent coal economizer and regenerator was brought to Consett's notice by A. Anderson, but nothing appears to have been done.(81) A few months later, Wm. Jenkins did instruct C. Parnaby, the mill manager, to arrange for the installation of a heating furnace offered by Mr. T.S. Forster.(82) Thus the search for input savers continued, whilst the cost of coal remained high during 1893 ; however when costs began to subside in 1894 so did the apparent interest in new equipment. Mechanical stoking was certainly adopted on a large scale in the Angle Mills, and although it is difficult to ascertain what improvements were made to heating furnaces &c., the examples do show that the Company was aware of its competitive environment, and reacted to protect its competitive position.

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(79) Wm. Jenkins to J. Procter & Co., 1 August, 1891.(DCRO : D/CO/77).
(80) Wm. Jenkins to W.H. Hedley, 1 October, 1892. (DCRO : D/CO/82).
(81) Wm. Jenkins to A. Anderson, 21 December, 1891.(DCRO : D/CO/79).
(82) Wm. Jenkins to C. Parnaby, 10 February, 1892. (DCRO : D/CO/79).

The plate mills were less obviously improved but Jenkins was alert to the new developments. The Company's most difficult problem in this area of manufacture was increasing capacity, because the relatively scarce input was the land on which to build or expand the mills. This may at first seem a strange predicament in west Durham, but the problem was due to the unsuitable topography, which limited the availability of sites for constructing large mills. To the west the land was rendered unsuitable bacause of its use for dumping slag, and the drop down to the Derwent Valley. On the east side the township of Consett limited any growth in that direction. Furthermore the heavy nature of some of the constructions necessitated sound foundations, and in some areas around the works this was difficult because of the honeycomb of old coal workings.

The problem could best be overcome by speeding up the production in the existing facilities and thus increase the output. The mills at Consett were of the reversing type, on the principle introduced by Jonathan Priestman. The plates produced by these required to be sheared on all sides to reduce them to their specified size. The amount of shearing and possibly waste scrap could be reduced by the introduction of a 'Universal' mill which would have vertical as well as horizontal rolls, which would roll the edges of the plate to size.(83) The 'Universal' mill had been invented as early as 1829 but was not put into operation in Britain until 1878, when one was erected at Samuelson's Brittania Works. During 1889 James Riley put one down at the Blochairn works of the Steel Company of Scotland,(84) and Consett began to take notice. Jenkins had acquired the patent for the Adams and Bealey Universal Mill in the Autumn of 1889,

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(83) H.J. Skelton, Economics of Iron and Steel, (London 1924, 2nd Ed). pp.298-99.

(84) Carr and Taplin, op.cit.,p.160.

for £500.,[85] but in his customary cautious manner he wanted to have information on the mill's performance before he committed the Company. Jenkins first tried to find out details of Riley's progress with the mill through the Company's Glasgow agent, A.D. Tolmie,[86] but this cannot have been fruitful for three months later he wrote to E.P. Martin at Dowlais:

> "It is whispered that you have actually been to see Riley's progress, and your Engineer Mr. Pattinson with you.....and if you have had some insight into Mr. Riley's progress you will now be better able to proceed on your own account, but clearly I have no right to ask you what you have seen, nor do I wish to press for this unless you can feel that you can volunteer to tell me what there is in the way of new features in the matter, in the same way as I have told you all I know from the beginning. At your convenience perhaps you will drop me a word or two about this Universal Mill business."[87]

Martin in fact had not been to Glasgow but did furnish as much information as he was able to help Jenkins. However nothing further was done, and when the works were described in 1893, there was no mention of Universal mills.

An alternative method of quickening production was the three high mill, and this was in fact tried at Consett in 1887-1888 in one of the light plate mills, but the technique was abandoned. Jenkins however was still in 1891 open minded on the question and conceded the arrangements in the mill had not been ideal.[88] However he felt that the most suitable practice for heavy work was the two high

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(85) Directors' Minute, 8 October, 1889, p.129.(DCRO : D/CO/34).
(86) Wm. Jenkins to A.D. Tolmie, 13 November,1889. (DCRO : D/CO/70).
(87) Wm. Jenkins to E.P. Martin, 26 February,1890. (DCRO : D/CO/72).
(88) Wm. Jenkins to E.P. Martin, 14 September, 1891. (DCRO : D/CO/77).

reversing mill, despite American claims of success with the three high mill in all classes of work. This was not a purely British view either, for in 1902 R.M.Daelen observed that German practice favoured the two high mill for heavy work.(89)

Jenkins was like many other makers, bound by the plant he had and this limited the range of adaptability.

> ...."I may say this, that if we, at Consett, were to begin afresh again for laying down a new plant for steel plates for what I would call shipbuilding and boiler plates, plus heavy and wide plates, we should do something as follows.
>
> "In the matter of lighter plates for shipbuilding we would erect a three high mill with such arrangements as we are in our experience thinking of, but in addition to the three high mill, we should add a subsidiary pair of two high rolls through which the plates would pass, as a finishing salt. For the latter lighter mill we should look for rolls 7'0" x 26" diameter.
>
> "For a heavier mill - that is for heavier plates for shipbuilding or for boiler plates we in our judgement, should lay down a strong pair of reversing engines with a pair of rolls for roughing and finishing the 10 x 6 plates, but added to the latter, a pair of 8 - 0 chill rolls for rolling ship-building plates of ordinary heavy sizes."(90)

It seems that once again space limited the options open to the Company, as well as other heavy capital expenditure commitments, and consequently the mills

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(89) R.M. Daelen, "Progress in Steelworks Practice in Germany since 1880" Journal of the Iron and Steel Institute, 1902 II. p.53.

(90) Wm. Jenkins to E.P. Martin, 28 September 1891.(DCRO : D/CO/78).

suffered.

Consett was striving to improve the handling facilities in the Plate mills, but in this it was troubled by allegations of patent infringement - Jenkins was adamant that there had been no piracy:

> "What I feel is that movable platforms and live rollers have existed long before the date of your patent; they have been in use for 20 years or more, but as stated above I would like to know what the precise details of your claim are." (91)

Jenkins' suspicions were confirmed by H.W. Hollis of the Weardale Iron and Steel Company, who testified that the traversing platform, the source of the allegation, had been in use for twenty years or more at Codnor Park.(92)

This phase came to an end with the retirement of Wm. Jenkins and the death of Richard Evans. They were succeeded by George Ainsworth, who rose from chemist to General Manager, and Henry Holliday who had been the General Manager of the Leeds Steel Works, Ltd., and had also spent some twenty years working under Edward Williams.(93)

In 1889 Consett had reached the zenith of its development, when it was the largest plate mill in the world.(94) However Jenkins was shortly afterwards complaining of the limitations imposed upon him by old plant. Space for further expansion was not readily available, and many of the new techniques could not be

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(91) Wm. Jenkins to Franklin Hilton (Bolckow Vaughan), 18 March, 1890.(DCRO :D/CO/72).

(92) Wm. Jenkins to H.W. Hollis, 13 November,1889. (DCRO : D/CO/70).

(93) Directors' Minute, 15 May, 1894, pp.179-180.(DCRO : D/CO/35).

(94) Wm. Jenkins to the Editor, 'Pittsburgh Times', P.A. US.A. 22 November,1889. (DCRO : D/CO/70). Jenkins wrote correcting a statement appearing in the Pittsburgh Times that the Homestead plant was the largest plate mill in the world. On the basis of the figures quoted Consett was larger.

profitably adopted, except in new custom built plants.(95) Relocation was never seriously considered for the plant as a whole; the only possibility explored was the removal of the blastfurnace plant to Derwenthaugh. This left the Company with the decision of whether to pull down old plant and reconstruct, or whether just to overhaul and patch it up.

Wm. Jenkins had reached the barrier imposed upon future innovation and investment. George Ainsworth failed to overcome it. The problems and pressures endured by Jenkins and his staff took a high toll on the management resources of the Consett Iron Company.

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(95) J. C. Carr and W. Taplin, op. cit. p.160.

4. 1894-1914. Delay and Indecision.

The period between 1894-1914 was characterised by large profits and dividends, ostensibly the trappings of business success. However the financial performance concealed a developing malaise. The Company was confronted by a number of unprecedented setbacks, such as the failures to secure another iron ore source, deteriorating labour relations in their collieries, and less obvious, but equally pervasive, the inadequate replacement of plant.

The Board showed reluctance to procede with capital development projects, and a tendency to modify them to such an extent that they became merely piecemeal replacements. The primary reason for this was that profit would have to be foregone through reconstruction and disruption. Not until 1910 was there any positive move to carry out a whole hearted programme of reconstruction. The coincidence of the renewal of the lease from the Ecclesiastical Commissioners and the proposed reconstruction is evidence of the Board's lack of interest in a new plant, for the plan could not be undertaken without the security of a long lease.

The balance between profit and replacement of capital fell firmly on the side of profit. George Ainsworth may have lacked the force of character to persuade the Board of the necessity of replacement, and accepted repeated postponement. In 1895 "Mr. Ainsworth referred generally to the desirability of improving our plate mill capacity, more particularly in the direction of increased speed and increased strength of rolls. He was not yet prepared with a definite recommendation, and had hesitated to bring the matter forward because of the probable heavy outlay. It was, however,

desirable to bear in mind that before long it would be necessary to obtain either an entirely new mill, or to remodel extensively one of the existing mills. The matter was left over for mature consideration."(1) Mature consideration meant in effect that the matter was brushed aside until it became more pressing. Almost two years after his original tentative suggestions Ainsworth introduced the matter in more urgent terms, describing No. 2 Mill as being in a 'rickety condition'. The alternatives of a complete overhaul or new mill were once again discussed and: "After very fully considering the question he (Ainsworth) had decided to recommend the overhauling of the Mill at a total cost of about £10,000, to be spread over a period as circumstances might dictate."(2) And so the pattern of delay and half measures was set; but the consequences were blurred by the profit and loss account and the harvest of inefficiency was not reaped until after 1914. Though the period after 1880 was not marked by any revolutionary new technical developments, there was a number of significant innovations in the operation of the existing techniques. In America, enormous advances had been made in blastfurnace practice, beyond those claimed by Potter in 1887; by 1901 the best practice was producing 500 tons of pig iron from one furnace, per day. Blast pressures were commonly four to five times greater than in British furnaces, and there was no indication by 1900 that Consett had advanced past 4½ lbs per sq. inch - about normal in Britain. The pig casting and breaking machine had been widely adopted in the U.S.A., as had devices to enable a continuous system of charging and tapping, without cutting off the blast.(3)

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(1) Directors' Minute, 26 July, 1895. p.110.(DCRO : D/CO/36).

(2) Directors' Minute, 18 May, 1897. p.175. (DCRO : D/CO/37).

(3) Carr & Taplin, op.cit.,pp. 208-210.

In 1894 B.H. Thwaite had patented a gas engine which utilized surplus gas from the blastfurnaces; British firms on the whole ignored it because of the difficulties in cleaning the gas. These engines had a wide range of application in the iron and steelworks and effected greater savings in fuel. The continued assertion that the cheapness of fuel was a retarding factor in Britain, in the light of Consett's own experience in the early twentieth century seems a very limp excuse.(4)

Another important development brought into the public glare in 1894 was the adoption of electricity for driving engines as well as producing light in iron and steelworks. Apart from Dorman, Long & Co. Selby-Bigge's exhortations fell upon stony ground for several years.(5) At Consett the working areas around the blastfurnaces were lit by electric lamps,(6) but nothing was done to extend the use to driving mill engines, despite the considerable energy expended by the Company in introducing electricity on a large scale to their pits up to 1914.

In the early part of the twentieth century the technology of gas engines and electricity converged and in 1908 a uniform electricity supply grid was established on the North-east coast.(7) There can be little doubt that electrically driven motors would be more economical in steel mills than yards

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(4) See Chapter V, section on adoption of by-product ovens.

(5) D. Selby-Bigge, "Electricity as a Motive power in the Iron andSteel Industries" Journal of the Iron and Steel Institute, 1894. I. pp.252-291.

(6) Wm. Jenkins, Description of the Consett Iron Works, p.30.

(7) B.H. Thwaite, "The Economic Distribution of Electric Power from Blastfurnace" Journal of the Iron & Steel Institute, , 1907.
C.H. Merz, "Power Supply and its effect on the Industries of N.E. Coast." Journal of the Iron and Steel Institute, 1908.

of lagged pipes and steam engines, but in Consett's case such a innovation would probably have necessitated new mills - thus the piecemeal policy adopted by the Board was all the more regrettable, for it tied the company to investment in an increasingly obsolete technology.

In the steelmaking process attention was directed towards a continuous open-hearth method, an end achieved by the tilting furnace developed by Benjamin Talbot in Britain. Talbot was the managing director of the new Cargo Fleet Iron Company where the technique was adopted in the reconstructed works in 1905-06.(8) With this continuous process emerged a completely new scale of furnace sizes, with capacities of 175-200,tons. By increasing the size the amount of heat lost through radiation was reduced thus effecting a most important economy in fuel.(9) Consett stuck to fixed open-hearth furnaces and between 1894-1914 increased their individual capacity from 20 tons to 35 tons, but this was still below the maximum capacities which had been introduced at Dorman, Long & Co.

Another fuel saving development pioneered in the late 1890's was the charging of the open-hearth furnace with molten metal. James Riley reported on his success to the Iron and Steel Institute in 1900 and neither he nor the two Welsh firms who adopted the method had found any serious difficulty.(10) In 1897, "Mr. Ainswath explained that he was desirous of experimenting with the use of fluid metal instead of pigs at the Melting Furnaces. He estimated that such a trial he had in view would cost for

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(8) Carr and Taplin, op.cit., p.216.

(9) H.J. Skelton, Economics of Iron and Steel, p.232.

(10) D.L. Burn, op.cit., pp. 202-203.

ladles, carriages &c. about £500."[11] This was approved by the Board but nothing further is mentioned about the experiments and it was not introduced on a permanent basis. Perhaps the Consett staff lacked the engineering competence to install such a system, or maybe they were hindered by the tortuous lay out of the plant, and the tap-holes on the blastfurnaces were too close to the ground to allow easy charging of the ladles.

Possibly the area of greatest concern and derision was steel mill practice in Britain. In 1901 William Garrett compared British practice most unfavourably with that in the U.S.A. The most significant development was probably the application of electricity to mill engines. However, as Consett used two-high reversing mills, this proved an obstacle to the adoption of electric power, because of the high cost of the German Ilgner reversing motor.[12] A suitable reversing motor was not developed until 1906. However Andrew Lamberton, of Coatbridge a mill builder of world-wide reknown, still felt that there was little between steam engines and electric motors. It was only in integrated plants with electricity cheaply produced by large blastfurnace gas engines that significant economies could be made.[13] Once more we return to Consett's dilemma of insufficient space for necessary reconstruction. In a report on the capacity of the steelworks in 1905, George Ainsworth reiterated the familiar complaint about the congested conditions in the works, which not only made extensions difficult but even interferred with the normal running of the plant. The only alternative appeared to be relocation; in 1899 James Scott had planned a blastfurnace plant for Derwenthaugh and

(11) Directors' Minute, 20 July 1897 p.91.(DCRO: D/CO/37).

(12) Carr & Taplin, op.cit.,p.226.

(13) Ibid.

borings showed that the site was sound enough to withstand the weight of any building or plant.(14) Nothing further was done, mainly because the saving in cost between Derwenthaugh and Consett was insignificant, because of the railway hauls, and also because the Derwenthaugh site was also insufficiently large to accomodate a fully integrated iron and steelworks.

What then did Consett achieve in plant improvements between 1894-1914? In 1897 approval was granted for the thorough overhaul of No.2. Mill, and this was effected between 1898 - 1904. Much of the effort was directed at improving the steam power by replacing cylindrical boilers with Lancashire boilers, and also by the installation of two water tube boilers of the Babcock and Wilcox type.(15) The work was spasmodic because of the interruption of booming trade and the renewal of the mill's foundations was not undertaken until 1904 when the trade in plates had slackened.(16) The business prosperity which had its roots as early as 1897 and went through until 1902 proved an effective brake on most developments since the works were stretched to full capacity. There can be no doubt that Ainsworth was aware of the shortcomings of the plant for in 1900 he paid a visit to Belgian Steel works to monitor their developments and the following year, Henry Holliday visited the U.S.A. to report on the causes of the competition from American works, and then Ainsworth and Scott also went to visit American steelworks.(17) The principal aim of the trips was probably the examination of blastfurnace practice because in 1897 Ainsworth put forward proposals for rearrangement of the blast

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(14) Directors' Minute, 30 March, 1901, pp.16-17. (DCRO : D/CO/39).

(15) Directors' Minute, 6 March, 1900, p.182. (DCRO : D/CO/38).

(16) Directors' Minute, 1 November, 1904, p.15. (DCRO : D/CO/40).

(17) Directors' Minutes, 11 August, 1900, p.221 (DCRO : D/CO/38); 9 February 1901, p.7. (DCRO : D/CO/39); 11 June, 1901, p.33. (DCRO : D/CO/39).

engines, boilers and other facilities at the blastfurnaces. The whole scheme he estimated would cost about £100,000 over several years. Though it was agreed to in principle final judgement was yet again postponed.(18) The timing is in itself significant for it marks the introduction of three eight hour shifts to blastfurnace working, and though the blastfurnacemen's union undertook to encourage their members to greater effort, there was no noticeable improvement in labour productivity and thus costs rose.(19)

After the proposal of 1897 operations at the blastfurnaces were so hectic for the next four years that no alterations could be undertaken. Ainsworth was still aware of the necessity to reduce the labour component in cost and he visited several works in 1901 to inspect pig breaking machines, and a machine was offered to Consett which would have saved 1½d - 1¾d per ton in labour costs.

Later in 1901 Consett engaged the services of an American blastfurnace specialist, Frank C. Roberts, to advise them upon the reconstruction of their plant - his fee was $100 per day and travelling expenses. His first plan, submitted at the end of the year, was considered unsatisfactory and unworkable, but his later proposals to dismantle the existing plant and replace it with four furnaces of the American type was adopted.(21)

At first only two new furnaces were to be put up, and a contract was given to Messrs. Westgarth, English & Co. to provide the blowing engines for

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(18) Directors' Minute, 7 August, 1897, p.198. (DCRO:D/CO/37)
(19) G.T. Jones, Increasing Returns, (Cambridge, 1933) p.127.
(20) Directors' Minute, 30 March, 1901, p.20. (DCRO : D/CO/39).
(21) Directors' Minutes, 4 March, 1902, p.93. (DCRO : D/CO/39); 2 August, 1902, p.123. (DCRO : D/CO/39).

£22,000 . The project was barely nine months old when Ainsworth cancelled it on the grounds that it was more costly than anticipated, and there were serious difficulties in keeping the works in operation during reconstruction which was likely to be prolonged. He estimated that the economies did not warrant the outlay. The whole scheme was mutilated until it was no more than a patching up of the existing plant.(22)

The old egg-ended boilers were replaced by more efficient Babcock boilers, whilst Richardson, Westgarth supplied two new blowing engines at the end of 1904. The new water pumping unit also installed during 1904 was electrically powered. The following year it was decided to construct an eighth blastfurnace so that the weekly output of pig iron could be raised to meet the demand of the steelworks, a step made necessary by the failure of the modified plant to live up to George Ainsworth's predictions.(23) Whether or not the fault for this shortcoming lay with the Richardson, Westgarth blowing engines, the contract for the engines for No.8. went to Parsons & Co. for turbine blowing engines.(24) Further minor improvements were effected to the blowing power and temperature of the blast by the addition of a Sturtevant fan in 1908 to increase the draught to the stoves of furnaces, Nos. 5, 6 and 7. The persistence of the spatial problem pervaded every attempt by the Company to revolutionise the Consett plant. Even the construction of the 8th furnace posed insufferable problems of lack of space. Only the most radical programme of demolition and replacement could have removed this

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(22) Directors' Minute, 5 May, 1903, p.170. (DCRO : D/CO/39).

(23) Directors' Minute, 12 April, 1904, pp.224-225. (DCRO : D/CO/39):- In this Ainsworth predicted a weekly output of 5,400 tons from six blastfurnaces However in 1905 the capacity achieved was only 4,772 tons per week. Directors Minute, 5 September, 1905, pp.77-78.(DCRO :D/CO/40).

(24) Directors' Minute, 6 February, 1906, p.123. (DCRO : D/CO/40).

constraint upon the growth of Consett's output. However despite large profits such a programme would have necessitated a cessation of operation (thus foregoing lucrative profits) and possibly even large borrowing. The equation didn't work, the foregone revenue and the disruption always outweighed the benefits. In view of the evident disadvantages of the Consett site it is surprising that more attention was not given to the alternative of relocation. Whether this was because of altruistic concern for the economic and social well-being of Consett as a community or for purely economic reasons, such as cheaper fuel, proximity to markets &c. it is impossible to conclude.

By 1910 the Company appeared more optimistic, having negotiated a favourable renewed lease for 42 years from the Ecclesiastical Commissioners on the large tracts of land around Consett. This was the preliminary step in establishing a base for the reconstruction of its manufacturing activities. The Company was already engaged in assorted negotiation to secure its hematite ore supply, and was carrying out extensive innovations in their coke making departments. It proposed to add to this the redevelopment of its blastfurnace plant along the lines of its new No.8 furnace, to extend the electrification programme to the Works, to open a new colliery at Crookhall and carry out a building programme for the housing of its workmen. The total cost of these proposals was estimated at £600,000 (25) It was certainly an ambitious scheme and would have put Consett back amongst the leaders in the technology of the industry.

The renewal of the lease was crucial, for the raison d'etre of the Consett Iron Company in Consett was still the abundant coal supplies which

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(25) Directors' Minute, 1 November, 1910 pp.97-98. (DCRO : D/CO/42).

were to be exploited by the new Crookhall Colliery. The Board's disinterest in renewing the lease before 1910 therefore indicates that they never really contemplated any major renewal before then. Once they were assured of a renewed long lease they could contemplate the capital outlay which would have to be written off over a long time period. Coal was still the dominant factor in location, and with a secure coal supply the pressure to look for an alternative location vaporised.(26)

Such a large scale scheme would take a considerable time to prepare, and unfortunately Consett was to be thwarted by the declaration of War in 1914 and an inevitable postponment of all but the most necessary capital investments. Since 1894 there had been little investment of any consequence except at the blastfurnaces and that had only been a half measure. The mills were for all intents and purposes being operated with the antiquated technology of the 1880's, whilst the melting furnaces were already suboptimal.

The slowing down in the rate of technical development may be explained by two factors which emerged in this period which had not been present in the 1870 - 1894 span. The first was the reversal in the secular price movement, from a downward trend, to an upward one. This led to a favourable situation for employers in the employer-employee relationship, for wages were in most departments of iron and steelworks automatically adjusted by sliding scales, which had a three month lag built in. Thus when prices were rising the wages of labour were relatively low, that is the wage paid had been fixed by prices during the previous quarter, but as price rose wages

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(26) R.W. Cooper to Sir Lindsay Wood, (Ecclesiastical Commissioners),15 November 1910 pp.99-100.(DCRO : D/CO/42).

remained fixed for a quarter ensuring an increasing margin to the employer, and thus a disincentive to substitute other factors for labour. This was in contrast to the situation between 1873-1896 when there had been a secular price fall, which operated in the opposite manner, putting pressure upon management from the labour sector.

The second new condition which prevailed was the marked deceleration in the growth of output of steel plates. After a period of excess demand in the 1880's the steel industry extended its capacity to meet the demand. This led to the alternatives of price war or collusion, and the makers of steel plates and angles opted for the latter. The Scots were as in the mid-1880's the first to form an association for the protection of their markets and they were joined in 1904 by the makers in the North east.(28) The Association was durable, extending to angles in 1906 and lasting intact until the outbreak of war. The presence of monopoly would have provided a disincentive to innovation since price would no longer equal marginal cost as under a perfectly competitive industry.

The Company had by 1914 shown signs of staidness and old age, and this was attributable in part to a less forceful management, which gladly embraced the comfort of collusion rather than competition, but more particularly to an external factor, the slowing down in the growth rate of the market for steel ship-plates.

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(28) D.L. Burn, op.cit.,p.278.

CHAPTER VII

The Markets for Iron and Steel

As the name the Consett Iron Company suggests, the principal purpose of the firm was the production and sale of iron, and later steel, products. The uses to which iron and steel could be put were manifold. Consett, however, was only concerned with the manufacture of rails, ship-plates, and angles; the rail-trade was abruptly terminated in 1876 and from then on the Company was inextricably linked to the demand generated by the shipbuilding industry.

When the iron rail trade collapsed in 1876, due to the competition from steel, the Company moved quickly into production of ship-plates. This was a sector in which demand was growing, especially on the North-east coast, because of rapid technological changes in shipping. Consett's own technical progress was to a certain degree fashioned by the demands of its market. In the 1880's the change over to steel was in part induced by the shipbuilders' acceptance of that material. By the 1900's the excess capacity of the shipbuilders and the stabilisation of the size of the market drove the steelmakers to collusive action.

This chapter will trace the disappearance of rail manufacture, the background to the demand for shipbuilding materials, the commercial methods of the Company, and finally the trend from competition to collusion.

1. The Iron Rail Trade

Consett had close ties with the Railway Companies, especially the North Eastern Railway which had absorbed the numerous independent lines in the North-east during the late 1850's and early sixties. Consequently the North Eastern Railway was by far Consett's largest customer, regularly purchasing over half the weekly output of about 600 tons of rails.(1)

Consett produced both light (56 lbs.) and heavy (82 lbs) rails, the latter being mainly for the use of main-line railways, whilst the light rails were sold to colliery owners and other industrial entrepreneurs, such as the Earl of Durham and Lord Londonderry. Consett's output reached its peak in the year ending June 1871 when 32,027 tons of rails were manufactured. From 1871 there was a gradual decline in the number of rails made, and a relative increase in the production of iron ship-plates.

TABLE VII.1

The Output of Rails at Consett 1865 - 1876

Year*	Output	Year	Output	Year	Output
1865	13,893 tons.	1869	21,179 tons.	1873	25,858 tons.
1866	18,901 tons.	1870	30,152 tons.	1874	29,321 tons.
1867	11,782 tons.	1871	32,027 tons.	1875	28,583 tons.
1868	14,502 tons.	1872	24,680 tons.	1876	17,727 tons.

* ending June.

Source: Profit & Loss Accounts, 1873-93 (DCRO : D/CO/89); Production & Stock Book, 1869-1888 (DCRO : D/CO/107).

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(10) Production and Stock Book, 1869-1888.(DCRO : D/CO/107).

The reason for the trend away from rail production to iron ship-plates is not difficult to ascertain - there was a far greater margin of profit per ton of iron plate, than per ton of rail, even though there was little difference in the cost of production. Thus by changing to plate production even in the relatively prosperous years for rail sales, Consett were earning a far higher return upon their working capital at least.

TABLE VII.2

Comparative Profitability of Rails and Plates,

Year Ending June 1873-June 1877

Year	Rails* Cost	Rails* Price	Rails* Profit	Plates* Cost	Plates* Price	Plates* Profit
1873	£8.04s. 2d	£9.16s. 1d	£1.11s.11d	£8.18s. 9d	£11.07s.11d	£2.09s 2
1874	£7.07s. 1d	£10.1s.11d	£2.14s.10d	£8.09s. 8d	£11.19s.3d	£3.09s 7
1875	£7.04s. 6d	£8.16s. 9d	£1.12s. 3d	£7.06s. 5d	£ 9.08s.4d	£2.01s1
1876	£6.13s. 0d	£6.13s. 6d	£0.00s. 6d	£7.01s. 1d	£ 7.13s. 2d	£0.12s 0
1877	£5.17s. 9d	£6.04s. 5d	£0.06s. 8d	£6.09s. 2d	£7.01s. 4d	£0.12s.2

* per ton

Source: Profit and Loss Accounts, 1873-1893. (DCRO : D/CO/89).

Between 1871 - 1875 the make of plates rose from 33,669 tons to 53,494 tons whilst that of rails dropped from its peak of 32,027 tons to 27,624 tons.

Apart from the North Eastern Railway Consett's other large railway customers were the Stockton and Darlington, which had formerly been one of the Company's largest creditors, the Blythe and Tyne, and the Caledonian; these were all regular buyers of iron rails from Consett. Most other customers took orders over three or six months, and there were occassional small orders. The Company's overseas sales were not at all large, the chief destinations being

Australia and France, with smaller quantities going to North America and Russia.(2)

From the cost and price data it seems clear that Consett transferred out of the sector in which there was the most competition into an area where demand was outstripping supply. This stood it in good stead when the iron rail trade disintegrated in 1876, making easier the complete change over to iron plate production.

2. Growth and Change in British Shipbuilding

Consett succeeded to the good reputation in the manufacture of ship-plates established by its forerunners. By 1864 the construction of iron ships was firmly established along the River Tyne, and on the Wear William Pile's shipyard employed 2000 men in building iron ships in 1863.(3) Further south at Hartlepool and on Teesside ship-building had grown quickly since the mid-1830's, the first iron ships appear to have been built by Pile, Spence and Company at West Hartlepool about 1855,(4) and the first one launched on the Tees was in 1854 by the Iron Shipbuilding Company at South Stockton.(5)

So long as timber remained the predominant material in the construction of ships the shipbuilding industry had been ubiquitous, the output of each centre being closely proportionate to the trade of the particular port.(6)

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(2) Production and Stock Book, 1869-1888.(DCRO : D/CO/107).

(3) D. Dougan, The History of North East Shipbuilding. (London, 1968). p.44

(4) R. Wood, West Hartlepool: The Rise and Development of a Victorian New Town (West Hartlepool, 1967) p.72.

(5) Thomas Richmond, The Local Records of Stockton and the Neighbourhood (London 1868) p.222.

(6) S. Pollard, The Economic History of British Shipbuilding, 1870-1914 (University of London Ph.D., 1951 Unpublished). p.213.

However, with the development of the iron resources of the North-east, originally on a small scale at Wilson, Losh and Bell at Walker on the Tyne, then at Consett and later in South Durham and Tees-side, the developed industries at Newcastle and Sunderland and the nascent industries of the Hartlepools and Tees were driven forward in a surge of innovation.

Apart from the favourable movement in factor prices, against timber and in favour of iron,(7) the advances in steam technology in the second half of the nineteenth century which induced the substitution of steam for sail, reinforced the trend towards the construction of iron ships.(8) In an atmosphere of a growing demand for iron built cargo vessels, shipbuilders and men of enterprise in the North-east were able to take advantage of the availability of the iron and coal resources in the region. There was a large element of inter-relatedness between the development of iron-making and shipbuilding.

In the mid-years of the 1860's a number of important innovations took place in shipbuilding, the most important being the development and general adoption of the compound engine. This extended the range within which steam vessels were competitive with sail.(9) More particularly on the North east Coast some builders were making significant strides forward in the design of iron ships, which were in the early days designed on much the same pattern and principles as wooden vessels. In 1869 the first well-decked steamer, designed by George Pyman was built at West Hartlepool, and after Plimsoll's Merchant Shipping Act (1876) this type of vessel was able to replace the old wooden barques.(10)

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(7) Ibid. p.24.

(8) C.K. Hurley, "The Shift from sailing ships to steamships, 1850-1890: a study in technological change and its diffusion." in D.N. McCloskey, Essays on a Mature Economy (London, 1971) p.218

(9) S. Pollard, op.cit., p.325.

(10) R. Wood, op.cit., p.62.

Between 1864-1872 the tonnage of shipping launched on the Tyne and Wear rose from 123,987 tons to 218,497 tons, whilst there was equally rapid progress made around the Tees as builders such as Denton, Gray & Co. expanded and new businesses like Withy, Alexander and Company were established. However, the industry suffered during the recession between 1866-69, largely precipitated by the collapse of the London Bankers, Overend, Gurney and Co. in 1866. It was most severe in West Hartlepool where Pile, Spence and Company went bankrupt in the summer of 1866. However the opening of the Suez Canal and the flood of emigrants to North America between 1869-71 created a fresh optimism amongst ship owners and the prosperity lasted through until 1874. This was an important phase in the development of the North-east's shipbuilding; the post-1866 recession had sounded the death knell for private shipbuilders on the Thames, hitherto the single most important centre, whilst much of the profit earned in the boom of 1869-74 was ploughed back by the firms on the North east Coast in the consolidation of their yards.(11) The builders were also specialising; the North-east became the centre for the construction of tramp ships, or general purpose cargo vessels.(12)

After 1874 a prolonged depression in shipbuilding set in which lasted until the end of 1879. However during the 1870's there was a persistent endeavour to produce a steel suitable for shipbuilding, and this was achieved in 1875 by the mettallurgists at Terre Noire in France. The process was eagerly taken up by James Riley at Landore in South Wales, as it offered an alternative use for the Siemens works, other than a lingering existence in the rail-trade.(13) Shortly afterwards Riley moved to the Steel Company

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(11) S. Pollard, op.cit.,p.328.

(12) R. Wood, op.cit.,p.64.

(13) S. Pollard, op.cit.,p.334.

of Scotland which became the first major producer of steel ship-plates for private builders. Although in 1879 William Denny, the Dumbarton shipbuilder expressed doubts about steel,(14) by 1881 his yard had turned over almost entirely to construction of steel vessels. He himself was convinced of the economy of steel built ships.(15)

The resurgence of prosperity in 1880 was due partly to the increasing acceptance by shipowners of steel as a more than suitable alternative to iron, and partly to the adoption of the triple expansion engine which extended the range of steamers, to China and the Pacific.(16) The reduction of scantlings required in a ship built of steel, and the rapidly improving fuel economy of the new engines, increased the capacity of the vessel which could be turned over to cargo space, and this increased the rate at which existing vessels became obsolete.

The proliferation of one ship companies' during the boom of 1880 -81, and the general ease of credit for investment in shipping had created a massive addition to capacity. This in turn reduced freights and discouraged any further building. The depression was particularly severe in the North-east, 'the cradle of cargo vessels,' and unemployment in 1885-86 was the worst in the shipbuilding industry before 1914.(17) Clydeside and Belfast continued to receive some orders for the construction of liners and cargo-liners.

In 1886 the depression began to ease, but there was no sustained recovery until late 1887. The following boom was fundamentally of a restocking and normal growth nature, for there was no significant upward shift in freight

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(14) Journal of the Iron and Steel Institute, 1880, I, p.221.
(15) S. Pollard, op.cit.,p.341.
(16) Ibid.,p.347.
(17) Ibid.,p.381.

rates. Its course was spent by 1889 although the work in hand at the yards did not begin to drop until the middle of 1890.(18)

Because of the stunted character of the 1888-1890 boom, the following recession was not particularly sharp, and freight rates declined only very slowly. This was also helped in part by the activity in liner construction in 1891-92 which did not have a great impact upon tramp freights. This factor did however lead to a standstill in launchings of liners in the ensuing years, which hit the Clyde yards particularly hard.

In an effort to employ their yards the Clyde builders courted the Government to extend their naval programme, and the expectation of large naval orders in 1894 precipitated a false boom, as owners rushed to expand their capacity before the Admiralty orders drove prices up.

A weak recovery from the 1895 depression was recorded during 1896, instigated partly by a renewed upward movement of freight rates, and also by the nadir in the price for new ships. This was the beginning of a prolonged upward movement in the activity of the shipbuilding industry which culminated with a shortage of shipping space and consequent high freight rates brought about by the flurry of military activity in the Eastern Mediterranean, the Sudan, the Caribbean, the Philippines and South Africa between 1898-1900.(19)

The collapse of the 1900 boom was the first for which the description of a world over-production of tonnage was permissible. The investments and technical improvements in ships and shipyards between 1896-1902 were only partially justified by commercial requirements. This resulted in shipbuilding capacity permanently in excess of the demands of world trade before 1913.(20)

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(18) Ibid., p.384.

(19) Ibid., pp.435-36.

(20) Ibid., p.465.

The recovery which began in 1905 was unreal, being induced by the low price of ships and the desire of the shipowners, who were engaged in a rate war, to purchase larger and more efficient vessels. The yards were caught between the low prices they contracted at, and the raised costs imposed upon them by the well cartelized steelmakers. (21)

1906 was the peak year in North-east shipbuilding, with 1,005,148 tons of merchant shipping launched, an increase of 434,852 tons over 1892 when the detailed lists began.(22) In the slump of 1908 the launchings on the North-east Coast plummeted to only 355,859 tons. Sunderland was particularly badly hit with 8,000 men put out of work in the Wear yards by December 1907, and over half the berths empty in the North-east in February 1908.(23) Despite the slump the North east still had the three leading yards in the world, Doxfords', Swan Hunter and Armstrong Whitworth, but other firms were less lucky including such famous names as Laing's, Palmers' and Robert Stephenson and Company.

Labour relations also deteriorated with trade; the Wear Conciliation Board came to an abrupt end in 1906, and when the employers tried to enforce a reduction of wages at the end of 1907, the shipwrights refused to accept calling a strike at the beginning of January 1908. The Employers' Federation replied with a lock-out inspite of the men's willingness to submit the case to arbitration, an indication of the severity of the trade depression.(24)

An upturn began in 1909 as foreign fleets bought second hand British ships and the British owners restocked with new tonnage, encouraged by the low price

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(21) Ibid., p.468

(22) D. Dougan, op.cit., p.223.

(23) S. Pollard, op.cit., p.488.

(24) D. Dougan, op.cit., p.127.

of vessels. The recovery uncharacteristically maintained it impetus, without the customary short relapse; probably because of the severity of the over-capacity, the owners resisted the temptation to buy when the only justification was low price and not a demand for increased shipping space.(25)

In 1910 the recovery was interrupted by another lock-out, caused by the refusal of some boilermakers to accept the National Working Agreement of 1909 which was designed to prevent a repercussion of the 1907-08 dispute, where the action of one group of workers caused the close down of the whole industry.(26) However during the three month dispute, orders and demand were merely posponed for a very excited boom between 1911-13, which was maintained by the irrepressible optimism of British shipowners, the sprint to enlarge the Royal Navy's fleet of new 'Dreadnought' class warships, and finally by the increase in foreign merchant fleets under the inducement of subsidies and direct grants.(27) By 1914 recession had set in yet again, and it is arguable that without the distortion caused by the 1914-18 War shipbuilding could have sunk into its worst depression ever.

2. Sales and Marketing Techniques.

At the outset of operations the Consett Iron Company had no formal channels for conducting sales policy outside the region. This was remedied in 1865 when Jasper Mounsey was appointed to represent the Company in London - an important market because of its overseas connexions. Mounsey had been an agent for the Derwent Iron Company, working in conjunction with Charles I'anson of Darlington. His terms of employment were £400 per annum plus 1% on dividends paid by the

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(25) S. Pollard, op.cit.,p.492.

(26) The Economist, 10 September 1910. p.505.

(27) S. Pollard, op.cit.,p.498.

Company.(28) As London and the Thames was the major centre of shipbuilding in the 1860's, the promotion of sales in the area was only natural.

Another bustling centre of industry and shipbuilding was Merseyside and the Lancashire conurbation; however, when it was proposed to appoint Mr. Joseph Simpson of Eccles as the Liverpool agent the arrangement did not mature because Simpson was unwilling both to leave Manchester and to act solely for Consett.(29)

Business in London, and profits for the Company as a whole did so well that in 1871 the Company renegotiated its arrangement with Mounsey. Since his original appointment his average earnings had been £959 per annum, and with the profits of the Company rising sharply in 1870-71, it was felt that the remuneration was becoming excessive. This was all the more the case as the business with London declined, owing to the run down of Thames shipbuilding and the Company's own shift away from rail production. Mounsey still could not complain since his commission was only reduced to ¾% on dividends.

As iron ship-plates became a more important aspect of the firm's trade, it sought to establish links in the other developing shipbuilding districts; next to the North east Coast, the West of Scotland was most important, and in an effort to expand its small trade with that part of the world, Consett appointed Alexander Tolmie, as its Glasgow agent in 1874.(30) Whilst Mounsey's business declined during the 1870's and 1880's, Tolmie's increased as Consett increased its specialisation in ship-plates, and sought out new markets for the ever increasing output. Tolmie's own influence also extended beyond the bounds

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(28) Directors' Minute, 9 August, 1865, p.58.(DCRO : D/CO/29).

(29) Directors' Minute, 11 November, 1865, p.71. (DCRO : D/CO/29).

(30) Directors' Minute, 10 March, 1874,p.27.(DCRO : D/CO/31).

of Clydeside, as he developed business for Consett on Tayside, Belfast and to some extent Barrow. The Company developed its own business in the North east through their Newcastle office. Thus Andrew Tolmie, who succeeded his father in 1878, and Frank Hodges, the agent in Newcastle were responsible for Consett's most important markets. Because the British shipbuilding industry became so dominant upon the world scene by the end of the nineteenth century, Consett was not much concerned with overseas outlets for its plates. It was loath to appoint special sales agents abroad, in 1891 William Jenkins wrote:

> "I am much obliged for the perusal of the letter of Messrs Veringhorn Brothers, which is returned herewith.
>
> We have so far disliked appointing a special agent in Canada trusting rather to our old customers coming now and then to us direct..."(31)

However four years later the Company did appoint Mr. G.A. Goodwin to act as its agent for sales in China and Japan.(32)

The normal method of payment was by a four month bill, less a discount of 5% or 2½%, often dependent upon the state of trade. The bill extended credit, whilst the discount encouraged cash payment; the buyer had the option between the two.(33) Some ship-plate manufacturers allowed their customers to extend their credit by permitting the renewal of outstanding bills, but this was not Consett's practice because of the inherent risk.(34)

Another aspect of trade concessions that Consett was loath to succumb to, was the payment of commission for the placing of orders. Reluctantly Jenkins

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(31) Wm. Jenkins to A.D. Tolmie, 15 December, 1891. (DCRO : D/CO/79).

(32) Directors' Minute, 3 August, 1895, p.115. (DCRO : D/CO/36).

(33) Wm. Jenkins to D. Dale, 14 January, 1893. (DCRO : D/CO/83).

(34) Wm. Jenkins to D. Dale 6 September, 1892. (DCRO : D/CO/82).

conceded:

> "There is a great scarcity of orders for steel. I think it would be well to pacify Sir Raylton, and possibly well to sacrifice 1% upon our steel plates and angles if we can get a large share of his orders..... If you think on the whole we had better not run the risk attending the committing of ourselves to even one single customer on the east coast to 1% commission pray tell me so..."(35)

The relationship on the North-east Coast was that between the iron and steel producers and the shipbuilders direct but in Scotland and to a lesser extent Belfast and Barrow, there existed an uneasy relationship between the steelmakers, and a group of middlemen, the merchants.

Just as the sub-contract system in the labour market relieved a part of the capital burden from the entrepreneurial capitalist, so too the merchant system, helped out the working capital shortages of the iron and steel manufacturers. The merchants were not as Burn suggested primarily responsible for co-ordination between manufacturers and consumers, or at least not in Consett's case.(36) This role was filled by Company agents, such as Tolmie and Mounsey, who were employees in that they received salaries, which were supplemented by a type of performance bonus. In Tolmie's case, his job primarily was to take the pulse of the market areas he was operating in, and to seek out business which came largely from the merchants.

The merchants were in fact speculators, who had a role to fill within the laissez-faire economy of nineteenth century Britain. In its most simple terms that role was to carry stocks; purchasing when price was low, and selling when

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(35) Wm. Jenkins to D. Dale, 18 February, 1893.(DCRO : D/CO/84).

(36) D.L. Burn, op.cit.,p.227.

price rose. The advantages this offered were that manufacturers' plants were kept fairly well employed during slumps, whilst during the booms customers were kept adequately supplied without price being forced up exorbitantly. By stocking the merchants were able to match supply and demand over the range of the business cycle and thus lubricate the system.

Why then were the manufacturers so resentful of the merchants' activities? Probably because they believed that whilst the industry was growing, they could match their own supply to demand by their price regulation. That is, during recession price reduction would induce shipbuilders to maintain their demand, whilst during booms excess demand drove up prices. The interference of merchants in their view merely constrained the extent to which price would rise in the boom, whilst offering no advantages in recession. Once overcapacity was reached then not even the intervention of the speculators could keep plants fully employed at a renumerative level - the makers' alternative was collusion to raise price.

Inspite of the resentment, the steelmakers had to sell to the merchants, because they had not the resources to carry heavy stocks. During the slump of 1892 Neilson, a Glasgow merchant, told Tolmie that "the Barrow Steel Co., are rather anxious sellers of 3000 tons at a very low price.."(37) Even Consett which was financially very strong, could only go on stocking to a certain limit; during the same slump when the value of Consett's stocks reached £55,000 Jenkins felt that they should begin to limit the cash value.(38) Conditions such as these drove the manufacturers into the arms of the merchants.

A few months after Consett had to abandon the stock building policy Wm. Jenkins complained to David Dale:

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(37) Wm. Jenkins to D. Dale, 26 July, 1892. (DCRO : D/CO/81).

(38) Wm. Jenkins to D. Dale, 6 September, 1892. (DCRO : D/CO/82).

"Obviously there is a great effort being made by merchants, who grasp at enormous quantities of plates for sales, to speculate largely and to keep in their hands very large quantities of plates for immediate delivery but at deplorably low prices." (39)

The second strength of the merchants, which was closely bound up with their ability to hold stocks, was that they were prepared to extend credit to their customers. Ideally the steelmakers preferred to be paid in cash on a monthly basis whereas the merchants were more willing to extend credit. In an effort to oust the merchants Consett had to be prepared to offer credit, as Jenkins pointed out to Dale:-

....."If the Naval Construction Company desire the option of payment by 4 monthly bill, I presume you would not object as it is one of the advantages which the merchants offer to the shipbuilders."(40)

On Clydeside the merchants were usurping a role which the steel makers would dearly liked to have held, that of an oligopolist. Its significance lay not in the merchants' enhanced selling power, but in his increased purchasing power. The fewer the merchants the easier their task in subordinating the steel manufacturers.

Consett's policy had always been to minimize individual quantities, but this was difficult as vigorous merchants pushed their sales with important shipbuilders. If Consett did not take the work, then some other manufacturer would.(41)

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(39) Wm. Jenkins to D. Dale, 27 December, 1892. (DCRO:D/CO/83).
(40) Wm. Jenkins to D. Dale, 18 May, 1891.(DCRO : D/CO/76).
(41) Wm. Jenkins to D. Dale, 16 December,1889.(DCRO : D/CO/71).

As Consett's local market was free from the merchants' influence the Company was used to the handling of customers, and it tried to extend its direct relationship into its other markets. Disputed ground appears to have been Belfast and Barrow.

> "At Consett we certainly have every desire to checkmate the merchants in their action, especially outside the area of the Scotch consumers on the Clyde, and have always aimed at going direct to the consumers such as the Barrow Shipbuilding Company." (42)

However, at Barrow its efforts were thwarted by the willingness of the Barrow Steel Company to deal with the Glasgow merchants. In Belfast, the Neilson Brothers of Glasgow seem to have had the edge in their selling technique for they "Had so ingratiated themselves with Messrs Harland and Wolff as to practically secure the whole of their contracts."... (43)

The shipbuilders themselves seem to have been more amenable towards the merchants - it made their purchasing more straight forward, and having established a reliable connexion they could put faith in the merchants' ability to secure good materials. This in particular rankled Consett and other northern plate makers who objected to the practice of Merchant brands on the plates, and not the makers. They were so adamant on this point that they advocated legislation to prevent any mark but the makers appearing on plates.(44)

On the whole Consett was unable to break down the hegemony of the merchants in Scotland, and they persisted as a thorn in the side of the plate

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(42) Wm. Jenkins to D. Dale, 26 July, 1892. (DCRO : D/CO/81).
(43) R. Evans to D. Dale, 16 November, 1892. (DCRO : D/CO/83).
(44) Wm. Jenkins to J.S. Jeans, 17 March,1887. (DCRO : D/CO/68).

makers even after the formation of the Associations in the 1900's.(45) The best that the Company could do was to minimise their influence, and the effect with which they could do this tended to fluctuate with the course of the business cycle.

Sales Policy

The last aspect of the Company's marketing policy to be considered here is its sales policy. This had a chameleon like quality, changing its tone as the business cycle took its course. The fundamental considerations were that at all times the Company's plant should be kept as close to capacity as possible, but this had to be traded off against the need to have capacity available at short notice in order to take advantage of any price rises. A second feature was the desire to maintain a large number of customers, so that the failure of one would not imperil the whole business, and also that no-one customer could exert unfavourable purchasing power.

For example let us take the case where Consett has worked off all the contracts made during the boom and is faced by empty order books and low prices. Such was the situation in late summer of 1892. In order to keep the mills employed Jenkins was prepared to slash his price quotations for specifications for immediate delivery.(46) However Jenkins was anxious that the orders be for immediate delivery and not for sale over several months. It was Jenkins' opinion on an enquiry by Neilson's that "it would not be prudent to go in for such a quantity as 10,000 tons as a speculation with them at this time while things are at their very lowest. The buyer can't go far wrong in buying but to sell ahead

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(45) The Economist, 6 October, 1906. p.1619.

(46) Wm. Jenkins to A.D. Tolmie, 25 August, 1892. (DCRO : D/CO/82).

largely is not I think prudent on the part of the plate maker."(47)

Once the trough of a recession had been reached, then the steelmaker became alert to the necessity of keeping his options open for a rise in price. However, it was concurrent with the time when he was most hard pressed by the merchants who were anxious to build up their stocks during the low prices. Although he resented the merchants, William Jenkins often had no option in the depth of depression, but to accept orders from them. For example in August 1892 Adam Tennant, one of the Glasgow merchants was prepared to take up 1250 tons of plates at £5.15s. per ton less 5%, an offer Jenkins could not reject.(48)

Once trade began to pick up Jenkins became less concerned with long orders, and more interested in pressing forward price. In the upturn of 1887 he felt three or four weeks work in hand was sufficient, and further forward selling without an advance in price would be imprudent.(49) When price began to move up and the business cycle was clearly in the upswing, it became necessary to watch against over-commitment, and to leave leeway for new contracts at advantageous prices.(50)

When orders eventually began to slacken then Jenkins began to seek ways and means by which the customers could be induced to make further purchases. At this stage, when it became necessary to make price concessions he fixed his attention upon extending the amount of plates on order, and this policy would be persevered with until no orders were forth-coming, and work in hand was completely despatched.

There were variations to this general pattern, the most significant being a shift from production of pig iron for the Company's own use to a policy of sales. Up to 1893 Consett had a pig iron surplus which was sold, splitting

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(47) Wm. Jenkins to A.D. Tolmie, 27 August, 1891. (DCRO : D/CO/77).
(48) Wm. Jenkins to A.D. Tolmie, 23 August, 1892. (DCRO :D/CO/82).
(49) Wm. Jenkins to D. Dale, 15 January, 1887. (DCRO : D/CO/68).
(50) Wm. Jenkins to A.D. Tomlie, 20 January, 1887. (DCRO : D/C/68).

roughly equally between Bessemer and cinder pigs. The latter were produced purely for sale purposes, being most suitable for low grade foundry work. The Bessemer pig was probably sold to other steel producers, though there is no reference to its destination. However, a common policy was, during a slump, to produce more cinder pig, thus keeping the blastfurnaces operational and avoiding the high cost of a cessation of work in this department. The output was then sold either to merchants such as Messrs. Matheson & Co., or to a regular foundry consumer such as Rio Tinto Co.(51) The advantage in selling cinder pig to merchants was that it would not have repercussions upon their own plate business in an upswing. If they sold large quantities of Bessemer pig at low prices then they might well play into the hands of the unintegrated plate mills, who might then be able to buy Consett Bessemer pig in an upswing from the merchant, at prices competitive with Consett's own production costs, as these would also rise in the upswing. In 1890 at the summit of the boom, many unintegrated Scottish producers were severely handicapped by the high price of pig iron, giving Consett the competitive advantage; had the Durham firm flooded the market with Bessemer pigs during the previous slump it might have prevented this and done itself immeasurable harm.(52)

When Consett began producing steel angles in 1893 it was confronted by a different sales problem. As Jenkins explained to Dale

> "Ship's angles are peculiar in the commercial action with regard to them. A shipbuilder when he wants his angles, he wishes them delivered immediately right off, and he will not effect a sale for these for any deferred period of delivery."(53)

Consett had to start a new establishing a reputation for quality and promptitude in delivery.

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(51) Directors' Minute, 12 October, 1886. p.274. (DCRO : D/CO/33); and Wm. Jenkins to D. Dale, 8 December, 1891.(DCRO : D/CO/79).

(52) Wm. Jenkins to A.D. Tolmie, 25 February, 1890.(DCRO : D/CO/72); and Wm. Jenkins to D. Dale 19 February, 1892.(DCRO : D/CO/80).

(53) Wm. Jenkins to D. Dale, 9 January, 1893. (DCRO : D/CO/83).

In its other branches of steel business the Company did have an established reputation. Jenkins was able to boast in 1890 to H.J. Boolde, a Lloyds' Surveyor:

> "It may be said without the slightest exaggeration that in the course of our manufacture and delivery of over 300,000 tons of steel which is about the gross quantity we have made since the commencement of our operations six years ago, there has really been nothing in the way of complaint of our quality."(54)

A few years later Swan Hunter, the Tyneside shipbuilders, actually wrote to Consett commending it for plates it had produced.(55) During the 1890's David Dale took time out to visit the local yards himself, in order to ascertain the amount and type of work in hand.(56) His national reputation was also an advantage for Consett in its sales efforts. In 1891 when the Cunard Company had an order out for two cargo vessels, Jenkins suggested that Dale might be able to improve Consett's case by approaching Mr. Ismay of the Cunard Company, and a fellow member of the Royal Commission on Labour.(57)

In contrast the atmosphere of euphoria in the Edwardian decade appears to have transmitted the same lack of drive to the Company's sales awareness as it did to its innovatory vigour. In 1913 Swan Hunter and Whigham Richardson of Wallsend enquired about the provision of 96" wide plates instead of traditional 84" plates. Consett claimed this was a completely new development, although

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(54) Wm. Jenkins to H.J. Boolde, 24 January, 1890. (DCRO : D/CO/71).
(55) Directors' Minute, 5 June, 1894, p.183. (DCRO L D/CO/35).
(56) Directors' Minute, 3 August, 1895, p.115. (DCRO : D/CO/36).
(57) Wm. Jenkins to D. Dale, 30 May, 1891. (DCRO : D/CO/76).

Swan Hunter intimated that several other shipbuilders were seeking a supplier of such large plates.(58) This is indicative of the vital absence of attention to the consumers' requirements, and the Company's neglect of new product developments in the Edwardian decade.

The final factor in the sales policy was the avoidance of over-dependence on one customer, and the surety of a customer's credibility. One of Consett's most prolonged wrangles over a debt was with the Sligo and Ballaghdaren Junction Railway in the early 1870's. The Company was owed £11,161.06s.10d by the contractor F. Nowell, but the only means of recouping the loss was to increase the credit so that the railway could be completed.(59) By 1874 the Consett Iron Company had extended the credit to the Sligo Railway to £20,000. The working of the railway was then taken over by the Midland and Great Western Railway Company of Ireland, but they were unable to run it at a profit. After almost a year of negotiations they did agree to purchase the line for £24,000, £5,000 of which was to go toward Consett's claim.(60) After six years Consett's experience of extending loans and credit to a consumer ended in quite a substantial loss to the Company.

This may have discouraged the Company over thirty years later from extending finance to shipbuilders.(61) When Sir James Laing & Co. went under in the slump of 1908 Consett one of their main trade creditors was reluctant to take part extensively in the capital reconstruction of the company. It only accepted shares in lieu of its debt, and these were sold in 1914. No more interest was shown in the Middlesbrough shipbuilders, R. Craggs and Sons who went under in the same slump; as the receiver wrote down the value of the

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(58) Directors' Minute, 17 January, 1913, p.28. (DCRO : D/CO/43).
(59) Directors' Minute, 4 April, 1871, pp.107-108. (DCRO : D/CO/30).
(60) Directors' Minute, 7 November 1876, pp.238-240. (DCRO : D/CO/31).
(61) Directors'Minute, 12 September 1907, p.36. (DCRO : D/CO/41.)

assets substantially and it was proposed that Consett and three other major creditors should float a new company. Conset was once again not amenable the scheme and it did not get off the ground.(62)

These were the only two serious failures amongst Consett's shipbuilding customers, probably because of the care and watchfulness exercised by the management in selling to new consumers. Prompt attention was also paid to customers who might be in difficulty or late in paying accounts. However the best insurance was spreading the output amongst a fairly large number of purchasers. Consett's policy was explained in considerable detail by Wm. Jenkins to David Dale, who was enquiring on behalf of the Barrow Hematite Steel Company, of which he was also a Director. Basically Jenkins tried to limit the specifications outstanding to one customer to about 5,000 tons at a time.(63) Thus the power of any one consumer was minimised as much as possible, in order to secure the Company's position in the market.

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(62) Directors' Minute, 3 May, 1910, pp.44-45.(DCRO : D/CO/42).

(63) Wm. Jenkins to D. Dale, 15 November, 1889.(DCRO : D/CO/70).

Competition to Collusion.

Throughout the period between 1864-1914 technological developments elsewhere impinged upon the competitive position of the Consett Iron Company. In the 1860's the growth of iron shipbuilding in the North-east generated a demand for iron-plates which appears to have created a lag between demand and supply, as one would expect Consett's response was to move from rail production to plate production where the return was much greater. The change was put into sharp relief by the events of 1876, which not only forced Consett out of iron rail production altogether, but created a surplus of puddling capacity, which in many instances was directed to the manufacture of iron plates.(64)

Although the tonnage of ships launched on the Tyne and Wear continued to grow after 1876, the supply and demand conditions were turned in favour of the shipbuilders, so much so that in the spring of 1879 Jenkins reported a critical position in the sale of plates. Inevitably a scheme was proposed amongst the makers for combined action to restrict the output of plates over a limited period, as well as resorting to the traditional wage reductions.(65) In an effort to keep the mills employed Jenkins was advised to sell plates for early or immediate delivery, a sure sign of under employment. The position was further aggrevated by the discriminatory pricing practice of the Scottish Railway Companies which effectively protected the Scottish ironmakers from competition from the North-east producers.(66)

With the reduction in profits there had been a related reduction of costs, in part due to lower input costs but also attributable to the improvements in

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(64) H.G. Reid, Middlesbrough and its Jubilee (Middlesbrough, 1881) p.92.

(65) Directors' Minute, 1 April, 1879, p.131. (DCRO : D/CO/32).

(66) Ironworkers' Journal, 1 February , 1879. The Scottish Railway Companies reduced freight rates by 15% for Scottish ironmasters.

TABLE VII.

Profit per Ton on Iron Plates 1873 - 1883.

Year	Profit per ton	Year	Profit per ton
1873	£2.09s. 2d	1879	11s. 8d
1874	£3.09s. 7d	1880	12s.0d
1875	£2.01s.11d	1881	£1.05s.10d
1876	£0.12s. 0d	1882	17s. 5d
1877	12s. 2d	1883	18s. 6d
1878	08s.10d		

Source : Profit and Loss Accounts, 1873-1893. (DCRO : D/CO/89).

the efficiency of the mills. However it is plain to see that even in the boom of 1880-1 there was only a partial recovery in the profitability of iron plates. This was probably, in part, due to the emergence of steel as a substitute, for the activity in shipbuilding industry was caused, to some extent, by the construction of new steel vessels. The recovery was not large enough to stretch the capacity of the iron-plate makers and thus drive up price.

However the boom in the early 'eighties did illustrate that steel was acceptable in terms of quality and price, and that there was a significantly greater margin of profit, because of its short supply.(67)

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(67) Journal of the Iron and Steel Institute, 1880, I, p.221.

TABLE VII.

Comparative Cost of Production and Profit per Ton on Iron and Steel Plates, 1884-1886

	Iron		Steel	
Year	Cost	Profit	Cost	Profit
1884	£5.02s. 9d	13s.2d	£6.12s. 6d	£1.01s. 6d
1885	£4.10s. 9d	6s.0d	£5.05s. 4d	£1.03s. 0d
1886	£4.08s. 6d	5s.1d	£4.11s.11d	£1.09s. 4d

Source: Profit and Loss Accounts, 1873-1893. (DCRO : D/CO/89).

After production of steel began in June 1883 capacity was expanded rapidly, and by 1886 the cost of producing iron and steel plates was more or less equalised. In 1885 the Consett Directors decided to make large additions to their steelmaking and rolling capacity, and this coincided with similar investment decisions by Bolckow Vaughan, Parkgate, John Brown's and other northern producers.(68)

1885 was a year of depression in shipbuilding particularly on the North-east Coast, but its severity was probably most acutely felt by the Scottish steelmakers who had an earlier start in the late 1870's. By 1885 the Scottish makers' capacity was probably approaching that demanded by the Clydeside shipbuilders. Up to then they had a monopoly of steel boilder plates, ship-plates and angles, purely because of the inability of any other district to export a surplus.(69) The severity of the depression in the North-east yards, compared with those on

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(68) W.A. Sinclair, "The Growth of the British Steel Industry in the Late Nineteenth Century," Scottish Journal of Political Economy, VI, (1958) p.36.

(69) H.W. Macrosty, The Trust Movement in British Industry : A Study of Business Organisation (London, 1907) p.66.

Clydeside, left the north of England steel makers with the spectre of idle capacity, following the preliminary expansion between 1881-1885. To protect themselves from competition the Scottish makers founded the Scotch Steelmakers' Association in 1885 and raised their prices by 10s.0d per ton. However their efforts proved fruitless, for in the winter of 1885-86 they were subjected to fierce price competition from the English makers and forced to reduce their price by 7s.6d per ton. Consett was in the vanguard of the assault.(70)

It seems clear that this onslaught by the English producers was taken from a position of strength, in that they had newer plant, which they desired to operate at capacity, and which was capable of turning out steel at costs which could undercut the Scottish. Although it was a short and sharp conflict which was soon settled by the renewal of activity in the shipyards on the North east Coast and Clydeside, it did set a precedent for later inter-regional competition.(71)

The recovery of business in 1887 soon re-established the profitability of the steel plate trade, as supply was unable to keep abreast of demand. In 1888, H.E. Moss & Co., a firm of merchants, were complaining of "the difficulty of getting quick delivery of steel plates, the demand being so great and the manufacture so limited."(72)

The decision to construct new Angle Mills in 1889 was an indicator that the tide was beginning to flow against the steel-producers, for although it was

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(70) Ibid.

(71) Ibid.

(72) Iron and Coal Trades Review, 30 March, 1888.

a response to increasing demand, it was also a conscious effort on the part of the Consett management to increase the marketability of their steel plates.

The period between 1887-1894 is well documented in the letterbooks of William Jenkins, and enables one more clearly to ascertain Consett's position in the industry, and whether in fact the Company held any monopoly. In 1889 499,093 tons of shipping were launched on the Tyne and Wear, and Consett produced in the region of 120,000 - 130,000 tons of steel and iron plates. Probably only about 60 per cent of the tonnage launched was accounted for by the plate input,(73) but Consett also sold to Tees-side and Clydeside. Thus allowing for one third of Consett's plate sales going to other areas, the Company still held about 25% of the market on the two important rivers of the Tyne and Wear. By 1894 the Company was producing almost 200,000 tons of materials for shipbuilding, whilst the total tonnage launched on the North-east Coast had risen to only 544,768 g.r.t.; it seems likely that Consett had at least maintained its market position.

Proximity to the yards was obviously important, and only Spencers and Palmers on Tyneside and the Wear Steel Company at Sunderland had an advantage over Consett in those markets; neither Spencer nor the Wear Steel Co., were very large, and the Wear Steel Company was certainly unsuccessful.(74) Hartlepool had a distance advantage over Consett for the Wear market, but the West Hartlepool Steel and Iron Company were unintegrated, and besides they had close ties with William Gray, the West Hartlepool shipbuilder.(75) The other Tees-side works and Consett were about equidistant from the Wear, and the former were the source of most competition on that river, but were not so

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(73) Wm. Jenkins to D. Dale, 22 September 1890. (DCRO : D/CO/74). Jenkins estimated the steel input for a ship to be 10 parts plate, 3 parts angles, 1 part rivets.

(74) Durham Chronicle, 26 February 1892. p.5.

(75) R. Wood, op.cit., pp.74-75.

troublesome on the Tyne.

The factor of distance created a delicate balance of partial monopoly, in which Consett was able to secure differentials in price between the three rivers. By 1893 when the boom had run its course and prices had fallen, William Jenkins was still able to report to David Dale:

> "We have not felt it necessary in the case of steel plates to force prices down for Stockton, local and export dly., lower than say the Wear and Tyne prices, but there is now so small a margin of profit and so fierce competition that we feel it requisite to compete with Stockton makers to come down to their prices i.e. prices at which they are able to sell at by virtue of their close proximity to the shipbuilding yards. The danger in our doing this is that a Tyne or Wear shipbuilder would probably claim to have such a price quoted to him for steel plates and angles at his yard as were quoted to shipbuilders on the Tees - but we hope we shall avoid this." (76)

However when the competition began to become fierce as in the Autumn of 1892 Consett was able to price cut to better effect than other makers, and still return profits. Several steel producers were in dire straits in 1892-93, most notably Palmer's Shipbuilding and Iron Company, which had been troubled by labour problems and an inefficient iron and steel department.(77) Spencers at Newburn were equally hard pressed, and the Wear Steel Company which had been formed in 1890 was in difficulty in the succeeding two years, mainly because of high costs, and competition from Consett.(78)

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(76) Wm. Jenkins to D. Dale, 30 May, 1893. (DCRO : D/CO/84).

(77) Newcastle Daily Chronicle, 24 September 1890 & 17 November 1893.

(78) Wm. Jenkins to Wm. Stobart, 13 March 1891.(DCRO : D/CO/75); and Durham Chronicle, 26 February, 1892.

The main influence upon Consett in adopting price-cutting tactics does not appear to have been the steel producers in competition, but the shipbuilders who in depression could afford to postpone purchases, and thus unless Consett competed they would be able to extend their demand over a longer period, drawing upon the business of the agglomeration of smaller steel producers.(79)

Consett by the 1890's had established a fairly strong secondary sales area on Clydeside, but it differed in many respects from that in the North-East. The Scottish trade was dominated by merchant buyers, and invariably merchants were able to assert their strength when a downturn began, since they were willing to buy speculatively and thus relieve steelmakers of stocks. The makers who most readily succumbed were those who had insufficient cash assets and were forced to sell from a position of weakness. By the recession of 1892 Consett had to follow suit, reducing price and increasing its commitments to a limited number of merchants. The increasing strength of the merchants was indicative of the rise in capacity between 1886-1892, and the approach of excess supply.

There were tell-tale signs of price co-operation in 1892 when some makers tried to introduce a scheme of uniform prices for certain extras. This was an effort to raise price by stopping 'Chiselling' of the price of extras,(80) but Jenkins was dubious of its chances of success.

In the wake of the boom in 1889 Consett had turned to the Clyde market, to look for orders. Jenkins wrote to Andrew Tolmie that he was of

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(79) Wm. Jenkins to D. Dale, 11 January 1890. (DCRO : D/CO/71).

(80) Wm. Jenkins to D. Dale, 11 August 1892. (DCRO : D/CO/81).

"the belief that the Clyde Steel Plate makers are now so handicapped with the high price of Pigs that they are straining unduly the high price of Steel Plate. In your sheet of yesterday you say 'makers would willingly sell at £9. less 5%'. I have no doubt they would do this. At Consett however we are placed in what might be called superior circumstances and it will not do for us to strain at anything like £9. per ton less 5% on the Clyde if we wish to add to our contract book.

Up to the present we have been aiming at £8 per ton less 2½% on the East Coast which would roughly be say £7.12s.6d nett at Consett. The equivalent of this would be £8.12s.6d less 5% for Clyde delivery."(81)

Consett could comfortably undercut the Scottish producers, and the latter reaped their sad harvest in 1892 with very depressing trading results. The plight of the Scottish-makers was attributed by J. Cronin, the General Secretary of the Associated Society of Millmen in Scotland, to the unfair competition of northern firms, and Consett in particular. He alleged that they were able to undercut by paying lower wages in their mills, but this was vigorously denied by Edward Trow, the Secretary of the Associated Iron and Steel Workers. In a fairly long winded debate it transpired that the labour productivity in Consett's mills was far in advance of that in Scottish mills.(82)

In view of this evidence, and the earlier evidence about the weakness of Palmers, the Wear Steel Company, Spencers, and the Barrow Steel Company it is clear that Consett's efficiency was far in advance of that of many of its competitors. In response to the competition from the south there was a spate of

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(81) Wm. Jenkins to A.D. Tolmie, 25 February 1890. (DCRO : D/CO/72).

(82) R.C. on Labour pp. 1892. [c6795-iv] XXXVI, QQ.16134-16178.

investment in Scottish steelworks between 1890-94, but overall Cleveland was establishing its ascendancy as the main centre of ship-plate production.(83)

By 1894 when most of the new Scottish plant was being brought or had been brought into operation the Scottish makers were getting aid from the railway companies to protect their home market and had settled upon a combination to raise price. (84) Jenkins was sceptical about the value of combination, and "had no great belief in combinations for raising price."(85) Although price was low early in 1894, Consett's order books were fairly full, and the Company was able to choose between supplying plates to Neilsons or the Admiralty; the latter being a direct contract was inevitably given preference.(86) In contrast the Scottish steelmakers were short of specifications.

The inter-regional competition was becoming bitter; in the Autumn of 1893 the Scottish Railway Companies "made very liberal concessions to steel-makers in Glasgow for the conveyance of material from their works to the coast and especially for continental enquiries."(87) Despite appeals and altercations by Consett and the North Eastern Railway the Scottish Railways steadfastly refused to extend any similar concession to English makers, or even to put Consett upon the lower rate paid by Jarrow. As Jarrow was a high-cost firm it was little threat to the Scots makers.(88)

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(83) W.A. Sinclair, op.cit., pp.38-39.
(84) Wm. Jenkins to J. Neilson, 10 February, 1894. (DCRO : D/CO/88).
(85) Ibid.
(86) R. Evans to D. Dale, 5 January, 1894. (DCRO : D/CO/88).
(87) R. Evans to D. Dale, 30 October 1893. (DCRO : D/CO/85).
(88) G. Ainsworth to A.D. Tolmie, 2 June 1894. (DCRO : D/CO/88).

When the Angle Mill was opened at Consett early in 1893, the Company was put in a difficult position because of the depression in shipbuilding. Mr. Jenkins was most concerned about the implications of such slack trade.

> "It will be a very awkward business if after all our efforts and all our anxiety in collecting men together, and pushing on the work if we shall have to come to a dead lock with our angle mill so soon after beginning. The danger will be that our men will leave us."(89)

Dorman Long's were eager to take advantage of Consett's temporary weakness, by doing a deal to split the markets for structural steel. Mr. Echalaz, Dorman Long's sales agent in the North East proposed that Consett should take over their angle contracts, about 10,000 tons, on the undertaking that Dorman's should have a free hand in the sale of girders, channels &c., for which there was a better price. However Wm. Jenkins treated the proposal coolly, as the price for angles was very low, and by taking up such a large contract Consett would be unable to take advantage of any upswing for some months. Richard Evans was more amenable, feeling that it would at least keep the new mills employed for the rest of 1893; however, Jenkins' view prevailed.(90)

By the mid-1890's it was evident that the rapid growth of the Scottish market was over, and to continue to prosper the Scottish makers had to abandon the internecine price warfare and adopt a policy of co-operation. The need for this was reinforced by the collapse in demand for liners after 1896. In the North East, saturation of the market had not quite been achieved, as the shipbuilding industry maintained its expansion; however the early difficulties

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(89) Wm. Jenkins to D. Dale, 2 June, 1893. (DCRO : D/CO/84).

(90) R. Evans, to D. Dale, 3 August, 1893, (DCRO : D/CO/85).

Consett experienced in selling steel angles, and the willingness of another producer to carve up the markets, is indicative of approaching equilibrium between supply and demand.

In the Autumn of 1894 Consett succumbed to the necessity to conduct negotiations to control the price of steel angles, and had successful negotiations with Bolckow Vaughan,(91) but there is no further mention about the progress of the proposals and it is not clear whether they ever took effect. If they did so it is unlikely that they were either effective or long lasting.

Further proposals for co-operation were not mooted until late in 1897 when a meeting was held by the North-east steelmakers to form an Association along the lines of that adopted by the Steel Rail Association. After consideration Consett decided in favour of the scheme, and began to encourage other North eastern producers to adhere to a common fixed selling price at various points of delivery.(92)

In Macrosty's thesis, the formation of localised association was the first step toward closer industry-wide co-operation, but at first it was related to vigorous inter-regional competition.(93) The North east plate makers were able to maximise price up to the limit where transport costs gave protection, they were also able to maintain capacity by 'dumping' outside their area.(94) When the North-east producers proposed a 2s.6d per ton advance in April 1898, Consett made known its disapproval, since it expected such an advance would

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(91) Directors' Minute, 2 October, 1894. p.280.(DCRO : D/CO/35).

(92) Directors' Minute, 18 December,1897. p.242. (DCRO : D/CO/37).

(93) H.W. Macrosty, op.cit., p.13.

(94) Ibid.

open the door to Scottish competition on the Tyne.(95)

However as trade improved, and industry began to boom at the turn of the century, much of the argument for association disappeared; demand filled up capacity and drove up the price.

The successive passing of booms brought progressively tighter markets in their wake. The problem of external competition became more than just a matter of price warfare with the Scots, for by the end of 1900 the North-east Coast producers were being undercut by Germans, Belgians and even Americans.(96) The depression of 1903-04 which followed was most significant to the steel-plate producers in that it was caused basically by excess capacity of shipping tonnage, and thus not much was likely to be gained by a price war to induce demand. The alternative solution was the adoption of co-operation to maintain price.

In 1904 as the depression reached its bottom, the Scottish Steelmakers' Association raised their prices in Scotland and Belfast, so that they might dump freely in England. This was a preliminary move to threaten the North east makers with an all out price war, or alternatively to reach an agreement of mutual advantage.(97) The proposal was that the makers should respect the integrity of each others districts, thus removing needless competition, and making important savings on railway charges. Consett was agreeable to such a scheme, on the understanding that it should be terminable at short notice.(98)

At the same time as the plate makers moved forward towards a national framework of price control, Consett was anxious that an Association should be formed to remove unnecessary competition from the sale of angles. In February 1905 a temporary arrangement was adopted by Consett, Palmers, Dorman Long, and

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(95) Directors' Minute, 3 May, 1898, p.30.(DCRO : D/CO/38).
(96) The Economist, 3 November, 1900 p.1551.
(97) M.W. Macrosty, op.cit.,p.69.
(98) Directors Minute, 6 June, 1905. p.55.(DCRO : D/CO/40).

Frodingham and it was formalised in June.(99)

All was not well, however, amongst the plate-makers, because those who made boiler-plates resorted to their past practice of securing orders for the more valuable boiler-plates by making concessions upon ship-plates and angles, which were commoner grades. This was possible by manipulating the price 'extras' that were invariably attached to the basic price for boiler-plates. This price 'chiselling' culminated in a serious crisis for the steelmakers in the summer of 1905, and threats of withdrawal from the combination.(100) However, the Association was maintained intact, and the following year was strengthened by the extension of the agreement on plates, to angles. There was still a chink in the protective armour of the Association, for although in the Autumn of 1906 it was agreed that the Belfast market be allocated to the North-east makers,(101) this was not effective because of the invasion of the market by Guest, Keen and an unassociated English maker.(102) This had an effect upon the shipbuilders on Clydeside and the North-east Coast who were resentful of the advantage held by the Belfast makers. The Clydeside builders claimed that the differential was as much a 15s.0d per ton on plates, and although this was disclaimed by the Scottish makers, there was a substantial differential. The scale of difference was similar in angles and boiler-plates sold in the Midlands, the price being the same despite transport costs of 10s.0d to 14s.0d per ton.(103)

In view of the above evidence, McCloskey's assertion that the ship-plate trade was never effectively cartelized prior to 1914 is unfounded, for although Belfast remained a renegade competitive area, by far the two most important areas for shipbuilding were tightly controlled by the steelmakers.(104)

(99) Directors' Minute, 6 June, 1905. p.55 (DCRO : D/Co/40).
(101) The Economist, 15 July, 1905. pp.1155-6.
(101) Directors' Minute, 6 November, 1906. p.198. (DCRO : D/CO/40).
(102) The Economist, 6 October, 1906. p.1619.
(103) Ibid., Using McCloskey's estimate Ps - MCs the excess of price over marginal cost, then in 1906 Scotlands MCs was about 13%, i.e. $\frac{117\frac{1}{2}-(117\frac{1}{2}-14}{117\frac{1}{2}-14}$
(104) D.N. McCloskey, Economic Maturity and Entrepreneurial Decline.. p.51.

Furthermore, in his study of shipbuilding Sidney Pollard attributes the low level of profits in the 1905-6 boom to the monopolistic power of the plate makers' collusion.(105)

Cartelisation is a retarding factor in an industry if that industry suffers from, or its single most important customer suffers from overcapacity, since innovation only becomes profitable if it can earn profits larger than those secured under cartelisation. If one firm were to reduce its marginal cost, then its maximum profitability within the cartel could be achieved only by increasing its quota, which would be unacceptable to other cartel members who would have to forego part of their quotas. Alternatively the firm could leave the cartel in which case the members of the cartel would retaliate by a price war, in order to maintain their market share and to drive the renegade firm back into the combine. Under such conditions, a company would have to be sure that the innovation in conditions of price warfare would be able to sustain a prolonged onslaught from a very much larger group acting in concert. As the industry suffers from overcapacity it is necessary for the renegade either to have a significantly lower marginal cost or that the total demand of the industry's products cannot be supplied by the cartel operating at full capacity.

Neither of these conditions would have held for the steel plate and angle industries, primarily because there were serious drawbacks to the main technical developments; the Talbot furnace was prone to breakdown, and was most suitable for basic steel production, which steel makers were still wary of, and the introduction of electrical machinery into the mills was retarded by the absence of a reliable reversing electrical motor until 1907. Secondly as the shipbuilding industry was liable to sharp fluctuations in demand between boom and slump, it would not have been beyond the firms remaining to fulfil the demand except during the most fervent activity.

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(105) S. Pollard, op.cit., pp.466-67.

It was for these reasons that cartelisation had a depressing influence upon innovation during the Edwardian era, as the measurements of Consett's real costs bears out. However, fundamentally it was the slowing of the growth of demand which provided the conducive atmosphere for cartelisation. This bears out Temin's hypothesis that the decline in entrepreneurial vigour was a function of the market situation and not vice versa.

Although the Association was unable to encompass the Welsh firms it was becoming during 1907-1908 more ubiquitous. In 1907 preliminary discussions were undertaken to establish the possibilities of a joint export selling agency, and even more ambitious a combination with Continental makers.(106) In February 1908 Consett agreed to the fusion of the North East Coast Plate and Angle Associations, and by July an arrangement had been reached for a joint selling agency for export materials.(107)

During the depression of 1908 price was driven so low that Continental competition in the domestic market declined. However once trade began to pick up again in the second half of 1909 imports of foreign steel began to rise once again. The Association, however, was remaining relatively effective, for both Dorman, Long and Company and Consett submitted to fines for selling in excess of their quotas. Consett was fined 6s.0d per ton on an excess sale of 18,106 tons (£5,431.06s.0d)(108)

However the resurgence of foreign competition prompted the Scottish Association in 1911 to propose a 5s0d per ton rebate for customers buying only from

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(106) Directors' Minute, 20 July, 1907 p.15. (DCRO : D/CO/41).
(107) Directors' Minute, May 1908. (DCRO : D/CO/41).
(108) Directors' Minute, 5 October, 1909, p.232.(DCRO : D/CO/41).

Association members. After a very full and thorough discussion Consett felt it was unable to be party to such a scheme, because of its dubious legality.(109) Later in the year a modified scheme was discussed and approved by Consett. The main difference was that the scheme should be terminated and rebates paid up when and if any member withdrew. This overcame the problem raised by the previous scheme, whereby customers of a company that withdrew would be ineligible for rebate, although through no design of their own.(110)

The rebate scheme lasted two years before it was abandoned by the Scottish firms because of the secession of the Lanarkshire Steel Company, but the English makers resolved to continue as best they could with the scheme.(111) The departure of Lanarkshire Steel Co. and the revival of the Cambuslang Works by a consortium of shipbuilders brought about the complete collapse of the Association in Scotland but many Scottish makers undertook to respect the integrity of the North-east market. However the collapse of price in 1914 on Clydeside led to such bitter complaints from Tyne, Wear and Tees shipbuilders that some concessions had to be made by the North east steelmakers.(112) For its part Consett had matured to acceptance a scheme for a Central Selling Agency of Steel by the outbreak of the War.

During the decade up to World War I Consett was party to an arrangement whereby the North east steel producers were effectively able to monopolise the sale of steel plate and angles to shipbuilders in their own regions, which over the period accounted for approximately half the shipping launched in the British

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(109) Scottish Steelmakers' Association to W.B. Peat, 24 June 1911, in Directors' Minute, 5 October, 1909, p.232.(loc.cit.).

(110) Directors' Minute, 5 September 1911, pp. 182-3. (DCRO : D/CO/42).

(111) Directors' Minute, 2 December, 1913, p.104.(DCRO : D/CO/43).

(112) Carr and Taplin, op.cit.,p.260.

Isles. Furthermore within the region the number of firms had been sharply reduced by the amalgamations in the late 1890's directed by Sir Christopher Furness, and Dorman, Long. The effect of this was to contribute to the decline of the firm's operating efficiency, whilst helping to maintain a healthy record of profitability.

CHAPTER VIII

LABOUR IN THE IRON AND STEELWORKS

This chapter will begin by tracking the movement from crisis in labour relations in the 1860's, through the disruption and inter-union squabbling of the early 1890's, to the relative peace of the Edwardian Decade. However, physical input is only one aspect of the labour supply necessary for the operation of a large concern. The last two sections will deal with the structure of management and the personalities of the men who filled the important posts.

Iron and steel works can be divided into three distinct operating departments, smelting the pig iron; refining it into wrought iron or steel; and finally finishing it off in rolling mills. The men employed in these departments were paid by tonnage or datal rates. The tonnage rates were most commonly paid to the most skilled operators, or those carrying the most responsibility for the working of the process, whilst the datal rates were paid to the unskilled labourers. Incorporated in this system of payment was the practice of sub-contracting labour: in other words the skilled operators were directly employed by the Company and paid tonnage rates, and they in turn employed the necessary labourers to assist with the process, and paid them datal wage-rates. This dichotomy in the labour force was marked both in terms of earnings and status, and was probably the main source of industrial dispute.

The labour relations in Consett's iron and steel works tend to under-line the importance of a settled community as a contributing factor to a passive labour force. After the mid-1890's there was no significant addition to the numbers employed in the steelworks, and a tradition had been well established of sons following fathers into the works.

1. Industrial Arbitration in the Iron Trade

When the Consett Iron Company took over the ironworks in 1864, the population of Consett was about 5,000 almost all of whom had migrated into the district since 1841. Equally significant was the fact that the vast majority were either directly or indirectly dependent upon the fortunes of the Iron Company for their livelihood. In 1873 it was estimated that the Consett Iron Company employed about 6,000 men, probably fairly evenly divided between the coal-mines and the ironworks.(1) Up to the 1890's there does not appear to have been a great change. In 1889 Wm. Jenkins described the works as employing 4,000 men and 1,000 boys and youths, and also educating in Company schools about 4,000 children.(2) However during the 1890's and early 1900's the size of the Company's labour force grew very rapidly, largely due to the expansion of its coal-mining activities at Chopwell. Though employment increased from 7,400 in 1902 to 9,200 in 1914 for the firm as a whole, the numbers employed in the ironworks rose from only 3,200 to 3,300 men.

The rapid growth of Consett was not untypical of what was happening in County Durham between 1820-1880, and because rapid growth was typical throughout the County it is probable that much of the Consett labour force originated outside the County. The growth of the Catholic population is a rough indicator of the size of the Irish immigrant population.

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(1) Kelly's Post Office Directory, 1873.

(2) Details of the Consett Iron Company for the Paris Exhibition, 1889 pp. 40-4. (DCRO : D/CO/71).

TABLE VIII.1.

Catholic Population in Brooms and Blackhill 1861 - 1882

Year	Broom	Blackhill
1861	1,134	2,760
1874	2,052	3,220
1882	1,800*	3,600*

* Approximate.

Source : Status Animarum, for the Diocese of Hexham & Newcastle V.2, 1847-1912.(3)

During the 1840's there was a great deal of sectarian antagonism in Consett, and the township had the reputation for being wild and lawless. The fusion of so many people of different origins generated considerable stress in industrial relations, and the 1860's were marked by a war of attrition between employers and employees. The decisive campaign was undoubtedly the strike of 1866, for it created a degree of war weariness upon both sides which culminated in the formation of machinery to settle disputes amicably in 1869.

Consett was plagued by industrial unrest during the difficult transitional years between 1857-1864, most particularly in 1861. However as trade improved during 1863 so did the industrial relations. The downturn in 1866 precipitated a new collision between workmen and employers. During July the iron shipbuilders began to press for wage reductions, and were quickly emulated by the ironmasters. Messrs Whitwell of Thornaby proposed a 1s.0d per ton reduction on puddling and a 10% reduction on other forge and mill work.(4)

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(3) For this information I am grateful to Mr. R.J. Cooter.

(4) Durham Chronicle, 13 July, 1866 p.5.

Consett's forges and mills were closed on the 14th July, 1866. The Company claimed they were unable to continue whilst wages remained so high, while the puddlers proposed a year's moratorium on wage rates.(5) This was really the first all out assault on the part of the ironmasters to cut back the high wage rates that had become customary in attracting labour from other districts, and which had been maintained during the boom conditions of the early 1860's. The competition which forced the Shotley Bridge Iron Company into the arms of Consett was adversely affecting the whole trade. This was further aggravated by the tight money market and the suspension of the important London Bank, Overend and Gurney. In such an atmosphere the local press expressed the belief that..

> "This will have a tendency to encourage the masters in this district in lengthening the strike."(6)

Everyone seems to have expected a long struggle; the employers were resolute in their determination to force the reduction, whilst at Consett "many of the workmen are preparing for removal to other centres of industry where work is expected to be abundant."(7) The better off puddlers at Bolckow Vaughan's Witton Park works were even taking the opportunity to visit relatives and friends back in Wales! By the end of July the whole of the Consett works were idle, and the cessation of the finished iron trade had an effect upon the pig iron manufacturers. Bell Brothers' men accepted a 10% reduction on condition that their wages would "advance.....again....when the state of the "iron trade is such to warrant it."(8)

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(5) Durham Chronicle, 20 July, 1866. p.6.

(6) Ibid.

(7) Durham Chronicle, 27 July, 1866. p.6.

(8) Durham Chronicle, 3 August, 1866 p.5.

Public opinion was not behind the men. There were even misgivings voiced by working men themselves, about the justice of the ironworkers case. Although no reductions were proposed in Staffordshire, Wales or Scotland, this was because the northern men were receiving higher wages than in the other districts. One 'Working Man' feared that "if the men concede nothing now, we may expect in the future to see concessions little thought of on either side."(9)

By the end of August bitterness grew amongst the men; the union was critically short of funds. On 27th August a very boisterous meeting was held in Consett, at which a large number of men voiced their willingness to return to work, and there was very nearly a riot between unionists and 'black-legs'. It seems clear that the movement for a return to work was favoured most by the lower wage datal labourers, whilst the puddlers who hired the labourers out of their piece-rates were determined to resist.(10) Hundreds of men had left the Consett district to seek work elsewhere, whilst others sought casual employment on railway construction, roadwork &c.

The strike was showing signs of breaking up. Messrs. W. Whitwell's blastfurnacemen returned to work on the advice of their leaders, since their funds were exhausted. At Consett there was increasing hardship and antagonism because of the strike, and the tide was running in favour of a return to work.

At the end of September, the town bellman announced that the men were to return to work, although this did not originate with the Consett management. When the puddlers appeared for work they were provided with puddling furnaces to start. By mid day of the 29th September men in all the

(9) Durham Chronicle, 10 August, 1866 p. 8

(10) Durham Chronicle, 31 August, 1866 p.8.

departments had agreed to return to work upon the 10% reduction.(11)

The strike/lockout had been poorly led. John Kane, the leader of the Amalgamated Malleable Iron Workers was badly received in Consett at the end of the strike, and was only able to escape safely with assistance from the local Priest. Their men's case was not a good one, as their wages were very high, at least the earnings of those who prosecuted the stoppage most fervently were high. A plate roller earned an average of £2.4s.2d a day, a plate mill shearer £7. a week and even the more lowly puddler made £2.11s.6d per week.(12) These were high earnings by contemporary standards, although a portion had to be paid to contract labour, and it was this group who suffered the most, through low datal wage rates and virtually non-existant union representation.

Clearly the organisation of the Amalgamated Malleable Iron Workers' Association was defective. Its strike fund paid at Consett dried up before the end of August, and one irate union member proclaimed that "he had paid £14 into the union, and he had just received 24s.0d out."(13) In view of this debacle of union organisation it is not surprising that John Kane should have turned his attention to a more suitable method of settling disputes. He began by 1868 to toy with the idea of a Board of Arbitration composed of men and masters with an independent chairman.(14)

However his position was severely weakened after 1866. Two further 10% reductions were enforced during 1867, and union membership fell drastically. After their victory of 1866 the employers were not at first disposed to entertain the notion of a Board of Arbitration.(15) In 1868, however, Kane

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(11) Durham Chronicle, 5 October, 1866, p.7.
(12) Durham Chronicle, 12 October, 1866, p.5.
(13) Durham Chronicle, 31 August, 1866, p.8.
(14) Carr and Taplin, op.cit.p67.
(15) J.H. Porter, "David Dale and Conciliation in The Northern Manufactured Iron Trade, 1869-1914", in Northern History, 1970 vol.V, pp. 159-160.

reconstituted his union, as the Amalgamated Malleable Ironworkers of Great Britain, and began a vigourous membership drive throughout all the iron making districts of the nation with marked effect.(16) Demand began to improve once again in 1869 pushing up prices, and the lessons that had been preached during the 1866 dispute began to be heard by the employers.

Foremost among the employers who took heed was David Dale, Consett's Managing Director. He had been particularly impressed by the results achieved by A.J. Mundella in Nottingham,(17) and when he became secretary of the ironmasters' association he urged the formation of a joint committee. Though Kane and Edward Trow, the union leaders, were favourable, the ironmasters were still hesitant, but their views altered as trade became more favourable.

At the beginning of 1869 the workmen at several Teesside and Darlington works requested advances in their wages. Along with the wage claims came a request for the formation of a Board of Arbitration along Mr. Mundella's lines.(18) Clearly if the masters had rejected either proposal out of hand they would have precipitated another bitter dispute, in which public opinion would probably have polarised around the union's cause. The 'Board of Arbitration and Conciliation for the Manufactured Iron Trade of the North of England' was constituted on 22nd March 1869, with David Dale as its first elected president.(19)

All was not plain sailing yet, for arbitrators still had to be called in to settle claims, but it was soon suggested by Rupert Kettle, the first arbitrator, that a selling price sliding scale should be adopted to regulate wages automatically.(20) This too took time to be accepted and adopted, and meanwhile Consett were not above distorting the arbitrators' awards. In 1870 it was alleged by the union that.....

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for footnotes see page 290.

"An attempt has been made to alter the terms of working in plate and rail mills, which will amount to a reduction instead of an advance and the Consett Iron Company were accused of "playing fast and loose with the resolution which was signed by Mr. Thomas Hughes, M.P."(21)

Though Consett may not have kept complete faith with the spirit of arbitration and conciliation, David Dale did, and his reputation for fairness grew in strength amongst the workmen. In 1872 he was instrumental in launching the first selling price sliding scale to regulate wages in the North of England iron trade.(22) This scale was short-lived, however, mainly because of the inter-regional competition; it was not revived until 1880, and then was only short-lived. A successful scale was not introduced until 1889 when price was moving upward once again, but by this date malleable iron was rapidly being replaced by steel, especially at Consett's own works.

During the early years of the Boards' existence Consett was central in its success, as one trade unionist attested in 1902:

"In the formation of the Conciliation Board, in the building up of the association [union] throughout the years of depression and crisis which followed upon the rush of the seventies down to the eighties, no one can lose sight of the fact that Consett was both the energising,

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(16) Carr and Taplin, op.cit.,p.69.

(17) Sir Edward Grey, Sir David Dale : Inaugral address delivered for the Dale Memorial Trust. (London, 1911) p.35.

(18) Durham Chronicle, 26 February, 1869 p.5.

(19) J.H. Porter, op.cit.,p.161.

(20) Ibid.

(21) Iron and Coal Trades Review, 6 April, 1870, p.219

(22) J.H. Porter, op.cit.,p.162.

vitalising and also steadying power, influencing and in a large measure governing the new policy of industrial peace and common sense initiated after the deplorable conflicts to which they had been accustomed."(23)

The Company consistently took advantage of the arbitration procedure established by the Board to regulate wages and modes of working and the method was extended to most of the operating areas of the ironworks. The blastfurnacemen, who were at first associated with the Malleable Ironworkers, broke away in 1878 and then set up their own joint regulating machinery upon similar lines to the wrought-iron trade.(24)

When Consett began to produce steel in the 1880's the revised methods of working were arbitrated by the Standing Committee of the Board of Arbitration. (25) The only area of difficulty which arose was that generated by the hostility between the old Associated Iron and Steel Workers (as Kane's old union evolved to) and John Hodge's Steel Smelters Union.(26)

After the turmoil in labour relations in 1866 Consett had an almost strike free record in the iron and steelworks. Consett was affected in 1880 by the general strike of ironworkers who took issue with Waterhouse's selling price certificate which imposed a 5% wage reduction. The men felt the price had been calculated by a method detrimental to them. However the dispute was over within a week, when the men were convinced of the fairness of the calculations.(27) Six years later Consett's blastfurnacemen came out

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(23) Ironworkers' Journal, May, 1902.
(24) H.A. Clegg, A. Fox, and A.F. Thompson, A History of British Trade Unions since 1889, I (Oxford, 1964) p.210.
(25) Ironworkers' Journal, July, 1885.
(26) Ironworkers' Journal, July, 1890.
(27) Ironworkers' Journal, June, 1880 p.5.

on a strike against a proposed 5% reduction, against the advice of their Union, but after eleven days they accepted the employer's terms and returned to work.(28) Then again in 1890 the firm's operations were interrupted for two weeks by a strike in the steel melting shops. These were the only major stoppages which originated in the ironworks.

In 1890 William Aucott of the A.I.S.W. crystallised the harmony that existed in labour relations at Consett's works:

> "For years past it had been his boast throughout the whole trade of the United Kingdom, that the men at Consett had always acted faithfully and loyally to their principles, and that the Lodge at Consett, in regard to the relationship between the employers and the operatives, was the easiest and best, and the most perfect that he knew of in any great concern in the country."(29)

The reason for such industrial peace at Consett seems to have been the stability of the community; in 1902 the reporter of the A.I.S.W.'s annual meeting of the Consett Lodge was struck by negligible change in personnel at Consett, as compared with other works.(30) Furthermore interest in trade unionism on the whole seems to have waned, at least amongst the men employed in the mills. A regular lament at A.I.S.W. meetings was the declining interest in the advantages of unionism.(31)

This relative freedom from strife, however, over such a long term may have had an adverse affect upon Consett's management, in that it

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(28) Durham County Advertiser, 23 April, 1886 p.7.

(29) Ironworkers' Journal, July, 1890.

(30) Ironworkers' Journal, May, 1902.

(31) e.g. Mr. John Orr (President of Durham Colliery Mechanics) felt it was "a shame that so few of the men of Consett were organised" Ironworkers' Journal, January, 1892.

removed an incentive to innovate. Several writers have observed the importance of strike action and militant labour on inducing innovation.(32) Since this was absent in Consett's case over most of the period, it is feasible that it contributed to the poor productivity performance from the late 1890's onwards. The period covered by this study more or less encompasses the secular price decline between 1873-1896, and then the secular price rise between 1896-1914 it may be that there was pressure from labour costs before 1896, but this was alleviated after 1896. The selling price sliding scale would have an influence upon this because of the lag between price movements and wage adjustments. William Jenkins observed this effect in 1882, pointing out that because of the 3 months lag between prices and wage adjustments ironworkers might get low rates whilst price was rising and high rates whilst price was falling.(33) As the first half of the period was one of price decline, manufacturers were faced with falling selling prices and high wage rates more often than rising prices and low rates, which became more normal after 1896. Sliding scales and wage arbitrations based on the average price for the previous 3months may have had an effect upon technical innovation.

A possible abuse that the Board of Arbitration avoided with respect to changes in productivity, was the risk of discouraging innovation by reducing the return on capital. Since many men were paid piece rates then it would have been unjust to the ironmaster had they been accredited with the full benefit of improved productivity bestowed by new machinery. There were several cases of arbitration to reduce the piece

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(32) E.J. Hobsbawm, Labouring Men, (London,1964) p.172.; J.F. Clarke Labour Relations in Engineering and Shipbuilding on the North-East Coast in the Second Half of the 19th Century." (University of Newcastle, M.A. Thesis, 1966) p.504.

(33) Ironworkers' Journal, 1st March, 1882. p.2.

rates because of the greater efficiency of the machine. This was not an attack on the men's earnings, merely an insurance that increments to productivity contributed by capital should be distributed to capital.

The adjudication of the Board was not always perfect, and their effectiveness in re-negotiating rates in line with technical improvements appears to have deteriorated over time. In 1900 Consett complained that;

> "There is no doubt that where rollers are placed in a position to earn £900 a year net.....by the character of the equipment placed at his disposal, some more consideration is due to the Company or firm than would be due to concerns that were not so well up-to-date."(34)

2. The Structure of Employment : The change from Iron to Steel.

One reason for the paucity of figures on numbers of men employed by Consett in the ironworks, is the mode of employment which was prevalent in the 19th Century - that of sub-contract labour. The system had probably evolved as a means of minimising the management problems of the new large scale entrepreneurs, and possibly also to reduce the burden upon working capital;(35) it was maintained in the forges and the finishing departments at Consett through the whole period,(36) although only in a very rudimentary form, since the Company increased its control over the amounts paid to datal men and labourers.(37)

The three tier system of masters, contractors and helpers was probably an advantage in facilitating the success of the Board of Arbitration,

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(34) Ironworkers' Journal, June, 1900.
(35) A.J. Taylor, "The Sub-contract System in the British Coal Industry" in LS. Pressnell, Studies in the Industrial Revolution, (London 1960) p.217.
(36) Ironworkers' Journal, June 1908.
(37) Ironworkers' Journal, May, 1886.

for as the Malleable Ironworkers' Association was in favour of arbitration, and was made up predominantly of contractors, it was able to impose an effective measure of discipline upon its members. This was possible since there was always a large pool of underhands anxious to rise to the position of contractor. The masters and Association were thus favourably placed to remove any contractor who disregarded Board decisions.(38)

However there were problems; in the slump of 1878-79 Consett was anxious to effect a reduction of wages, but wished to be discriminating in that it wanted it to apply only to the 'high-class' workmen, who were the contractors. Naturally Edward Trow, the Associations secretary was adamant, since this was an attack upon his members. When David Dale eventually made the award of a reduction in 1878 there ensued a protracted dispute about whether the contractors should pass the reduction on to their helpers.(39)

The helpers, who were contributors to the Board, but not necessarily members of Trow's union, were determined that they should not suffer a reduction, as the Board did not authorise one for them. The helpers were doubly affronted since they had increased the output of the forges and mills without any advance in their wages. Finally David Dale arbitrated, awarding that no reduction should be made in helpers' wages, whilst the contractors should be partially relieved of some of the reduction.(40)

Sub-contracting had never been an important element at the blastfurnaces, and during the mid and late 1880's it began to lose ground in other departments.

(38) H.A. Clegg. etal., op.cit., pp.22-23.

(39) Ironworkers' Journal, November 1879.

(40) Ironworkers' Journal, February, 1880 p.1.

The principal reason for this was the substitution of steel for iron, and the emergence of a new system of working and a new union. In the ironworks a contractor would control one process, i.e. a puddler or roller, but in the new steel works the contractor controlled the whole workshop or mill.(41) This meant the majority of workmen were subordinated to a datal wage system; the first assault upon this system was made by John Hodge in Scotland, and the Scottish employers acquiesced.(42) Hodge was also the initiator of the Associated Society of Millmen in 1888, but he resigned the following year to concentrate upon his duties as Secretary of the Smelters' Association and was replaced by John Cronin.

Having established himself in Scotland, Hodge began to invade the North of England for members. In Scotland he had not been confronted by any well organised union,(43) but in England he came up against Edward Trow's A.I.S.W.. Hodge's campaign in the North of England was clearly planned upon the classical lines of Napoleon and Wellington. As he remembered...."In the early days of the Union, I copied their "tactics, ever endeavouring to tackle employers singly - a hint to one of what his rival thought kept them jealous of one another."(44)

Hodge's tactics appear to have worked, and the firm he singled out was Consett. When prices began to improve in 1887 there was a claim for an advance in piece rates. William Jenkins attempted to encourage co-operation amongst the producers of the North of England.(45) However

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(41) H.A. Clegg et al. op.cit., p.205.

(42) Carr and Taplin, op.cit.,p.140.

(43) Ibid., p.139.

(44) John Hodge, Workman's Cottage to Windsor Castle (London, 1931) p.103 .

(45) Wm. Jenkins to:- Bolckow, Vaughan & Co.; Dorman, Long & Co; Moor Iron Co.; Palmers Shipbuilding & Iron Co.; and Weardale Iron & Coal Co.; 25 January 1887.(DCRO : D/CO/68).

there does not seem to have been a willingness as Jenkins later complained.... "I have recently aimed at getting some co-operation in the case of those firms who are rolling steel, but there is not much encouragement."(46)

Jenkins had recognised Hodge's tactics, for a little later in 1887 he wrote to David Dale:

> "Our men have affiliated themselves with the Glasgow Steel Melters Union and they appear to have singled us out for attack, as turning out about the largest quantities in the North of England, and if their point is carried here no doubt they will follow it up by pressing the same claim at other works." (47)

The lines of battle between the new union and Consett were thus drawn, but there was also a second front, between the Smelters and the A.I.S.W.. Although trade unionism was not strong at Consett, - possibly a reason why Hodge choose the Company for his main assault, it had been long established. As the new steelworks were constructed, displaced puddlers were moved to work at the open-hearth furnaces.(48) Antagonism between the Smelters and the A.I.S.W. reached a climax in 1890 when the Smelters called a strike, closing the works. Trow and Aucott of the A.I.S.W. complained bitterly about the Smelters' attempts to coerce their members to join the Smelters' Association.(49) Relations between the two unions remained strained, but at least their strengths polarised in the melting shops and mills respectively, thus reducing the prospect of further inter-union warfare over membership.(50)

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(46) Wm. Jenkins to Wm. Whitwell, 28 February, 1887. (DCRO :D /CO/68).
(47) Wm. Jenkins to David Dale, 7 April, 1887. (DCRO : D/CO/68).
(48) R. Evans to David Dale, 4 April, 1887. (DCRO : D/CO/68).
(49) Ironworkers' Journal, July, 1890.
(50) Ironworkers' Journal, January, 1892.

On the main front, however, John Hodge was faced by an able and energetic opponent in Wm. Jenkins, for Consett's General Manager knew that the line of defence, or even counter-attack to adopt was that of co-operation between all employers on Smelters' wages. Jenkins took a central role in the organisation of the employers, and as Hodge's own success grew, raising the wage of a first melter from 17s.0d a day in 1887 to £9.12s.7d a week at the end of 1889, the steel-makers gradually came round to the wisdom of joint action. Jenkins had complained to Windsor Richards of Bolckow Vaughan in 1887 that the higher wages at his firm incited the Consett men to ask for an advance and as late as the end of 1889 he was still striving to fit the Moor Iron and Steel Works into the pattern of co-operation.

> "It is a pity that you do not unite with the other employers in aiming at something like strength on the part of employers to meet the superior wisdom and strength of the operatives themselves."(51)

However, Jenkins' strategy was taking shape by the beginning of 1890. For the first time he began to get co-operation not only from the English makers but also their Scottish counterparts.(52) Hodge was also changing his tactics, for as he recalled, "as soon as I had the position of the society consolidated and rates and conditions of employment fairly well stabilised, I realised the importance and the benefit of collective bargaining."(53)

From 1890 the relationship between the Smelters' Association and the steel makers was stabilised, and eventually in 1905 a selling price sliding

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(51) Wm. Jenkins to C.J. Bagley, Moor Iron & Steel Co., 13 December, 1889. (DCRO : D/CO/70).

(52) Wm. Jenkins to A.D. Tolmic, 14th January, 1890. (DCRO : D/CO/71)

(53) John Hodge, op.cit., p.103.

scale was negotiated, probably because Hodge saw the advantages which would accrue once a price combine had been formed between the English and Scottish makers in 1904.(54)

The emergence of the Steel Smelters' Association was illustrative of the ability of a 'new' union to gain extensive concessions and then successfully consolidate. Hodge's strategy proved successful in exploiting the employers' weakness to organise themselves, despite Jenkins' efforts, and he gained significant wage advances for his men. In contrast the steelmillmen do not appear to have fared as well. In 1888 agreement was reached with the millmen at Consett and Jarrow to regulate their wages by a sliding scale.(55) When the millmen's scale came up for renewal in 1890 the boom had passed its peak and bargaining strength was swinging back towards the manufacturers. The men claimed for meal breaks, short hours on Saturdays &c. and a 2½% advance on the basic rate. The employers after long negotiations were able to strip off and dismiss all 'the extraneous items', conceding only the 2½% advance,(56) a poor reward for two years loyalty to the sliding scale during such a period of agitated labour relations. In 1892 when the slump was at its worst, the millmen got no concessions for agreeing to continue with the scale.(57)

Hodge's tactics won large advances during the boom years but these were eroded in the depression, whereas the millmen's advances were more conservative, but then so were the later reductions. Hodge could have done better for his members by negotiating a sliding scale when his strength

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(54) H.A. Clegg et al., op.cit., p.350.

(55) Ironworkers' Journal, May, 1888.

(56) Wm. Jenkins to:- R. Stephenson (Stockton Malleable Iron Co.); J. Price, (Palmers) A. March, 1890 (DCRO : D/CO/72).

(57) Wm. Jenkins to J. Price (Palmer's) 15 March,1892.

was at its peak in 1889-1890.

TABLE VIII.2.

Advances and Reductions made to Steelsmelters and Steel Millmen Between March 1888 - March 1891

Date	Smelters		Millmen	
	Advance %	Reduction%	Advance%	Reduction %
Mar 1888	8.33		5.00	
June 1888				2.50
Apr. 1889	3.80		2.50	
May 1889	3.70			
July 1889			2.50	
Nov. 1889	10.00			
Jan. 1890			2.50	
Mar. 1890			5.00	
June 1890		10.00		
Aug. 1890		5.00		
Sept 1890			2.50	
Dec. 1890				7.50
Feb. 1891		5.00		
Mar. 1891		5.00		7.50

Source : William Jenkin's Letterbook, pp. 208-209.(DCRO : D/CO/75).

The problems experienced in labour relations in the period between 1887-1890 show up some of the problems involved in the introduction of new plant and techniques. In 1889 Jenkins complained to E.P. Martin, of Dowlais, that he could not contemplate introducing a new machine into the steel mills

because of the difficult relations with the shearmen.

Jenkins also resented new entrants into the industry taking advantage of Consett's hard won experience in labour management.

> "At Stockton Malleable Mr. Robert Stephenson and his men are in a very great state of confusion as to progress in fixing wages for their new steel mill plant. We at Consett are getting rather tired of assisting and posting up people who come into the trade after all the difficulties and experience we have gone through."(59)

Consett's own entry into the sectional steel trade presented it with problems of labour supply and wage rates. Jenkins sought his information on wage rates from J.R. Winpenny, the Secretary of the North of England Ironmasters' Association. The recruitment of Labour was more of a problem. Jenkins was anxious to minimise the number of strange men he required at the plant, as he felt they would be a disruptive influence. However, the headmen who were experienced and skilled in an Angle Mill had to be brought from elsewhere. Jenkins went to great lengths to find the best man who could "by his presence and experience give one an assurance that he is capable of managing "Men" "(60) Most of the labourers and other semi-skilled men were redeployed from the Tin Mill which was being run down.

Consett was, like many other plants, troubled by the normal labour problems such as absenteeism, restrictive practices, uncontrollable militants and careless workmen. The first was so bad in the puddling shops that prize money was paid to the men to encourage them to fettle their furnaces on Sunday evenings so that a prompt start would be possible on

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(59) Wm. Jenkins to David Dale, 29 October 1890.(DCRO : D/CO/74).
(60) Wm. Jenkins to A.D. Tolmie, 21 Fenruary 1890.(DCRO : D/CO/72).

Mondays.(61) The restriction of output was also commonly used when new piece rates were being fixed.

In most other national issues such as the eight hour day Consett followed the stream of opinion, except in the case of its millmen. In 1900 the men appointed a deputation for negotiating an eight hour shift.(62) Though Ainsworth was violently against the proposal at first, he seems to have eventually conceded. In 1903, E. Holliday the Consett representative at the Annual Conference of the A.I.S.W. proposed that the union should take the initative and open negotiations for a three shift system. It was already, he claimed, acceptable in principle to Consett's management. However, it was the union membership who quashed Holliday's motion, since they feared such a system would reduce their earnings.(63) The eight hour shift was adopted at the blastfurnaces in 1897, but nowhere else in the steel plant until 1919.

3. Wages at Consett

Because of the varying working conditions and rates applied to them it is difficult to ascertain where Consett stood in relation to other companies in the payment of labour. In 1892 J. Cronin of the Associated Society of Millmen in Scotland alleged that Consett paid lower wages than Scottish works. However under cross-examination from Edward Trow, his English counter-part, it was shown that though piece rates were slightly lower, productivity was higher and so were earnings.(64)

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(61) Ironworkers' Journal, 1 June, 1878; and 1 July, 1888.

(62) Directors' Minute, 3 April, 1900 p.193. (DCRO : D/CO/38).

(63) Ironworkers' Journal, July, 1903.

(64) R.C. on Labour, P.P. 1892 [c6795 - iv] XXXVI, QQ.16134-16178.

In 1895 George Ainsworth made as good a comparison as possible between the numbers employed at Consett and Barrow and the wages paid. He concluded that....."the general impression received is that if the reductions sought are obtained the rates paid will not in many instances be lower than now paid at Consett." He also thought Consett was not in a 'disadvantageous condition' with regard to the numbers employed.(65)

Although iron and steelworkers wages were good, and well above average by contemporary standards (see Table VIII.3) the men were not immune from hardship caused by slack trade or cessation of work.

TABLE VIII.3.

Money wages paid to different classes of workmen at the Consett Iron Company's Works c.1890

Occupation	Money Wage	
Steel smelter 1st Hand	£9.12s.7d per week	*
Steel smelter 2nd Hand	£6.03s.10d per week	*
Steel smelter 3rd Hand	£3.16s.2d. per week	*
Blastfurnace keeper	6s. 7d per shift	+
Blastfurnace labourer	3s. 2d per shift	+
Boiler minders & B'furnace	4s. 6d per shift	+
Loco Enginemen	4s. 2d per shift	+
Rollers	£16 - £18.per week.	≠

Source: * Wm. Jenkins to David Dale, 15 November, 1889.(DCRO : D/CO/70).
+ R.C. on Labour, Group A. P.P. 1892 (c.6795 - iv) XXXVI Q. 14,240.
≠ Ibid. Q. 16177.

(65) George Ainsworth to David Dale, 27 February, 1895.(DCRO : D/CO/86).

In 1877 there were twenty-one operatives at Consett who earned the very attractive sum of £200 - £400 per annum, which was more than many of the Company's managers were earning[66] and equivalent to the income of the average incumbent in County Durham.

However in times of distress the men had only their savings on which to fall back. As trade unionism amongst the ironworkers decreased so did the opportunity of partaking of any unemployment or sickness benefits. In 1894 Consett had only limited facilities for personal insurance or saving, but had a surfeit of public houses. Wm. Jenkins lamented that the highly paid steel smelters were "said to be spending the bulk of their money and spare time in betting and gambling." [67]

When the Company undertook the alteration of its mills in 1886 - 87 for the production of steel large numbers of men were thrown out of employment or took large reductions in earnings by working on excavations &c. The distress was such in the winter of 1887 that the Company opened a soup kitchen, providing 1200 quarts of soup a day. Jenkins was indignant about some unemployed men who were 'unbearable in their conduct'.[68] He could not reconcile himself with the imprudent behaviour of the men who were forced to work twelve hours a day in appalling conditions, and then suffer the humiliation of charity.

Thus the most prominent feature of the labour relations between Consett and the iron and steelworkers is the relatively easy atmosphere in which they were conducted. The widespread implementation of selling price sliding scales from the 1890's onward in all departments removed the major source of

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(66) Directors' Minute, 5 November, 1872. (DCRO : D/CO/30).

(67) Wm. Jenkins to David Dale, 15 November, 1889. (DCRO : D/CO/70).

(68) Wm. Jenkins to David Dale, 21 January, 1887. (DCRO : D/CO/68).

friction, wage adjustment. Work place disputes were normally handled through the Boards of Arbitration, and on the whole both sides abided by decisions made. When in 1907 the shearmen's helpers in the two light plate mills refused to accept an arbitrators decision, the Standing Committee of the Board of Arbitration authorised Consett to dismiss the men and replace them, and they were supported by the Union, the A.I.S.W., who condemned the men for their refutation of the principle of arbitration and conciliation.(69)

Consett was blessed with a co-operative labour force, which although a great benefit, may have been a partial drawback in the long term process of technological change.

4. The Structure of Management

Consett was one of the largest ironworks in the kingdom in 1864, and as such was probably amongst the largest industrial enterprises. It had adopted the new form of limited liability which opened the door to an even greater scale of operations. However in terms of organisation its development was still very rudimentary. The Company was managed by two Managing Directors, Jonathan Priestman and David Dale. Priestman had been in control since the unsuccessful attempt to float the Derwent and Consett Iron Company in 1859. David Dale's association began as an inspector appointed by J.W. Pease, one of the Derwent Iron Company's chief creditors, in 1857.(70) His shareholding appears to have been as a trustee for the Pease interests, and the Stockton and Darlington

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(69) Ironworkers' Journal, May, 1907.

(70) J.S. Jeans, Pioneers of the Cleveland Iron Trade (Middlesbrough, 1875) p.200.

Railway, as he held his shares in conjunction with Henry Fell Pease, Emerson Bainbridge and Thomas MacNay. David Dale's salary was £500 p.a., whilst Priestman was given a five year contract and allotted 854 shares. He gave five promissory notes each for £1,281 plus 10% simple interest, and received one back each year as payment. The Board of Directors was otherwise non-executive.

Between them Dale and Priestman were responsible for the operations of the Company - in sales they were aided by a London agent. There was a number of departmental managers, the most senior of whom was James Radcliffe the Assistant Manager. In 1868 Radcliffe's contract was revised and his salary fixed at £800 p.a.(71) It is most probable that he was a practical ironmaster who undertook the day to day running of the works. The other departmental managers were paid by salary and commission, in that they received as a bonus a percentage on the Dividends paid.(72) (See Table VIII.4.)

The Table shows the extent of the Company's management network in the 1860's. A few of the more senior members of the Company's management were also shareholders, among them, Robert Greenwell, Thomas Green, Richard Latimer, James Ratcliffe, William Keenleyside and C.P. Douglas.

The structure remained very much of this form until David Dale's retirement from active management in 1872. Then a Company Secretary was appointed; first Richard Latimer, who resigned within a few months, and second Richard Evans. By 1872 the growth of the firm's business had led to a proliferation in the number of salaried staff. There had also been a

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(71) Directors' Minute, 19 November 1868. (DCRO : D/CO/29).

(72) Directors' Minute, 10 June 1865. (DCRO : D/CO/29).

TABLE VIII.4.

Payment of Company Agents 1864 - 65

Name of Agent	Nature of Employment	Fixed Salary	% on Dividend
James Ratcliffe	Corresponding Clerk &c.	£400	£1.00s. 0d
Richard Latimer	Cashier	None	£1.05s. 0d
Robert Greenwell	Newcastle Agent	£200	5s. 0d
Edward Charlton	Railway & Traffic Manager	£200	10s. 0d
Thos. Ridley	Pay Clerk &c.	£200	5s. 0d
Wm. Prosser	Rail Mill Foreman	£124	10s. 0d
James Jones	Plate Mill Foreman	None	£1.02s. 0d
John Lishman	Resident Viewer	£150	5s. 0d
Thos. Siddell	Puddling Mill Foreman	£120	6s. 0d
John Wilson	Puddling Mill Foreman	£120	6s. 0d.
Jos Cuthbertson	Consett B'furnace Foreman	£132	4s. 0d
Thos. Green	Store Keeper	£100	5s. 0d
Wm. Keenleyside	Coke Oven Foreman	£100	5s. 0d
Thos. Elsden	Crookhall B'furnace Foreman	£100	5s. 0d
C.P. Douglas	Draughtsman	£110	4s. 0d
W. Brown	Ass. Railway & Traffic Manager	£ 80	4s. 0d
J.T. Little	Crookhall Clerk	£100	2s. 0d
George Grant	Plate Inspector	None	12s. 0d
Wm. Stockton	Loco Foreman	£100	2s. 0d
Chas. Young	Boiler Smiths Foreman	£100	2s. 0d
John Dowson	Commercial Ledger Keeper	£ 80	2s. 0d
John Heymer	Manufacturing Ledger Keeper	£ 80	2s. 0d

Source: Directors' Minute, 14 October 1865, pp. 67-68 (DCRO : D/CO/29).

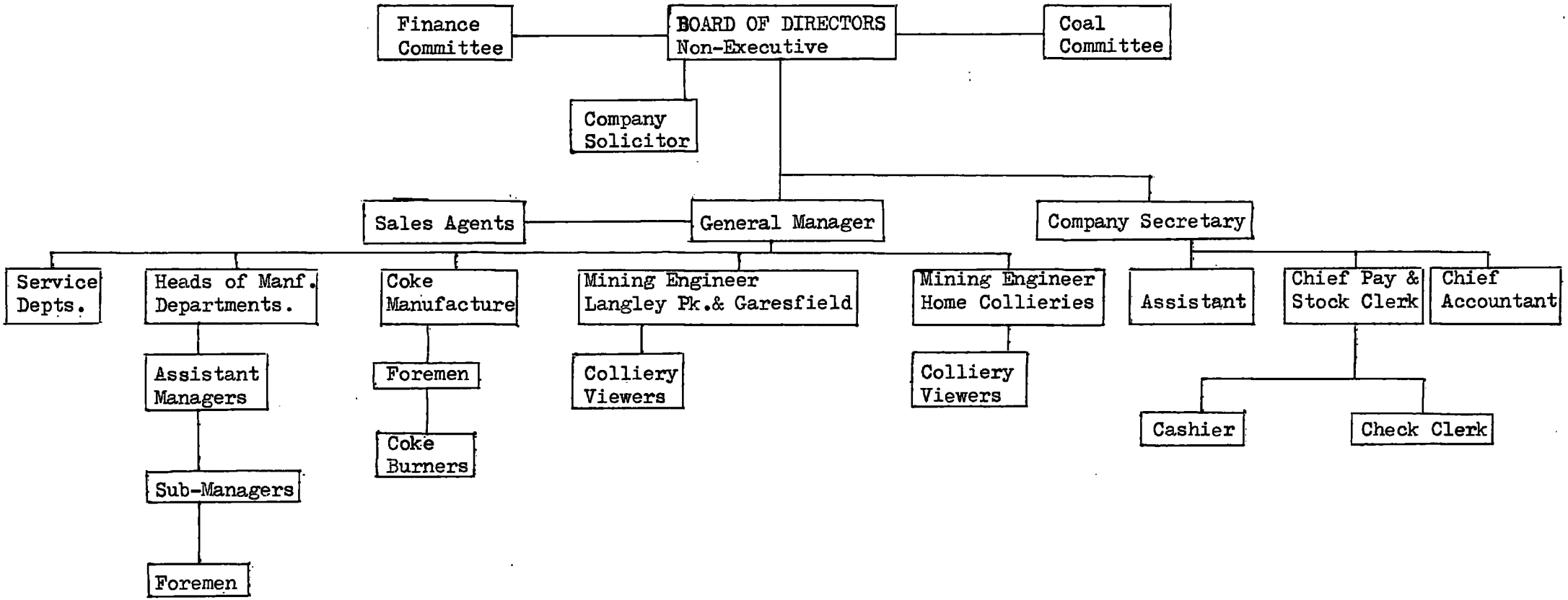
change in the method of remuneration, since all were paid a fixed salary. C.P. Douglas had risen from the relatively lowly rank of draughtsman to blastfurnace engineer, earning £500 p.a. The main growth area appears to have been junior office staff to handle the increasing volume of correspondence, invoicing, cost records &c. that was necessitated by the growth in the scale of operations. Whereas only 22 men were listed as salaried agents in 1865, this had risen to 41 by 1872. Unfortunately this is the last full account of salaried employees given in the records, but it is most certain that the numbers rose, if only because of the expansion of the administration to supervise the new collieries which were opened, from the 1870's onwards.

When David Dale withdrew from active management, apart from the appointment of a Secretary, two sub-committees of the Board of Directors were set up to direct policy for the Collieries and Financial matters. Within the new structure of management William Jenkins became primarily responsible for the operation of the ironworks and the sale of all products, whilst Richard Evans was responsible for administrative functions, and acted as Jenkins' chief lieutenant, whenever he was absent.

The structure remained fundamentally the same until 1894 when Jenkins retired, and Evans died. H. Holliday, who came from a post as General Manager of the Leeds Steelworks was appointed to fill Evans' place; Jenkins' replacement, George Ainsworth, came from within the Company: he had entered the Consett Iron Company as a chemist, sometime between 1865-1872. Along with the change in personnel, there was an alteration in structure. Ainsworth was to be responsible for the iron and steelworks alone, whilst the secretarial and commercial functions were transferred to Holliday. The colliery affairs were by the 1890's split between the managers at Langley Park, Garesfield and Consett and this remained the format of organisation until 1914. Chart VIII shows the relationships within the management structure about 1893.

CHART VIII.1.

ORGANISATIONAL CHART FOR THE CONSETT IRON COMPANY (c.1893)



Ideally, Alfred Sloan believed the concept of management of a business reorganisation to be -

> "to divide it into as many parts as consistently can be done, place in charge of each part the most capable executive that can be found, develop a system of co-ordination so that each part may strengthen and support each other part; thus not only welding all parts together in the common interests of a joint enterprise, but importantly developing ability and initiative through the instrumentalities of responsibility and ambition - developing men and giving them an opportunity to exercise their talents, both in their own interests as well as in that of the business."(73)

Jenkins' own views were not far removed from those of the master of organisation Sloan, for he explained to David Dale:

> ...."it will be well if we can organise these several departments in such a way that good and responsible men are attached to them, having distinct duties clearly defined."(74)

Having established what the framework was, the question arises whether it was necessary to find men to fit the various posts, or whether the framework evolved because of the men available? The latter seems to have been the case since the major changes in the organisation of management coincided with breaks in continuity caused by the departure from management of a leading figure.

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(73) R.S. Edwards and H. Townsend, Studies in Business Organisation, (London; 1967) p.88.

(74) Wm. Jenkins to David Dale, 6 March, 1890. (DCRO : D/CO/72).

5. The Managers

The two outstanding figures in Consett's management were William Jenkins and David Dale, for they guided the Company through the critical period of readjustment in the 1870's and 1880's.

Jenkins was the son of the schoolmaster of the Dowlais Iron Company in Merthyr Tydvil. After a brief education in his father's school he entered the employment of the Dowlais firm at one of their collieries. He eventually moved through all the departments of the firm gaining a sound knowledge of the iron-trade, and in 1852, when Sir John Guest died, Wm. Jenkins was appointed commercial manager for the whole Company.

Jenkins was therefore a contemporary of Edward Williams in the management of the Dowlais business, and it is not surprising that, when in 1869 Williams, then the manager of Bolckow, Vaughan, advised Consett to appoint a new manager, Jenkins should have got the post. He was one of several prominent 19th century ironmasters to begin their careers at Dowlais.

When Consett then appointed a Secretary in 1872 the link with South Wales was maintained, for Richard Evans had his early commercial training in the offices of the Dowlais concern. He then went to an ironworks in Maryport, Cumberland, whence he went to Consett.

Jenkins views were those that one would expect of a middle-class Victorian dissenter. He was a staunch Liberal, and if not totally in favour of abstinence, he believed that the hours for liquor sales should be closely supervised and restricted.(75) With regard to labour he felt men should

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(75) Wm. Jenkins to I. Williams, 17 June, 1887. (DCRO : D/CO/69).

have the free choice whether to enter a union or not, and steadfastly maintained an 'open shop' at Consett.(76) John Hodge, the Steel Smelters' leader, remembered Jenkins as a man who "could talk like a parson", he was fair-minded but stubborn in wage negotiations, and gave ground slowly and reluctantly.(77) His attitude to technical innovation in many respects was not dissimilar, as he was very conservative about the introduction of new techniques. In fact he could never have been described as an innovator since he prefered any new machinery adopted at Consett to have been proven elsewhere. He was loyal to his managers and engineers, however, and was ever reluctant to allow strangers an insight of the Consett plant.(78)

The greatest disservice that Wm. Jenkins may have bestowed upon Consett was his own capacity for control, and a strong preference for 'home grown' managers. In retrospect it is difficult to assess how much responsibility was delegated, but from Jenkins' own correspondence it is evident that he submerged himself, not only in the general directing of the development undertaken in the 1880's, but also in the finest detail of their execution. As early as 1887, before work began on the new Angle Mill even, Jenkins confided to Dale.

> "Our extensions and reconstructions are giving me much anxiety. The contracts for machinery, casting &c. at all points are day after day requiring pressure and watching as to the details while the contractors on the ground are slow to move."(79)

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(76) Wm. Jenkins to David Dale, 3 May, 1890. (DCRO : D/CO/73).
(77) John Hodge, op.cit., pp. 105-106.
(78) Wm. Jenkins to J. Scott, 18 August, 1892. (DCRO : D/CO/82).
(79) Wm. Jenkins to D. Dale, 18 June, 1887. (DCRO : D/CO/69).

Because Jenkins took so much on by himself, his subordinates management capabilities were developed in a situation in which they were aware of the problems but were not given the scope to solve them. It is possible that George Ainsworth ascended to control, with a framework of decision making which had been dictated by William Jenkins. Thus problems of space for development which evolved during Jenkins' era, were accepted by Ainsworth. A man appointed from outside the organisation might have dealt more boldly with some of the particular problems Consett faced after 1900. The outstanding examples of steel managers in the late 19th and early 20th centuries, on the whole, were men who came from outside the organisation, they came to control, for example, Edward Williams, E. Windsor Richards, Benjamin Talbot, and Wm. Jenkins himself.

Spanning a much longer period of Consett's history than Jenkins was David Dale. He was most noted for his association with industrial relations and the formation of the Board of Arbitration and Conciliation in 1869.(80) Besides this however, he was probably one of the most astute businessmen in the North of England at the time. His greatest attribute in business was his talent for financial matters, and he played a central role in resurrecting the Consett Ironworks and then guiding their financial policy along sound lines. His appetite for work was as insatiable as that of Jenkins, and Sir Alfred Pease "never knew anyone who took such immense pains nor who so delighted, as it were in the drudgery of figures."(81)

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(80) J.H. Porter, op.cit..

(81) Sir Edw. Grey, op.cit.,p.31.

Although he resigned from his executive position with the Consett Iron Company in 1872, and took up a position as Managing Director of the Pease family's mineral interests,(82) he remained closely identified with Consett as a Director, and then as Chairman from 1884, until his death in 1906. He served on both the Coal and Finance sub-committees of the Board bringing to bear his great knowledge of the former through this position with Pease and Partners, and his fine talent to the latter. Besides these two important directorships he was also a member of the North Eastern Railway's Board from 1881, and Consett's representative on the Board of the Barrow Hematite Steel Co. Ltd.(83)

David Dale also had a brief but - from Consett's point of view - significant association with some Tees-side shipbuilders. In 1866 three engineering and shipbuilding firms proposed to amalgamate their interests into one company. The three concerned were Richardson, Denton, Duck & Co., Denton, Grey & Co., and Thos. Richardson & Sons, and David Dale was elected Vice-Chairman of the new company. However, the benefits of the merger were not realised and the concerns reverted to their separate identities.(84) Nevertheless this indicates that Consett had some potent linkages with the shipbuilding fraternity.

Amongst the other Directors Consett had a wide range of experience, interests and capabilities. Its first Chairman Henry Fenwick was an M.P. However, his successor John Henderson was a prominent local businessman, building up a substantial carpet factory in Durham City. His connection with Consett, like many others, was through the Northumberland and Durham District Bank in which

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(82) Ibid.
(83) Consett held shares in the Barrow Hematite Steel Co. in lieu of a debt owed to them by Hannay & Co..
(84) J.S. Jeans, Pioneers.....p.p. 205-206.

he had been a large shareholder, and it is probable that his links with Northumberland collieries were formed in the same way.(85) Henderson's son succeeded David Dale as Chairman in 1906. Important links were established with other iron and steel producers, Thomas Spencer (1864-1890) was also a partner in John Spencer & Sons of Newburn, the Tyneside Steel Company.(86) Thomas Hedley (1869-1890) was a Director of the Solway Hematite Iron Co. in Cumberland,(87) probably the same firm as the one from which Richard Evans came. Hedley also had an inter-linking Directorship with the Tyne Steam Shipping Company, whilst several other Consett Directors were member of shipbuilding companies' Boards. T.H. Bainbridge (1890-1912) held directorships in the Wallsend Slipway Company, and Swan, Hunter and Wigham, Richardson.(88) The Company's most ubiquitous directors, however, were Wm. Stobart and Roland Philipson; the former had interest in coal, steel, marine engineering and shipping, outside his interest in Consett,(89) whilst Philipson could add railways, insurance and ten miscellaneous firms to Stobart's collection.(90)

The interest of the Directors were broad, but it is difficult, if not impossible, to assess whether Consett derived any benefit other than that of experienced direction. It would have been unlikely for example for Wm. Stobart via his shipping interest to put work Consett's way, when his own foundation the Wear Steel Company was labouring so pitifully under the strain of Consett's competition, or, for the coal owners to arouse competition from Consett. These men

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(85) Newcastle Daily Journal, 5 April, 1884.
(86) Newcastle Daily Chronicle, 1 May, 1905.
(87) Newcastle Daily Chronicle, 14 November, 1890.
(88) Newcastle Daily Journal, 13 November, 1912.
(89) Newcastle Daily Chronicle, 26 June, 1905.
(90) S. Pollard, op.cit., p.457.

were however, successful businessmen who would have been able to bring a wealth of experience to the direction of Consett.

CHAPTER IX

POSTCRIPT : 1914-1939

1. The War 1914-1918

Although Britain had been preparing for a major conflict since 1906 when the naval race to build 'Dreadnoughts' had begun and the formation of a General Staff for the Army had been effected by Haldane, the nation was unprepared both materially and psychologically for the holocaust they entered upon on 4th August, 1914. The view was widely held, even by those in the most responsible positions that the War would be won within a matter of months.(1) Few could have imagined a war of attrition with the whole economy directed by Central Government as the driving cog of the whole war machine.

Within a matter of weeks Lord Kitchener, the Secretary of State for War, had recognised that the chief difficulty was 'one of material rather than personnel.' The uncontrolled patriotism of the Autumn of 1914 created the ludicrous spectacle of an armed force without munitions. By the end of 1914 there was a shortage of shells and at first Kitchener refused to extend the list of authorised manufacturers, insisting that only experienced firms could make a satisfactory product. Though this was in fact proved to be the case, the list had to be extended and new firms given the experience, because there was insufficient capacity amongst the old firms to meet greatly increased demand.

Consett was in the most crucial sector of the economy being both a steel producer and fuel producer. When the War broke out in 1914 the Company had been sunk in a deep depression, suffering from the

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(1) A.J.P. Taylor, English History 1914-1945 (Oxford 1966) p.4.

slump in shipbuilding, severe competition from Germany and the drought during the summer which almost brought the steelworks to a standstill.(2)

The War naturally removed the spectre of German competition but it did not bring an immediate revival of the Company's prosperity because of the number of contracts undertaken during the depression of 1914, at low prices, which had to be completed in an atmosphere of escalating costs. The profits up to June 1915 were 50% lower than in 1914 and the dividend of 12½ per cent was the lowest of the century.(3)

The immediate effect of the War was a shortage of shipping space, and within a month and a half of the outbreak the price of timber from the Baltic for pit props had soared. At the end of August the Company purchased the cargo of the 'S.S. Advance' for £6,696, an increase of 100 per cent over the pre-war rates. By October £78,000 had been expended on purchasing timber, though the stocks were so increased as to last until December 1915.(4) The Board also negotiated with the Commissioners for Woods and Forests to get permission to fell timber in Chopwell Wood for colliery purposes.(5)

However much more serious than the escalation of timber prices because of the shortage of shipping space, and cessation of trading relations with Finland, was the potential short supply of imported Spanish hematite which would seriously interrupt the operations of the iron and steel-works. By January 1915 George Ainsworth reported to the Board the extreme difficulty in obtaining boats to carry ore. Sir James

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(2) Newcastle Daily Chronicle, 3 August, 1914.
(3) Newcastle Daily Chronicle, 9 August, 1915.
(4) Directors' Minute 6 October, 1914, p.161.(DCRO : D/CO/43).
(5) Directors' Minute 1 September, 1914, p.155.(DCRO : D/CO/43).

B. Dale one of Consett's Directors met with Dr. Macnamara and the Director of Transport at the Admiralty in the middle of January to arrange some system whereby shipping space would be allocated for the shipment of ore from Bilbao. One solution was that steamers returning from the Mediterranean should call in at Bilbao and Santander to collect ore shipments.(6) The Company had considered purchasing two steamers of its own but the Government would give no undertaking that the boats would not be comandeered.(7) Consett also began to negotiate with the other hematite users of the North East Coast to form a collective action group for the purchase of ore.(8) Consett eventually did buy two steamers in the second half of 1919, and appropriately they were called the S.S. Consett and S.S. Blackhill.(9)

As Consett was a partner with Krupp in the Orconera Iron Ore Company this could have raised some problems. Fortunately the custom of the Germans to register limited companies in London averted another possible crisis. Krupp's shares in the Orconera Company were taken over by the Public Trustee, and all their deliveries under contract were cancelled. Thus the very large share of the ore taken by Krupp's was available for distribution to British works.(10) After the disruptions of the first half of 1915 there does not appear to have been a critical shortage of hematite ore, for after falling to 94,952 tons the first 6 months of 1915, pig iron production picked up to top 142,000 tons in the first six months of 1918. This was all achieved on hematite ore.(11)

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(6) George Ainsworth to Director of Transport, the Admiralty, 25 January 1915 pp.192-193.(DCRO : D/CO/43).
(7) Directors' Minute,25 January 1915 p.192.(DCRO : D/CO/43).
(8) Directors' Minute,2 February 1915, p.196.(DCRO : D/CO/43).
(9) Profit and Loss Accounts 1917-1937. (DCRO : D/CO/90).
(10) F.W. Harbord, Ministry of Munitions to the Consett Iron Company, 29 October 1915 p.254.(DCRO : D/CO/43).
(11) Private Cost Book.(DCRO : D/CO/101).

TABLE IX.1.

Output of Pig Iron 1914-1919

Year ending June	Quantity
1914	231,258 tons
1915	206,223
1916	210,212
1917	258,594
1918	290,723
1919	219,206

A more persistent shortage which arose during the first few weeks of the war was that of manpower. At the Annual General Meeting on 7th August 1915, Mark Fenwick reported that output had fallen by 33% due largely to the massive migration of men to join the forces. Altogether 2400 employees had joined up, almost one quarter of the Company's labour force, and 650 of these had been men from the steelworks. The office staff had also been decimated by the surge of patriotism and it was composed by mid-1915 largely of women and girls.(12)

The Company had also undertaken to pay a separation allowance to men who had gone to the front, and this cost it £34,000 up to June 1915. Families were allowed to stay in Company cottages rent free and allowances were paid to those who did not have Company housing. However, probably most important was the promise that....."the places of all men who have gone to the front in any capacity will be kept open for them".(13)

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(12) Newcastle Daily Chronicle, 9 August 1915.

(13) Directors' Minute 1 September 1914 p.155.(DCRO : D/CO/43).

This was a promise that Consett found more difficult to implement than to make, for in 1919 it suffered serious friction between the men returning to their old jobs and the men recruited during the War to replace them. The situation was such that the Company had to open a drift near Chopwell to employ about 400 men and youths who were demobilized during 1919.(14)

After the rush to join the colours during the first nine months of the war there was a marked slackening in the desire to go to the front, for by June 1917 only 2707 employees were under arms. The horrific slaughter of the War obviously had a stringent effect upon recruitment even before the introduction of the Military Service Act in January 1916 which imposed not only conscription, but also exemptions for men employed in sectors vital to the prosecution of the war, such as steel and coal.(15)

Not everyone was as patriotic in their efforts towards winning the war as Mark Fenwick, the Company's Chairman could have wished. He complained that at "some collieries they (the miners) had hardly done all that the nation might expect from them, and at one pit at the beginning of the week absentees totalled fully 20% on the average." (16) However, the Company itself was not unblemished for in September 1915, the 32" Bar Mill engine broke down, and was out of operation for 3 months.(17) The strain of the war was taking its toll upon the old equipment in the mills, and the responsibility for this lay at the management's door.

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(14) W.R. Garside, The Durham Miners', 1919-1960 (London 1971), p.103.

(15) A.J.P. Taylor, op.cit., pp.53-55.

(16) Newcastle Daily Chronicle, 14 August, 1916.

(17) Directors' Minute, 7 September, 1915. p.243. (DCRO: D/Co/43).

Finally in November 1915 Consett came under the control of the Ministry of Munitions, as the need to bring all vital establishments to the task of shell production increased.(18) The Company had only in September decided against opting to be controlled, although it was acutely short of labour and had had to cease operations in No.2. Plate Mill. The control was also extended over the Company's collieries, especially with regard to price. Exports were restricted and diverted to less profitable channels and even the price of coal exports to France was controlled.(19) The mines were eventually brought under the guidance of the Coal Controller on 1st March 1917.

Despite the price limitations, controls on sales and the excess profits tax imposed by Mckenna in 1915 the Company's profits blossomed. On 30th June 1914 the Consett Iron Company had £631,000 set aside for reconstruction, of which £404,452 had been spent since the opening of the Account at the beginning of the century. By 30th June 1919 it had been increased to £681,000 and expenditure had risen to £471,548; added to this however undivided profits rose from £3,257 in 1914 to £229,952 in 1919 giving the Company £439,403 available for reconstruction. This had been achieved whilst dividends of 12½% in 1915, 50% in 1916, 40% in 1917, 40% in 1918 and 35% in 1919 had been paid to the shareholders. In addition Consett paid £500,000 Excess Profit duty in 1918 alone.

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(18) W.H. Beveridge to the Consett Iron Company, 26 October 1915 p.253. (DCRO : D/CO/43).

(19) Ordinary General Meeting, 12 August 1916.(DCRO : D/CO/57).

TABLE IX.2

Nett Profits of the Consett Iron Company Ltd. 1914-1919.

Year ending June	Nett Profit	Distributed Profits
1914	£408,014.01s.00d.	£340,000
1915	£214,383.15s.03d.	£165,000
1916	£625,937.06s.06d.	£540,000
1917	£521,661.04s.11d.	£440,000
1918	£516,224.00s.05d.	£440,000
1919	£512,291,12s.08d.	£390,000

In view of the state of the Company's steel plant before the outbreak of the War, and the immense strain that was placed upon it during the hostilities, the financial policy of the Consett Iron Company was distinctly liberal. Not until 1918 was any money put specifically aside for deferred repairs, and then only £50,000 and in the following year another £100,000 was put aside; but after June 1915 actual expenditure on reconstruction was negligible.

2. The Inter War Years 1919-1939.

The years between 1919-1939 were ones of almost unbroken gloom for those basic sectors of British industry in which the Consett Iron Company was firmly entrenched. After the frantic post-war boom Consett was plunged into sixteen years of unrelieved difficulty, only recovering in the years after 1936.

The problems which confronted the Company were many. After the First World War it was faced with the necessity of reconstructing much of the steelworks. This required the floating of two large debenture issues. This burden of debt upset the balance between the Company's financial structure and its profitability during the lean years of the 1920's and early 1930's. Finally in 1936 a comprehensive capital reorganisation had to be undertaken, in order to ensure the future prosperity of the Company.

These years also drove the Company to rethink its market orientation. It had to do so firstly, because of the reversal of roles in the coal and coke market from excess demand ,to excess supply. Then later the collapse of the shipbuilding industry forced Consett to seek alternative markets for its steel products. This led to the establishment of marketing and sales techniques to a degree of sophistication which had never before been necessary.

Finally the crisis in the coal trade generated another and more tragic problem; the confrontation between the miners and the coal owners during the early and mid-1920's.

In 1919 the works and collieries of the Consett Iron Company were valued at £3,500,000 excluding any temporary appreciation caused by existing economic conditions.(20) This emphasised the under-capitalisation of the Company's nominal share value of £1,500,000. In order to redress this imbalance an additional £2,000,000 of Ordinary shares was created. This operation was merely the capitalisation of assets on the balance sheet,

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(20) Ralph Alsop to Ordinary and Preference Shareholders, 31 July 1919.(DCRO: D/CO/57).

and elsewhere, which represented at least £2,000,000 of undivided profit. It was within this under valuation that the myth of the Company's exceptional profitability had flourished before 1914. In 1920 the dividend was only 12½ per cent, although the nett profit was £599,144.14s.10d. whereas prior to the recapitalisation, the profit of £512,000 in 1919 had yielded 35 per cent.

When the Company eventually turned its attention to extensive reconstruction of its plant in 1922, the reserves accumulated during the previously profitable years were not large enough to carry out the whole programme. Thus in May 1922 Consett offered £1,500,000 of 1st Debenture Stock at 6 per cent per annum. This stock was to be redeemed over 30 years from 1933 at par, but the Company reserved the right to repay the whole at £102 per cent at any time after 1933, upon three months notice.(21) The issue was made to facilitate the refund to the Company of £950,000 already expended on reconstruction out of reserves, and to enable it to complete the programme. The sum proved insufficient for in October 1924 a further £1,000,000 of 6 per cent Debenture Stock was floated, on the same conditions as the previous loan. This issue was largely taken up by one institutional investor.

Consett had thus to pay £150,000 per annum fixed interest, and after 1933 provide for the redemption of £2,500,000 of stock. In the trading conditions of the 1920's and 1930's this was to prove an impossible task. The burden of fixed interest stock crippled several other famous steel companies, among them Bolckow Vaughan who were absorbed by Dorman Long in

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(21) Prospectus for the Issue of £1,500,000 1st Debenture Stock. (DCRO : D/CO/58).

1929, and Ebbw Vale. After 1924 Consett failed to pay a dividend on its Ordinary shares until 1937, and could only intermittently pay the dividend on Preference shares. It had however succeeded in paying the interest on the Debentures. By 1933 the shareholders were becoming restive, for the future could offer them little encouragement as the Company had to start setting aside a fund for the eventual redemption of the Debenture Stock.

Thus in 1933 the Company had no option but to ask its Debenture holders for a partial moratorium. It proposed to reduce interest on the stock to 4 per cent between 1933-35, whilst the unpaid 2 per cent would be carried forward and paid out of profits for the year ending March 1937; it further suggested that in calculating profits the Company should be allowed to charge a modest £50,000 a year for depreciation. In addition the Company was precluded from exercising its right to redeem stock on three months notice until 1 July 1942. Finally a sinking fund, absorbing £62,500 per annum was to be operated from 1942 for the eventual redemption of the stock.(22) The proposals which had been worked out in conjunction with the large institutional investors were carried by an overwhelming majority; 162414 votes for and only 1051 against.

The optimism, engendered by the introduction of a 33⅓% ad valorem duty on steel imports at the end of 1932, which had encouraged Consett to apply for only a postponement of repayment, proved unfounded. By 1936 it was apparent that Consett would be unable to carry out the proposals of the 1933 moratorium. Greater provision for depreciation and

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(22) Notice of a Meeting of 6 per cent First Debenture Stockholders, 1933. (DCRO : D/CO/57).

obsolescence was necessary, whilst there were nine years arrears of dividend on Preference shares. In addition if the Company was to maintain its position in the iron and steel industry it would be necessary to carry out substantial alterations to the plant. It was also an opportune moment for it to move into the constructional engineering industry, and plans were afoot to take over a large company in this sector.(23) The gearing between equity and stock was so unsatisfactory, that it was unlikely that Consett could raise any fresh capital, either by equity or stock.

Fundamentally the scheme agreed upon by Consett and the large institutional investors was that £2,000,000 should be written off the Ordinary share capital, and a fresh £2,000,000 raised by the issue of 6,000,000 6s.8d shares. In addition £1,000,000 was to be written off the Debenture capital. This would be achieved by repaying the whole of the 6 per cent Stock and its accrued interest, on 1 July 1936. As an inducement to Stockholders it was to be repaid at a premium of £109¼.

In place of the 6 per cent Stock, £1,500,000 of 4¼ per cent Debenture Stock was to be issued on a pro rata basis, and also 1,500,000 6s.8d Ordinary shares at a value of 8s.6d. The Stockholders had to pay cash for both the 4¼ per cent Stock and the shares, the amount payable being set off against the amounts payable to them by the Company in repayment of the 6 per cent Stock.

The Preference shareholders were allotted 400,000 ordinary shares in lieu of their dividend arrears. Though this was not full compensation they benefited from the reduction in capital ranked above them, whilst the

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(23) The Consett Iron Company to Debenture Stockholders and Members, 23 March 1936.(DCRO : D/CO/58).

deferred interest on the Debentures was paid out of the receipts from the new share capital, which ranked behind them. Finally future profits would be reduced by setting aside funds for arrears of depreciation, since these were accounted for by the reduction of the book value of fixed assets.

Not unnaturally it was the Ordinary shareholders who bore the brunt of the reorganisation. However it did offer them the prospect of future dividends, whilst the only real losers were those who had purchased shares since the recapitalisation in 1919.

TABLE IX.3

Capital Structure of the Consett Iron Company Ltd

1919 - 1936		After 1936	Nominal	Issued
6% Debenture Stock -	£2500,000.	4½% Debenture Stock	£1,500,000	£1,500,000
8% Preference Shares -	500,000.	8% Preference Shares	500,000	500,000
Ordinary £1. Shares -	3000,000.	9 million Ordinary 6s.8d. Shares	3,000,000	2,800,000
Total	£6000,000.		£5,000,000	£4,800,000

Source: The Consett Iron Company to Debenture Stockholders and Members, 23 March 1936. (DCRO:D/CO/58).

Since the scheme was supported by the large institutional Stockholders, its adoption and implementation was a formality. As in 1857, Consett had come perilously close to financial collapse because of excessive indebtedness. However the reorganisation was a complete success; in 1937 the Company paid a dividend of 7½ per cent, whilst it was also able to put aside considerable

amounts for depreciation. The Company was also able to buy a subsidiary in the construction engineering industry.

After the interruption of the Great War Consett began to reconsider the problem of reconstruction in 1920. A new pit was opened at Crookhall to take over from the older Home Collieries with their high costs. It was also decided to erect an additional Coke and By-product Plant to replace the inefficient bee-hive ovens.(24) A start on the actual work of reconstruction was postponed until 1921 because of the high cost of labour and materials during the boom of 1920. However, once unemployment began to rise work was started upon the Fell Coke Works, using labour thrown out of work in the steel mills.

For the year ending June 1921 the Company sustained heavy losses on the manufacture of steel plates (£100,194) and sectional steel(£45,608).(25) The condition of the steelworks was such that they could not possibly compete in the frenzy of competition and low prices. After only intermittent working during 1921 reconstruction of the melting shops began early in 1922. The old plant was replaced by nine new 75 ton fixed open-hearth furnaces. Later during 1922-23 the extensive remodelling and electrification of the rolling mills was started. Only modest alterations were made to the very antiquated blastfurnace plant.

The failure to reconstruct the blastfurnaces imposed certain limitations upon the extent of the economies possible in the reconstructed

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(24) Report of the Directors of the Consett Iron Company, August 1920. (DCRO:D/CO/57).

(25) Profit and Loss Accounts. (DCRO : D/CO/90).

melting shops and mills. The low level of the tapping holes on the blastfurnaces prevented the supply of molten pig iron to the melting shops, thus the Company had to work cold metal.

TABLE IX.4

Comparative size and performance of open-hearth furnaces.

Works	Furnace	Capacity	Fuel Consumption per ton of steel	Nature of Charge
Appleby	Tilting	250 tons	17.5%	Hot phosphoric pig
Bochum	"	180 tons	16.5%	Hot & Cold pig
Consett	Fixed	75 tons	26.0%	Cold metal
John Lysaght	" Terni	50 tons	19.75%	Hot metal
Schneider Le Breuil	" "	60 tons	19.5%	Cold metal

Source : Journal of the Iron and Steel Institute, 1930 II. p.121.

The gas used from the Wilputte by-product ovens at the melting shop was not sufficient to be used for reheating slabs in the plate mills, thus producer gas had to be manufactured especially. This gas shortage was also caused by the inadequacy of the blastfurnace plant, which had no arrangement for cleaning waste gas.(26)

Except for their failure to utilize fully all the possible fuel economies the mills did incorporate the best modern practice. They were able to roll plates between 6 - 10 tons, varying in thickness from $\frac{1}{8}$ inch to 3

(26) Iron and Coal Trades Review, 13 September 1929.

inches, and up to 9 feet wide. All the new equipment was electrically driven, and the system was so designed that Consett could draw upon additional power from the local Electricity Supply companies or, conversely deliver any surplus power into its grid system.(27)

The most conspicuous success of the reconstruction was the opening of the Fell Coke and By-product Works in 1924. The sixty Wilputte regenerative high-temperature ovens were the first installed in Britain, and they were to revolutionise British coking practice. The ovens were capable of carbonising 6,000 tons of coal a week and gave great yields of by-products from the ancillary Coppee plant. The gamble was successful because of the production of high quality silica bricks at Consett's own Templetown brickworks.(28)

The success of the Fell Works encouraged Consett to build another coke and by-product plant at Derwenthaugh between 1927 -29. As well as the usual range of by-products the works supplied gas to the Newcastle and Gateshead Gas Company. The coke from the Derwenthaugh works was exported via the Company's staithes, which provided probably the quickest loading facilities available on the North East Coast.

Besides the conversion of some of the open-hearth furnaces to the 'Terni' system in 1929 there was no significant renewal of the iron and steel plant until the end of the 1930's. However in 1936 Consett became

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(27) Ibid; and Iron and Coal Trades Review, 10 September 1923.

(28) The Mining Journal, 22 September 1923. p.716.

involved in the scheme to develop a new steel complex at Jarrow. In 1935 the British Iron and Steel Federation commissioned H.A. Brassert and Company to produce a feasibility study upon the Jarrow scheme. His report was favourable, contending that the Tyne was as well suited as the Tees for major development. However, the Teesside makers scotched the scheme by what the Economist later described as their 'jealous exclusiveness'(29) The great surge in demand for steel during 1936 was most easily accomodated by extensions to existing plant, and once firms began to expand output by this means, Consett withdrew support for the original comprehensive scheme. Consett suggested a smaller alternative scheme which Brassert suspected would be uneconomical.(30)

Despite the efforts of Walter Runciman, the President of the Board of Trade, to persuade the steelmakers to change their minds about the Jarrow project, and the tragic protest of the Jarrow Marchers, the North-East steel men remained hostile. However, in June 1937 Runciman was elected to the Consett Board, and inside a week he announced a new scheme to build a steel rolling mill at Jarrow. The project involved the joint participation of Consett, the Bankers' Industrial Development Company, the Nuffield Trustees and a loan from the Government under the provisions of the new Special Areas Act (1937) to raise the £1,000,000 for the proposed development.(31)

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(29) The Economist, 26 June 1937

(30) Carr and Taplin, op.cit.,p.535.

(31) The Economist, 26 June 1937

The next year, 1938, the New Jarrow Steel Company was incorporated, and Consett held 20 per cent of the capital. Consett also undertook to supply the mill with semi-finished steel, and controlled its operations.

Once Consett was placed back on a sound financial footing it was able to return to the task of modifying its plant. In 1938 the Board began to consider the expediency of replacing their old sectional steel mill. They also finally installed gas cleaning plant, at the blastfurnaces, and in 1940 the Civil Defence Act's anti-glare provisions prompted the Company into the very belated adoption of mechanical pig casting, to replace the old fashioned sand-casting.(32)

One aspect of reconstruction not yet considered was the house rebuilding programme. The programme was seen as an instrumental factor in improving labour relations. Clarence D. Smith, the Company's Chairman, was convinced that bad housing conditions were one of the chief factors in promoting industrial unrest. Consett built almost twelve hundred new homes in the first half of the 1920's(33)

A single issue dominated the operation of collieries during the first half of the 1920's, the question of miners' pay and its relation to labour costs. The first clash between the miners and owners occurred in October 1920, when the men struck for an advance of 2s.0d per shift to bring them up to the real standard of living they had enjoyed in 1914.

By the beginning of 1921 the coal industry was plunged into depression. The Government reacted by handing the control of the industry back to private enterprise on 31 March 1921 and the Durham owners immediately

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(32) The Times, 14 June 1940.

(33) Newcastle Evening Chronicle, 26 June 1924.

demanded an average reduction in wages of 5s.0d per shift. The miners would not concede without a fight,(34) and after three months defending their position under impossible conditions they were forced back to work on the Owners' terms.

In contrast to the miners the men in the steelworks had accepted a reduction without even the threat of a strike; a laudable gesture in the opinion of the Company's Chairman. The report for the year ending June 1921 was closed with an appeal "to the workmen.....to increase production in every possible way, in order to meet that very keen foreign competition.'(35)

The tension in labour relations in the coal industry was eased a little with an improvement in trade in 1923-24. However the improvement was only temporary and once conditions were normalised on the Continent, British coal exports were savagely reduced.

However, at the Annual General Meeting in 1924 Smith was preparing the ground for yet another assault upon the miners' standard of living. He complained that output was 26,000 tons less in the year ending March 1924 than it had been for the year ending March 1913, despite the employment of an additional 2,800 men in 1924. The blame was laid at the door of shorter hours and more non-productive men.(36)

During July 1924 an agreement was made to raise the minimum wage of miners by 21 per cent, whatever the conditions of trade. When prices

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(34) Durham Chronicle, 1 April 1921 p.1.
(35) Newcastle Daily Chronicle, 8 August 1921.
(36) Newcastle Evening Chronicle, 26 June 1924.

began to fall in the autumn the increased labour costs imposed a crippling burden.(37)

Consett was handicapped by the age of some of its pits; out of the seven hours working day, 1 hour 10 minutes was spent travelling to and from the seams.(38) As trade conditions continued to deteriorate during the winter of 1924-25 the management attempted to alleviate their high costs by asking for a reduction in wage rates and longer hours.(39) Consett was on the brink of the most bitter industrial struggle of their history; a conflict that convulsed most of the Company's collieries during the second half of 1925, and paved the way towards the General Strike in May 1926.

Consett was among several colliery companies which in the early summer of 1925 launched an all out attack upon its men by locking them out. The lock outs began first of all at Sherburn House, one of the Lambton pits, but was quickly followed by threats and notice of closure from the Horden Coal Company, the Stella Coal Company and Consett. In June Consett gave notice to the men at the Chopwell Collieries, Derwent, Busty, Hunter and Westwood pits, about 4,500 men in all.(40)

The Chopwell Lodge had refused the Company's proposal for a full seven hours working day bank to bank and for reductions in piece rates; Westwood had been undecided and had sought the advice of the Durham Miners'

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(37) Report of Proceedings at the Annual General Meeting, 25 June 1925. (DCRO : D/CO/57).

(38) Report of Proceedings....., 17 June 1926 (DCRO : D/CO/57).

(39) Newcastle Evening Chronicle, 25 June 1925.

(40) Durham Chronicle, 13 June 1925.

Association's headquarters, at Redhill.(41) As in the years before the war, Chopwell was the most militant colliery; a tradition of radical political opinion had been fostered by workmen such as Vipond Hardy, J.W. Callender, and later by William Lawther and his brothers. The socialism of the Independent Labour Party was the political creed upheld by the Chopwell Lodge. William Lawther had moved from Chopwell to the nearby Victoria Garesfield Colliery in 1919, and became its representative to the new Miners' Communist Movement in January, 1921. The Victoria Garesfield Lodge followed the road of Chopwell into militant socialism as the following extract from the 'Durham Chronicle' illustrates.

> "Marxist Socialism among Durham Miners - One has only to study the voting at the Lodges where this teaching is predominant and the evidence of their influence with the rank and file is seen. To cite only one Lodge, Victoria Garesfield, in Durham, there the voting was overwhelmingly against compromise to the very last. That lodge, as is well known in the county, is revolutionary in the extreme.(42)

Chopwell was geographically close to Victoria Garesfield, and Will Lawther still had most of his brothers working at Chopwell. It is not therefore surprising that Chopwell refused even to negotiate with the Consett Iron Company over the proposed reductions.(43) Conditions in the village were approaching anarchy - the collieries had closed on the 20th June. Harry Imrie, the colliery manager, was asked to resign because he refused to declare the lock-out an industrial dispute.(44) There was

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(41) Durham Chronicle, 6 June, 1925.
(42) Durham Chronicle, 21 January, 1921.
(43) Report of Proceedings....., 17 June, 1926. (DCRO : D/CO/57).
(44) Information given by Sir William Lawther in an interview on the 31st May, 1972.

persistent stealing of coal from the Company's trucks, and during August 1925, twenty police reinforcements were moved into the village. The offices at the colliery were picketed and the Company's officials harrassed in travelling to and from work. Feeling amongst the men was running very high, and at the Gala in August 1925 they demonstrated their solidarity and enthusiasm to their cause.

> "The Chopwell miners again brought their banner containing portraits of Marx, Lenin and Keir Hardie, and the men following sung The Red Flag. In Silver Street they jeered at the Union Jack displayed by Messrs. Neale, and threatened to haul it down. As the Lodge moved on some of the followers turned round and made insulting remarks about the flag." (45)

In October a number of men from Chopwell were tried at Gateshead Magistrates' Court; yet this was not enough for the harassed officials at Chopwell who complained to the Home Secretary, W. Joynson Hicks of light sentences, and the dangers that Communism might present.(46)

At the beginning of 1926 the Durham Miners' Association gave permission to those lodges affected by the lock-outs to negotiate their own settlements.(47) More positive action was taken on the weekend of the 16th January when Peter Lee and T. Trotter both visited the Consett men, and encouraged them to enter upon negotiations. An important consideration was that even if only a few men were restarted, all the others would be entitled to their unemployment benefit.(48) The urgency of this was highlighted by a decision

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(45) Durham Chronicle, 1 August, 1925.
(46) Chopwell Colliery Officials to the Rt. Hon. W. Joynson Hicks, 16 October, 1925. In the collection of papers held by Mr. Andrew Lawther.
(47) Durham County Advertiser, 8 January, 1926.
(48) Durham County Advertiser, 22 January, 1926.

the following week in which the Court of Referees disallowed the men's claim for further unemployment relief at Langley Park; 1,175 men were affected by the decision.(49)

Finally men and management met to settle the dispute, and a ballot was held to ascertain the views of the men. Westwood, Derwent, Medomsley and Langley Park allowed the D.M.A. to conduct their ballot, but Chopwell refused to allow outside interference; predictably the first four were favourable to the terms, but Chopwell voted against, with the unlikely coincidence of exactly 1000 votes being cast against the proposals. The obstinacy of Chopwell protracted the dispute until almost the end of April and even then the Chopwell lodge remained renegade, and so merged the local dispute into the greater framework of the General Strike.

The lawlessness that had been characteristic of the Chopwell dispute up to May 1926 became during the General Strike an alternative lawfulness, as the local leadership established Councils of Action in an effort to combat the organisation of the Government.(50) However, whilst the regions and local organisations may have been resolute in their desire to fight a General Strike, the T.U.C. and Trade Union leadership generally was uncertain whether merely to make a gesture of support or to prosecute the Strike in a determined fashion. The General Strike collapsed after nine days amongst the empty echoes of promises by coalowners and the Government and innuendoes about the illegality of such a strike made by Government Ministers. The miners were left to fight alone, and it inevitably proved to be an uneven struggle.

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(49) Durham County Advertiser, 29 January, 1926.

(50) A. Mason, The General Strike in the North East. (Hull, 1971) p.36.

The men that had led the miners' struggle were victimised imprisoned and then denied employment - no-one in the Lawther family was restarted at Chopwell in 1926, and many other men were blacklisted.(51)

After 1926 the labour force became passive, and even the attitude of the management mellowed. The bitter lesson of the 1920's was well heeded; in 1937 the Coal Owners of Durham reached an agreement with the Durham Miners' Association stabilising wages for the following three years. The same year the blastfurnacemen also gained a six day week, to replace traditional seven day week. Finally in 1938 agreement was reached between Employers and Unions to introduce annual holidays with pay.

The final factor which disrupted the Company's capitalisation and its labour relations was the collapse of the markets in which Consett competed. In response the Company attempted to improve their competitiveness by better marketing, and by exploring new outlets for their productive capacity. One of Consett's earliest successes was in establishing a good reputation for the production of silica bricks. This made feasible the adoption of the new high-temperature coke ovens, a significant technical step forward in the production of coke. As more coke producers built high-temperature ovens in the late 'twenties and the thirties, Consett was able to secure many orders for silica bricks. This was the most valuable 'spin-off' from the construction of the Fell Coke Works. However, an important and forward looking addition to the new Coke Works was a tar distillation plant, giving the Company access to the expanding market of road construction both at home and abroad.

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(51) Interview with Sir. Wm. Lawther, 31 May 1972, also a black-list from the Chopwell Colliery in a collection of papers held by Mr. Andrew Lawther.

By maintaining the coke works at the forefront of technical developments Consett was able to continue operating them at something near their capacity. Between 1927-29 a new plant was built at Derwenthaugh, to maintain the export capabilities of the Company but also to sell gas to Newcastle and Gateshead. In addition Consett had started to produce 'coke nuts' for sale to the household market, and these were distributed locally by the firm's own fleet of lorries.(52)

Externally imposed schemes such as the Coal Mines Act (1930) were generally ill-received by individual firms; Consett particularly resented any intrusion which would interfere with its competitiveness, especially with regard to quotas and the control of export prices.

The potential for developing new markets and uses for the products was much greater on the iron and steel side, than in the sale of coal. Consett had naturally begun to use steel pit props and supports, and its own mines were used as a showplace for these developments. In the early 1920's when the steel plant was reconstructed, the blastfurnace management showed flexibility and resourcefulness in seeking out new markets for pig iron. These efforts were sustained even after the new steelworks were opened.(53) However, the major drive forward was not embarked upon until the shipbuilding industry sank into its abyss after 1930. Consett then began to develop a range of special steels for use by the chemical engineering industry, the motor industry, the Admiralty and for wire drawing.

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(52) Report of Proceedings....., 14 June 1928.(DCRO : D/CO/57).

(53) C.S. Gill, "Blastfurnace Practice at Consett", Foundry Trade Journal XXXV (1927) pp.331-334.

Consett also became an active lobbyist in an effort to restore the buoyancy of its markets. Clarence Smith was a very vocal advocate of protection for the steel industry, on the grounds that not only was it good for the industry but also for the nation as a whole. In 1928 he asserted:

> "Our own experience has proved beyond any doubt that if we could operate our Plants at two-thirds of their capacity - and much more so at full capacity - we could effect such savings that the prices at which we are selling today could be substantially reduced and British consumers of steel would consequently benefit as a result of safeguarding." (54)

The industry's own attempts at solving the problems of foreign competition, such as the payment of rebates to consumers who used only British steel, proved generally unsuccessful.(55)

The demise of the shipbuilding industry and the impact this had upon Consett, diverted Smith's attentions to another type of Government backed scheme to stimulate demand. He attempted to induce the Government to adopt a nation-wide scheme to rehabilitate the shipbuilding industry, by encouraging owners to scrap old tonnage, and replace it by new. Apart from a concession on depreciation allowed on shipping by the Inland Revenue nothing positive was introduced until 1935. However the British Shipping Act (1935) was not wholly satisfactory, for though grants were made to encourage scrapping, this was effectively negated by other subsidies paid on tramp freight rates.

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(56) Report of Proceedings....., 14 June 1928. (DCRO : D/CO/57).

(57) Ibid.

The advent of protection in 1933 and rearmament from 1936 put Consett back upon the road to prosperity. By the outbreak of the Second World War in 1939 the Company had gone a long way to restoring something of its Victorian prestige. It had successfully survived the very difficult years of depression, which claimed a number of famous steel companies. It had also moved forward into the realm of modern commercial philosophy with considerably more emphasis upon the search for and promotion of new demand. The first hundred years was marked by an uncanny symmetry of a half century of prosperity flanked on both sides by twenty-five years of doubt and crisis.

TABLE IX.5

The Financial Performace of Consett, 1914 - 1940.

Year end June.+	Profit	Ordinary Dividend	Preference	Retained Profits	Provision Depreciation	Debenture
1914	£408014	30%	8%	£62,606		
5	£214384	12½%	8%	£ 3,535	£40,000 *	
6	£625,937	50%	8%	£82,668		
7	£521661	40%	8%	£61,661	£20,000*	
8	£516224	40%	8%	£16,224	£50,000 ** £10,000 *	
9	£512292	35%	8%	£21,582	£100000 **	
1920	£599145	12½%	8%	£40,946	£50,000** £90,000*	
1	£356430	10%	8%	£ 9,605		
2	£194344	4%	8%	£20,670		
3++	£266162	5%	8%	£30,097	£30,789-※	£ 58,457
4	£451725	7½%	8%	£52634	£29,940 ※	£90,000
5	£265119	2½%	8%	£21,857	£ 1,665-※	£109,425
6	£136227 Loss					£150,000
7	£35,474 Loss					£150,000
8	£300322				£318781 ≠	£150,000
9	£313255		8%	£23,255	£100000	£150,000
1930	£491266		8%	£101266	£200000	£150,000
1	£387733			£237733		£150,000
2	£299726			£149,726		£150,000
3	£209039			£ 90,413		£150,000
4	£294406			£94407	£100000	£100000≠‡
5	£456734			£56,735	£300000	£100,000
6	£568988			£106488	£350000 **	£112,500
7	£828561	7½%	8%	£141,499	£125000 £200,000**	£62, 641
8	£1060311	10%	8%	£215952	£155000 £200000**	£61,411
9	£755131	7½%	8%	£186120	£125000 £100000**	£ 61,411
1940	£810698	7½%	8%	£200461	£125,000 £100,000**	£ 59,226

* Written off Investments.
\+ Year changed from June to June, to March to March in 1922-23
** Provision towards deferred Repairs, & Reserves
++ Nine month accounting year
※ Writing off from Debenture Issue Expenses.
≠ Written off : Debit in Profit and Loss Account by a transfer from Reserve Account
‡‡ Motion of Debenture Stock holders to reduce interest to 4% during 1933,1934 & 1935.

Profit is the profit on the years trading account plus the profit retained, and before any deductions is made for Debenture interest.

CONCLUSION

The fifty years between 1864-1914 delimit the span of this case study in Victorian business history, and coincide with a period during which the British economy is held to have done relatively poorly vis à vis other industrial nations. Financially the Consett Iron Company performed unquestionably well throughout the period under review, but as has been pointed out financial results may mask underlying economic ills.

The evidence presented, both qualitative and quantitative, suggests that from approximately the end of the 1890's there was a weakening in the managerial drive at Consett. This manifested itself over a wide range of functions such as the acquisition of alternative iron supplies, the adoption of new manufacturing techniques and the management of labour relations. It was also exhibited by the absence of any interest in the exploitation of new market outlets.

In the search for alternative ore supplies, the Company's time-honoured strategy of ensuring an adequate ore supply was hampered in its implementation by the extravagant expectations deriving from the Company's great success in the Orconera venture. Consett was a little naive and ill-prepared for the risks inherent in the competitive business of mineral exploration and exploitation in the early twentieth century.

Much clearer is the stagnation, and in some instances the upward movement of real costs after 1900, in the steelworks. Investment on this side of the Company's business was characterised by piece-meal projects and a habit of postponing thorough reconstruction.

In the collieries also, there was a downward movement in labour productivity, and also a degeneration in labour relations. However, to counter-balance this the Company completed a comprehensive investment in the

electrification of its mines before 1914.

Probably the most serious entrepreneurial failing after 1900 was the absence of any attempt to seek out new markets for iron and steel products, in view of the saturation of the shipbuilding market. Consett was unable to throw up an entrepreneur of the quality of Charles Schwab, who revitalised the fortunes of the Bethlehem Steel Corporation by producing the 'Grey' beam for the constructional engineering industry.

The experience of Consett fits quite well into the hypothesis that the dynamism of an industry, or a company is determined by the buoyancy and the rate of growth of the market. Thus as the demand for shipbuilding materials was satisfied around the turn of the century, the incentive for new investment was reduced, the average age of the capital employed rose, and productivity began to suffer. This thesis is not invalidated by Consett's experience in the coal trade, for although labour productivity deteriorated this was in a large part due to geological conditions. The rapid extension of coal sales was accompanied by a thorough investment in the electrification of the collieries.

On the whole the Consett findings can be added to those in Essays on a Mature Economy : Britain after 1840, that there was no serious overall entrepreneurial failure in late Victorian Britain.(1) The Company only began to show signs of slackening enterprise in the Edwardian decade. Attitudes concerning the iron and steel side of the business ossified, whilst on the coal side the Company was in many respects exploiting its enterprising

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(1) D.N. McCloskey, Essays on a Mature Economy : Britain after 1840 (London, 1971).

territorial expansion of the 1880's. The years between 1900-1914 were marked by the absence of any fundamental policy decision upon which it could develop in the future. This pattern is diametrically opposed to D.H. Aldcroft's assertion that "it seems likely that entrepreneurial lethargy was more evident before 1900 than afterwards."(2)

The early start hypothesis also has some fresh blood driven through its veins. The heritage of old plant and limited space at Consett made the implementation of new and extensive investment after the mid-1890's increasingly problematical. In the collieries resources were suffering from half a century's exploitation, whilst even the new pits at Chopwell were sunk in an area previously worked, and when the Whittonstall royalty was opened out old workings were encountered. Though the existence of old plant is not an insurmountable problem it adds an extra dimension to decision-making.

Consett was never in any sense a family business, and was not therefore vulnerable to the neglect that family firms were often subject to by heirs more intent upon social improvement than business success. However certain personalities left a marked imprint upon Consett's business. They planned and fashioned the success of the Company, but their success bred complacency in their successors.

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(2) D.H. Aldcroft, "The Entrepreneur and the British Economy, 1870-1914", Economic History Review, 2nd ser. XVII (1964-65) p.134.

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APPENDIX A.1.

Ascertained net selling price of all types of Durham Coal, as given on the Accounts's Certificates of the Durham Coal Owners Association & the Durham Miners Association. (3).

Year	Price*	Year	Price*	Year	Price	Year	Price	Year	Price
12/1871	5s.3d	6/ 1882	4s. 7d	1887	4s. 6d	1892	6s. 6d	1897	5s. 2d
1/ 1873	15s.10d	/9/1882	4s.10d	1887	4s. 5d	1892	6s. 2d	1897	5s. 4d
4/ 1874	12s.8d	12/1882	4s.11d	1887	4s. 4d	1892	6s. 2d	1897	5s. 4d
8/ 1874	10s.2d	1st1883	4s.10d	1887	4s. 6d	1892	5s.11d	1897	5s. 5d
2/ 1875	7s.6d	2n 1883	4s.11d	1888	4s. 5d	1893	5s. 4d	1898	5s. 4d
10/1875	6s.6d	3r 1883	4s.11d	1888	4s. 4d	1893	5s. 1d	1898	5s.10d
11/1875	6s.1d	4t.1883	5s. 0d	1888	4s. 6d	1893	5s. 7d	1898	6s. 0d
6/ 1876	5s.8d	1884	4s. 8d	1888	4s. 7d	1893	6s. 2d	1898	6s. 0d
		1884	4s. 8d	1889	4s. 8d	1894	5s. 5d	1899	6s. 3d
1876 - 1879	coke and	1884	4s. 8d	1889	4s.10d	1894	5s. 4d	1899	6s. 7d
coal prices	combined	1884	4s. 9d	1889	5s. 3d	1894	5s. 7d	1899	7s2d
		1885	4s. 6d	1889	5s.10d	1894	5s. 5d	1899	7s.10d
10/1879	4s.3d	1885	4s. 7d	1890	6s.11d	1895	5s. 2d	1900	8s. 8d
2/ 1880	4s. 4d	1885	4s. 8d	1890	7s. 5d	1895	5s. 2d	1900	9s.11d
6/ 1880	4s. 5d	1885	4s. 8d	1890	7s. 6d	1895	5s. 0d	1900	11s. 4d
10/1880	4s. 8d	1886	4s. 5d	1890	7s. 5d	1895	5s. 2d	1900	11s. 4d
2/ 1881	4s. 9d	1886	4s. 5d	1891	7s. 3d	1896	5s. 0d	1901	9s.10d
6/ 1881	4s. 6d	1886	4s. 5d	1891	7s. 2d	1896	5s. 1d	1901	8s. 7d
10/1881	4s.10d	1886	4s. 6d	1891	6s.10d	1896	5s. 1d	1901	7s.11d
2/ 1882	4s. 8d			1891	6s. 8d	1896	5s. 3d	1901	7s.11d

APPENDIX A.1. continued

Year	Price	Year	Price	Year	Price
1902	7s. 6d	1907	7s.11d	1912	8s. 1d
1902	7s. 2d	1907	8s. 6d	1912	8s. 1d
1902	7s. 3d	1907	9s.2d	1912	8s. 7d
1902	7s. 4d	1907	9s. 4d	1912	9s. 0d
1903	7s. 2d	1908	9s. 1d	1913	9s.10d
1903	7s. 1d	1908	8s.10d	1913	10s. 2d
1903	7s. 8d	1908	8s. 7d	1913	10s. 4d
1903	7s. 0d	1908	8s. 3d	1913	10s. 2d
1904	6s. 8d	1909	7s. 7d	1914	10s. 0d
1904	6s. 6d	1909	7s. 7d	1914	9s. 9d
1904	6s. 5d	1909	7s. 6d	1914	9s. 5d
1904	6s. 5d	1909	7s. 6d	1914	9s. 0d
1905	6s. 4d	1910	8s. 0d		
1905	6s. 4d	1910	8s. 0d		
1905	6s. 5d	1910	8s. 1d		
1905	6s. 7d	1910	7s.10d		
1906	6s. 7d	1911	7s. 6d		
1906	6s.11d	1911	7s. 7d		
1906	7s. 1d	1911	7s. 6d		
1906	7s. 3d	1911	7s. 7d		

* Prices to the nearest penny

(3) C.E. Mountford Appendix D.

APPENDIX A.2.

The Price per ton of Steel Plates at Middlesborough, 1887-1913

Year	Price*	Year	Price*	Year	Price*
1887	£6. 5s.0d	1896	£5. 0s.0d	1905	£5.17s.0d
1888	£6. 5s.0d	1897	£5. 2s.6d	1906	£7. 0s.0d
1889	£7. 5s.0d	1898	£6. 0s.0d	1907	£7.10s.0d
1890	£7. 0s.0d	1899	£7.10s.0d	1908	£6. 5s.0d
1891	£6. 5s.0d	1900	£8.10s.0d	1909	£5.15s.0d
1892	£6. 0s.0d	1901	£5.17s.6d	1910	£6.10s.0d
1893	£4.17s.0d	1902	£5.15s.0d	1911	£6.15s.0d
1894	£5. 0s.0d	1903	£6. 0s.0d	1912	£7.15s.0d
1895	£4.17s.6d	1904	£5.12s.6d	1913	£8. 5s.0d

Source: The Economist, 1887-1913 Vol. 45-77.

* The Price in June of each year.

APPENDIX A.38

The Price per ton of Various Types of Iron Ore at Consett 1868-1914

Year ending June	Cleveland Ironstone	Spanish Hematite	Cumberland Hematite	Purple Ore
1868	7s. 1d	£1. 1s.0d	£1. 1s. 4d	
1869	7s.11d		£1. 1s. 4d	
1870	6s. 8d		£1. 0s. 9d	
1871	6s. 6d		£1. 1s. 4d	
1872	7s. 0d		£1. 4s.10d	
1873	8s. 0d	£1. 7s. 6d	£1.10s. 0d	
1874	9s. 0d	£1.10s. 9d	£1.13s. 0d	
1875	9s. 1d	£1. 1s. 8d	£1. 5s. 9d	19s. 1d
1876	9s. 0d	£1. 2s. 1d	£1. 4s. 8d	14s. 3d
1877	8s. 6d	£1. 2s. 5d	£1. 1s. 0d	17s. 3d
1878	8s. 8d	£1. 1s. 7d	£1. 1s. 0d	10s. 0d
1879	8s. 6d	18s. 8d	18s.11d	11s. 0d
1880	7s. 8d	16s. 9d		13s. 7d
1881	7s. 3d	19s. 1d		15s. 9d
1882	7s. 0d	17s. 7d		16s. 3d
1883	8s.10d	18s. 6d		17s. 7d
1884	8s. 5d	16s.10d		16s.11d
1885	6s. 8d	14s. 6d		9s. 2d
1886		13s. 4d		8s. 7d
1887		12s. 5d		8s. 4d
1888	7s. 3d	12s. 9d		8s. 4d
1889	6s. 0d	14s. 1d		8s. 7d
1890		14s. 9d		13s. 5d
1891		14s. 9d		16s. 5d
1892		13s.10d		14s. 8d
1893		13s. 4d		9s. 6d
1894		12s. 9d		7s.11d
1895		13s. 1d		10s. 1d
1896		12s.11d		9s. 3d
1897		13s. 4d		8s. 0d
1898		14s. 4d*		
1899		14s. 8d		
1900		16s. 1d		
1901		17s. 9d		
1902		14s. 7d		
1903		14s. 8d		
1904		14s.10d		
1905		14s.11d		
1906		15s. 1d		
1907		17s. 7d		
1908		19s. 7d		
1909		15s. 5d		
1910		14s.11d		
1911		17s. 5d		
1912		16s.11d		
1913		18s. 4½d		
1914		18s. 0½d		

* Spanish and Purple Ore Prices Quoted as one.
Source: Private Cost Books (DCRO : D/CO/97, 100 & 101).

APPENDIX A.4.

The Price per ton of Pig Iron 1870-1913

Year	(1) Cumberland Hematite Pig Iron	(2) Pig Iron+ sold by Consett	Year	(1) Cumberland Hematite Pig Iron	(2) Pig Iron sold by Consett
1870	£3.12s. 6d		1893	£2. 6s. 0d	£2. 9s. 7d
1871	£4.10s. 8d		1894	£2. 5s. 6d	
1872	£7. 2s. 6d		1895	£2. 6s. 5d	
1873	£8. 9s. 2d	£3.12s. 5d*	1896	£2. 9s. 3d	
1874	£5. 9s. 7d	£3. 7s. 9d	1897	£2.10s. 6d	
1875	£4. 1s. 7d	£2.12s. 6d	1898	£2.14s. 7d	
1876	£3.14s. 1d	£1.18s. 2d	1899	£3.10s. 3d	
1877	£3.12s. 9d	£1.17s. 9d	1900	£4. 2s. 1d	
1878	£3. 0s. 0d	£1.16s. 7d	1901	£3.11s. 0d	
1879	£2.17s. 6d	£1.13s. 5d	1902	£3. 4s. 0d	
1880	£3.10s. 0d	£2.14s. 4d	1903	£2.18s. 7d	
1881	£3. 1s. 1d	£2.15s. 0d	1904	£2.14s. 6d	
1882	£2.18s. 6d	£2.13s. 2d	1905	£3.11s. 1d	
1883	£2.11s. 9d	£2.10s. 7d	1906	£3. 9s. 9d	
1884	£2. 6s. 11d	£2. 4s. 5d‡	1907	£3.18s. 3d	
1885	£2. 4s. 6d	£2. 3s. 7d‡	1908	£3.10s. 8d	
1886	£2. 3s. 7d	£2. 1s. 7d	1909	£2.19s. 7d	
1887	£2. 6s. 1d	£2. 0s. 5d	1910	£3.17s. 1d	
1888	£2. 4s. 8d	£2. 1s. 0d	1911	£3. 4s.11d	
1889	£2.12s. 3d	£2. 4s. 2d	1912	£3.15s. 9d	
1890	£2.19s.11d	£2.19s. 7d	1913	£3.18s. 7d	
1891	£2.11s. 8d	£2.19s. 2d			
1892	£2. 9s. 7d	£2.13s. 7d			

* Years ending June.
\+ Between 1873-1884, the type of pig iron undefined.
‡ Bessemer Pig Iron.
Sources: (1) D.N. M^{c}Closkey, "Economic Maturity and Entrepreneurial Decline", pp. 144-145
(2) Profit and Loss Accounts, 1873-1893. (DCRO: D/CO/89)

APPENDIX B.1. (i)

Average Cost per Ton of Consett Home Collieries Coal 1868 - 1914.

Year Ending June	Wages	Rent & Coal	Stores	Royalty Rent	Coal to Engines	Estimated Charges	Bank Charges	Total Cost
1868	1s.9d .99	1.68	3.75	3.62	1.07	10.09	0.16	3s.6d .36
1869	1s.9d .65	1.87	3.42	3.58	1.03	7.93	0.32	3s.3d .8
1870	1.s9d	1.96	3.69	3.38	0.85	7.64	0.12	3s.2d .64
1871	1s.10d .36	1.92	3.65	3.89	0.92	9.48	-	3s.6d .22
1872	2s.0d .86	2.03	4.14	4.35	1.06	10.7	-	3s11d .14
1873	3s1d .85	2.03	6.37	4.45	1.99	11.53	-	5s.4d. 22
1874	3s.6d .03	2.17	7.04	4.04	1.23	11.96	-	5s.8d .47
1875	3s.0d .16	2.36	5.72	4.15	0.84	9.99	-	4s.11d .22
1876	2s.9d .44	2.51	5.10	3.75	0.80	8.71	-	4s.6d .31
1877	2s.7d .68	2.59	5.43	3.93	0.83	8.39	-	4s.4d .85
1878	2s.5d .42	2.73	4.70	4.12	0.9	9.89	-	4s.3d .76
1879	2s.5d .05	2.71	3.87	4.24	0.87	10.01	-	4s.2d .75
1880	2s.1d .43	2.18	4.15	3.79	0.70	8.31	-	3s.8d .56
1881	2s.3d .24	2.13	4.56	3.83	0.75	8.71	-	3.s11d .22
1882	2s.4d .25	2.15	4.74	3.99	0.77	8.77	-	4s.0d .67
1883	2s.5d .83	2.23	4.23	3.97	0.81	8.21	-	4s.1d .28
1884	2s.6d .5	2.54	4.2	4.41	0.63	8.93	-	4s.3d .21
1885	2s.4d .54	2.67	3.93	4.92	0.60	8.37	-	4s.1d .03
1886	2s.4d .25	2.94	4.25	4.84	0.61	8.49	-	4s.1d .38
1887	2s.3d .63	2.85	3.62	4.49	0.60	8.35	-	3s.11d .54
1888	2s.4d .57	2.80	3.57	5.27	0.62	8.56	-	4s.1d .39
1889	2s.6d .30	2.69	4.57	5.56	0.60	8.58	-	4s.4d .3
1890	3s.0d .83	.269	5.14	5.58	0.73	8.89	-	4s.11d .86
1891	3s.5d .11	2.76	4.86	5.40	0.79	8.67	-	5s.3d .59
1892	3s.4d .84	2.91	5.05	5.46	0.96	11.43	-	5s.6d .64

APPENDIX B.1.(i) continued.

Year Ending June	Wages	Rent & Coal	Stores	Royalty Rent	Coal to Engines	Estimated Charges	Bank Charges	Total Cost
1893	2s.11d .90	2.99	4.55	5.33	0.83	10.39	-	4s.11d .99
1894	2s.11d .25	2.59	4.71	5.22	0.76	9.84	-	4s.10d .37
1895	3s.0d .87	2.60	4.95	5.51	0.81	9.29	-	5s. 0d .03
1896	2s.10d .82	2.56	4.81	5.57	0.82	8.88	-	4s.9d .46
1897	2s.11d .36	4.97	5.44	0.78	8.58	0.78		
1898	3s.2d .75	2.36	5.99	0.83	9.22	1.5		
1899	3s.3d .75	2.41	5.23	5.76	0.88	9.05	3.32	5s.6d .40
1900	3s.8d .26	2.53	6.14	5.90	0.98	9.81	3.53	6s.1d .15
1901	4s.7d .63	2.77	8.34	6.80	1.34	10.52	5.53	7s.6d .93
1902	4s.2d .71	3.69	6.66	6.78	1.09	10.31	1.75	6s.10d .99
1903	4s.1d .03	3.66	6.52	6.36	0.98	11.26	2.40	6s.8d .21
1904	4s.0d .65	3.55	7.44	6.12	0.95	10.77	1.91	6s.7d .39
1905	4s.0d .29	3.65	7.44	6.16	0.89	10.74	1.09	6s.6d .26
1906	4s.0d .70	3.52	6.97	6.19	0.97	10.86	1.57	6s.6d .78
1907	4s.1d .99	3.11	6.48	6.53	0.96	11.15	2.57	6s.8d .79
1908	4s.8d .24	3.34	7.38	6.99	1.11	11.92	2.49	7s.5d .47
1909	4s.8d .39	3.92	7.41	6.93	1.32	1	4.18	7s.8d .29
1910	4s.9d .84	3.73	7.80	6.66	1.27		3.21	7s.8d .81
1911	4s.2d .01	3.51	4.00	6.42	1.02	11.27	1.60	6s.5d .83
1912	4s.8d .8	3.62	5.47	5.56	0.42		1.80	6s.7d .36
1913	4s.7d .33	3.18	6.31	6.15	0.09		0.78	7s.0d .57
1914	4s.11d .98	3.32	6.37	7.00	0.07		2.64	7s.8d .67

Source : Private Cost Books. (DCRO : D/CO/97,100 & 101). 1868 - 1892 Included Westwood Collery.

APPENDIX B1.I.(ii)

Langkey Park Colliery: Annual Average Costs per ton Coal

Year ending June	Wages	Rent and Coal	Stores	Royalty Rent	Estimated Charges	Miscellaneous (coal for Engines)	Total Av. Cost
I877	2s. 8½d.	2½d.	8½d.	Is. 0½d.	5½d.	I d.	5s. 2 d.
I878	3s. 3 d.	3½d.	6 d.	9½d.	9½d.	I½d.	5s. 5½d.
I879	2s. 5 d.	2 d.	7 d.	8½d.	6 d.	½d.	4s. 4½d.
I880	2s. 0 d.	I½d.	6 d.	7½d.	5½d.	½d.	3s. 8 d.
I88I	2s. 3 d.	I½d.	5½d.	8 d.	5½d.	I d.	4s. 0½d.
I882	2s. 2½d.	I½d.	5 d.	I0 d.	5½d.	I d.	4s. I½d.
I883	2s. 6½d.	I½d.	6 d.	I0 d.	5 d.	I d.	4s. 6 d.
I884	2s. 7½d.	I½d.	7 d.	I0 d.	5 d.	I½d.	4s. 8½d.
I885	2s. 7 d.	2 d.	4 d.	8½d.	5 d.	I½d.	4s. 4 d.
I886	2s. 5 d.	I½d.	4 d.	9 d.	4½d.	I½d.	4s. 3½d.
I887	2s. 5 d.	I½d.	3½d.	7 d.	4½d.	I½d.	3s.II d.
I888	2s. 4½d.	2 d.	4½d.	7½d.	5 d.	I½d.	4s. I d.
I889	2s. 3½d.	2 d.	5 d.	7 d.	4½d.	I½d.	3s.II½d.
I890	2s. 9 d.	I½d.	6½d.	II d.	4 d.	I½d.	4s. 9½d.
I89I	3s. 2½d.	I½d.	6½d.	II½d.	4½d.	2 d.	5s. 4½d.
I892	3s. 6 d.	2 d.	6½d.	9 d.	6 d.	2½d.	5s. 8 d.
I893	3s. I d.	2 d.	5 d.	9 d.	5½d.	I½d.	5s. 0 d.
I894	2s.I0 d.	I½d.	4½d.	9 d.	4½d.	I½d.	4s. 7 d.
I895	2s.I0½d.	I½d.	5 d.	8½d.	5 d.	I d.	4s. 7½d.
I896	2s. 8½d.	I½d.	6½d.	8 d.	4½d.	I d.	4s. 6 d.
I897	2s. 7 d.	2 d.	4½d.	9½d.	4½d.	½d.	4s. 4 d.
I898	2s. 0½d.	I½d.	3½d.	I0 d.	3½d.	3½d.	3s.I0½d.
I899	2s. 0 d.	I d.	4½d.	9½d.	3½d.	2 d.	3s. 8½d.
I900	2s. 3 d.	I d.	4½d.	Is. 2 d.	3 d.	5½d.	4s. 7 d.
I90I	2s. 9 d.	I d.	6 d.	Is. 0 d.	3½d.	6 d.	5s. I½d.
I902	2s. 5 d.	I½d.	6 d.	5½d.	3½d.	5½d.	4s. 3 d.
I903	2s. 6 d.	I½d.	7 d.	7 d.	4 d.	4 d.	4s. 5½d.
I904	2s. 9½d.	I½d.	9 d.	6½d.	4 d.	5½d.	5s. 0 d.
I905	2s.I0 d.	I½d.	7 d.	6½d.	4 d.	5 d.	4s.I0 d.
I906	2s.I0½d.	I½d.	7 d.	7 d.	4 d.	4 d.	4s.I0 d.
I907	3s. 7 d.	2 d.	6½d.	7 d.	4 d.	6 d.	5s. 2½d.
I908	3s. 8½d.	2 d.	9½d.	7 d.	5 d.	5 d.	6s. I d.
I909	3s.II d.	2 d.	I0 d.	7 d.	4½d.	4 d.	6s. 2½d.
I9I0	4s. 2 d.	2½d.	8 d.	7 d.	5½d.	6½d.	6s. 7½d.
I9II	4s. 0 d.	2½d.	7 d.	7½d.	5½d.	3 d.	6s. I½d.
I9I2	4s. 2 d.	3 d.	7 d.	8 d.	6 d.	2½d.	6s. 4½d.
I9I3	4s. 6 d.	3 d.	7 d.	8 d.	6 d.	4½d.	6s.I0½d.
I9I4	5s. I½d.	3½d.	9 d.	8 d.	6½d.	Is.I0½d.	9s. 3 d.

Source: Private Cost Books. (DCRO: D/CO/97,I00&I0I)

APPENDIX B.I. (iii)

Chopwell Colliery: Annual Average Costs per ton Coal at Derwenthaugh

Year ending June	Wages	Rent and Coal	Stores	Royalty Rent	Estimated Charges	Miscellaneous	Total Av. Cost
I898	4s. 5½d.	4½d.	Is. 2½d.	6 d.	3½d.	9½d.	7s. 7½d.
I899	3s.I0 d.	3½d.	II d.	6 d.	3½d.	2½d.	6s. 0½d.
I900	3s. 9½d.	3½d.	9 d.	6 d.	4 d.	9 d.	6s. 5 d.
I90I	4s. 6 d.	4 d.	9 d.	6 d.	4½d.	I0½d.	7s. 4 d.
I902	3s.II d.	3½d.	8 d.	6 d.	4 d.	I0½d.	6s. 4 d.
I903	3s. 8½d.	3½d.	7½d.	6 d.	4 d.	4½d.	5s.I0 d.
I904	3s.II d.	3½d.	5 d.	6 d.	4½d.	5 d.	5s.II d.
I905	3s. 9 d.	3½d.	6 d.	6 d.	4 d.	7 d.	6s. 0½d.
I906	4s. 0 d.	3 d.	5½d.	6 d.	4½d.	Is. 8 d.	7s. 3 d.
I907	4s. 5 d.	3½d.	6 d.	6 d.	4½d.	Is. 3 d.	7s. 4 d.
I908	5s. 5 d.	4 d.	7 d.	6½d.	4½d.	Is. 9 d.	9s. 0 d.
I909	5s. 2 d.	4 d.	7 d.	6 d.	3½d.	I0½d.	7s. 9 d.
I9I0	5s. 0 d.	3½d.	8 d.	6 d.	3 d.	Is. 2½d.	7s.II d.
I9II	5s. 0 d.	3½d.	7 d.	5½d.	4½d.	8½d.	7s. 5 d.
I9I2	5s. I d.	4 d.	8 d.	5½d.	5½d.	9½d.	7s. 9½d.
I9I3	5s. 5 d.	4 d.	7½d.	5½d.	6 d.	Is. 0½d.	8s. 4½d.
I9I4	5s. 8½d.	4½d.	6 d.	6 d.	6 d.	I0 d.	8s. 5 d.

Source: Private Cost Books. (DCRO: D/CO/I00, & I0I).

APPENDIX B.2. (i)

Average Cost per ton of Coke at Consett's Home Collieries, 1868-1914

Year ending June	Wages	Coal	Miscellaneous Stores, Estimated Charges	Total Cost	Yield*
1868	Is. 0½d.	6s. 5 d.	Is. 0½d.	8s. 6 d.	65.89
1869	11½d.	6s. 7 d.	9½d.	8s. 4 d.	64.43
1870	10½d.	6s. 4 d.	6½d.	7s. 9 d.	64.90
1871	10½d.	6s. 5 d.	7½d.	7s.11 d.	65.34
1872	11 d.	6s. 9 d.	8 d.	8s. 4 d.	65.78
1873	Is. 2 d.	12s.11 d.	10 d.	14s.11 d.	64.17
1874	Is. 4 d.	8s.11 d.	11 d.	11s. 2 d.	63.00
1875	Is. 2½d.	7s. 9 d.	9 d.	9s. 8½d.	62.03
1876	Is. 1 d.	7s. 2 d.	8 d.	8s.11 d.	62.97
1877	Is. 0 d.	6s.10 d.	7 d.	8s. 5 d.	63.63
1878	11½d.	6s. 9 d.	6 d.	8s. 2½d.	63.26
1879	11½d.	6s. 6 d.	3½d.	7s. 8 d.	64.96
1880	11 d.	5s.10 d.	4 d.	7s. 1 d.	63.21
1881	11 d.	6s. 1 d.	4 d.	7s. 4 d.	63.72
1882	11 d.	6s. 3½d.	3½d.	7s. 6 d.	63.93
1883	11½d.	6s. 3 d.	4½d.	7s. 7 d.	65.26
1884	Is. 0 d.	6s. 5½d.	4½d.	7s.10 d.	66.72
1885	11½d.	5s.11 d.	4½d.	7s. 3 d.	68.20
1886	11½d.	6s. 1 d.	4½d.	7s. 5 d.	66.97
1887	11 d.	5s.11 d.	4 d.	7s. 2 d.	67.45
1888	11 d.	6s. 0 d.	5 d.	7s. 4 d.	68.51
1889	11 d.	6s. 8 d.	5 d.	8s. 0 d.	68.19
1890	Is. 0 d.	7s. 7 d.	6 d.	9s. 1 d.	67.67
1891	Is. 2 d.	8s. 8½d.	4½d.	9s.10 d.	67.09
1892	Is. 3 d.	9s. 0 d.	6 d.	10s. 9 d.	65.58
1893	Is. 0½d.	7s.11½d.	5 d.	9s. 5 d.	66.88
1894	Is. 2 d.	7s. 9 d.	5 d.	9s. 4 d.	67.94
1895	Is. 1 d.	7s. 8 d.	6 d.	9s. 3 d.	67.67
1896	Is. 0½d.	7s. 5 d.	4½d.	8s.10 d.	67.23
1897	Is. 0½d.	7s. 6½d.	4 d.	8s.11 d.	67.25
1898	Is. 1½d.	8s. 4 d.	3½d.	9s. 9 d.	67.32
1899	Is. 2 d.	8s. 8 d.	5 d.	10s. 3 d.	68.32
1900	Is. 3 d.	10s. 1 d.	3 d.	11s. 7 d.	68.23
1901	Is. 5½d.	12s. 2½d.	5 d.	14s. 1 d.	67.78
1902	Is. 4½d.	10s. 7 d.	4½d.	12s. 4 d.	67.58
1903	Is. 3½d.	10s. 6 d.	4½d.	12s. 2 d.	66.10
1904	Is. 3 d.	10s 4 d.	4 d.	11s.11 d.	66.76
1905	Is. 3 d.	10s. 3 d.	5 d.	11s.11 d.	66.93
1906	Is. 3 d.	10s. 0 d.	3 d.	11s. 6 d.	67.84
1907	Is. 3½d.	10s. 5 d.	5½d.	12s. 2 d.	66.44
1908	Is. 5½d.	11s.10½d.	6 d.	13s.10 d.	66.13
1909	Is. 5 d.	12s. 1½d.	4½d.	13s.11 d.	66.29
1910	Is. 4½d.	12s. 8 d.	5½d.	14s. 7 d.	64.38
1911	Is. 4 d.	9s. 8 d.	5½d.	11s. 5½d.	67.66
1912	Is. 8½d.	10s. 4½d.	6 d.	12s. 2 d.	62.90
1913	Is. 4 d.	11s. 3 d.	5 d.	13s. 0 d.	65.62

*Yields for 6 months ending June.
The Yield is the % Yield of coke per ton of coal.

APPENDIX B.2. (ii)

Langley Park Colliery: Annual Average Costs per ton Coke.

Year ending June	Wages	Coal	Miscellaneous	Total Av. Cost	Yield*
					%
1877	Is. 1 d.	10s. 0½d.	3 d.	11s. 4½d.	52.07
1878	Is. 0 d.	10s. 3 d.	5 d.	11s. 8 d.	54.56
1879	10½d.	7s. 7 d.	1½d.	8s. 7 d.	57.40
1880	10 d.	6s. 4½d.	3½d.	7s. 6 d.	60.46
1881	10 d.	6s.11½d.	2½d.	8s. 0 d.	58.63
1882	10 d.	6s.10 d.	3 d.	7s.11 d.	61.66
1883	10½d.	7s. 5½d.	3 d.	8s. 4 d.	60.22
1884	11 d.	7s. 8 d.	2½d.	8s. 9½d.	61.66
1885	Is. 0 d.	6s.10½d.	4½d.	8s. 3 d.	63.35
1886	11 d.	6s. 7 d.	4 d.	7s.10 d.	64.06
1887	10 d.	6s. 0½d.	3½d.	7s. 2 d.	64.47
1888	10 d.	6s. 4 d.	2 d.	7s. 4 d.	64.08
1889	10 d.	6s. 3 d.	2½d.	7s. 3½d.	65.29
1890	11 d.	7s. 3 d.	3½d.	8s. 5½d.	66.07
1891	Is. 0 d.	8s. 2½d.	2½d.	9s. 5 d.	64.94
1892	Is. 1 d.	8s. 9 d.	1 d.	9s.11 d.	64.84
1893	11 d.	7s. 8½d.	2½d.	8s.10 d.	65.59
1894	11 d.	6s.11 d.	3 d.	8s. 1 d.	65.82
1895	11½d.	7s. 1 d.	2 d.	8s. 2½d.	65.17
1896	11 d.	6s.11 d.	2½d.	8s. 0½d.	65.30
1897	11 d.	6s. 8 d.	3 d.	7s.10 d.	64.17
1898	11½d.	6s. 1½d.	3 d.	7s. 4 d.	63.68
1899	Is. 0 d.	5s.10½d.	3 d.	7s. 7½d.	63.99
1900	Is. 1 d.	7s. 0 d.	3 d.	8s. 4 d.	65.61
1901	Is. 4 d.	7s. 9 d.	3 d.	9s. 4 d.	66.31
1902	Is. 2½d.	6s. 4½d.	3½d.	7s.10½d.	65.47
1903	Is. 1½d.	6s.10 d.	5 d.	8s. 4½d.	65.09
1904	Is. 0 d.	7s. 5½d.	4 d.	8s.10½d.	66.55
1905	Is. 1 d.	7s. 1½d.	3½d.	8s. 6 d.	68.69
1906	Is. 1 d.	7s. 2 d.	3 d.	8s. 6 d.	67.66
1907	Is. 1½d.	7s. 9 d.	4 d.	9s. 2½d.	66.77
1908	Is. 3 d.	8s. 11½d.	4 d.	10s. 6½d.	67.71
1909	Is. 3 d.	9s. 5 d.	8 d.	11s. 6 d.	64.48
1910	Is. 2 d.	10s. 1 d.	6½d.	11s. 9½d.	65.90
1911	Is. 7 d.	9s. 3 d.	3½d.	10s. 7½d.	66.86
1912	Is. 1 d.	9s. 6½d.	2 d.	10s. 9½d.	65.47
1913	Is. 1 d.	10s. 6 d.	2½d.	11s. 9½d.	65.59
1914	Is. 3 d.	14s. 3 d.	2½d.	15s. 8½d.	64.48

Source: Private Cost Books (DCRO: D/CO/97, 100 & 101).
* Six months ending June. The Yield is the % Yield of coke per ton of coal.

APPENDIX B.2. (iii)

Chopwell Colliery: Annual Average Costs per ton Coke.

Year ending June	Coal	Wages	Miscellaneous	Total Av. Cost	Yield*
1898					
1899	8s. 2 d.	1s. 4 d.	1s. 2 d.	10s. 6 d.	63.24
1900	9s. 5 d.	1s. 2½d.	1s. 0 d.	11s. 7½d.	67.68
1901	10s. 6½d.	1s. 6 d.	1s. 1½d.	13s. 2 d.	67.57
1902	8s. 7 d.	1s. 4 d.	1s. 0½d.	10s.11½d.	70.26
1903	7s.11½d.	1s. 2½d.	10 d.	10s. 0 d.	70.36
1904	8s. 0 d.	1s. 2 d.	11 d.	10s. 1 d.	70.87
1905	8s. 2 d.	1s. 1½d.	8½d.	10s. 0 d.	71.55
1906	10s. 0 d.	1s. 1 d.	1s. 2 d.	12s. 3 d.	69.62
1907	10s. 3 d.	1s. 1 d.	1s. 0 d.	12s. 4 d.	68.60
1908	12s. 6 d.	1s. 2 d.	11 d.	14s. 7 d.	69.80
1909	10s.10 d.	1s. 2 d.	11 d.	12s.11 d.	68.57
1910	11s. 1 d.	1s. 2 d.	11 d.	13s. 2 d.	68.85
1911	10s. 3 d.	1s. 1½d.	10½d.	12s. 3 d.	68.97
1912	10s.10 d.	1s. 1½d.	1s. 0 d.	12s.11½d.	69.28
1913	11s.10 d.	1s. 2½d.	1s. 0 d.	14s. 0½d.	67.83
1914	12s. 0½d.	1s. 4 d.	11½d.	14s. 4 d.	66.87

Source: Private Cost Books. (DCRO: D/CO/100, & 101).
*Yield for six months ending June. The Yield is the % yield of coke per ton or coal.

APPENDIX B.3. (i)

Consett Iron Company, LTD.: The Cost of Producing an Average ton of Pig Iron

Year ending	Cost of Iron Ore	Cost of Limestone	Cost of Coal	Cost of Coke	Wages	Miscell-aneous	Total Av. Cost
I870	I9s. 9 d.	9 d.	Is. 5½d.	9s. 8½d.	4s. 0½d.	3s. 2d.	£I.I8s.I0d.
I87I	£I. 0s. I½d.	I0½d.	II d.	I0s. I d.	3s.II d.	3s.11d.	£I.I9s.I0d.
I872	£I. 0s. 6 d.	I0½d.	4 d.	9s. 9 d.	4s. 4½d.	3s. 7d.	£I.I9s. 5d.
I873	£I. 3s.I0 d.	II d.	2½d.	I8s. 5½d.	5s. 4 d.	3s. 8d.	£2.I2s. 5d.
I874	£I. 4s. 3 d.	I0 d.	I½d.	I3s. I½d.	6s. 2½d.	4s. 8d.	£2. 9s. 0d.
I875	£I. 4s.II d.	I0 d.	I½d.	IIs. 9 d.	5s. 5½d.	4s 2d.	£2. 7s. 3d.
I876	£I. Is. 2 d.	I0 d.	3½d.	I0s. 9 d.	4s.I0½d.	4s. 1d.	£2. 2s. 0d.
I877	I7s. 2 d.	II d.	2½d.	IIs. 0½d.	4s. 7½d.	4s. 1d.	£I.I8s. 0d.
I878	I9s. 3½d.	I0½d.	3 d.	I0s. 8 d.	4s. 4 d.	2s. 6d.	£I.I7s.IId.
I879	I6s.I0 d.	8½d.	2½d.	9s. 5½d.	3s.II d.	2s.10d.	£I.I3s.IId.
I880	I8s. 5½d.	8 d.	½d.	8s. 7 d.	3s. 8 d.	2s. 5d.	£I.I3s.I0d.
I88I	£I. Is. 3½d.	8½d.	I½d.	8s. 7 d.	3s. 6½d.	1s.11d.	£I.I6s. 2d.
I882	£I. 3s. 2½d.	8 d.	2 d.	8s. 3½d.	3s. 7½d.	2s. 2d.	£I.I8s. Id.
I883	£I. 4s.I0 d.	8 d.	½d.	8s. 5½d.	3s.6½d.	1s.10d.	£I.I9s. 4d.
I884	£I. Is. 8½d.	9 d.	½d.	8s. 8 d.	3s. 6 d.	2s. 3d.	£I.I6s. 5d.
I885	I8s.II½d.	9 d.	½d.	8s. 5 d.	3s. 4½d.	1s. 9d.	£I.I3s. 3d.
I886	I7s. 6½d.	9 d.	½d.	8s. 8 d.	3s. 4½d.	1s. 9d.	£I.I2s. Id.
I887	I7s. I½d.	I0 d.	¼d.	8s. 7 d.	3s. 2½d.	1s. 9d.	£I.IIs. 6d.
I888	£I. 0s. 5 d.	8½d.	½d.	8s. 5½d.	3s. I½d.	1s. 9d.	£I.I4s. 6d.
I889	£I. 2s. 3 d.	8½d.	½d.	9s. 2½d.	3s. 0½d.	1s. 8d.	£I.I6s.IId.
I890	£I. 2s.I0 d.	9 d.	½d.	I0s. 6 d.	3s. 3½d.	1s. 7d.	£I.I9s. 0d.
I89I	£I. 5s. 3 d.	9 d.	½d.	I0s. 8 d.	3s. 3½d.	2s. 6d.	£2. 2s. 6d.
I892	£I. Is. 9 d.	I0 d.	2 d.	I2s. I d.	3s. 7 d.	1s. 5d.	£I.I9s.I0d.
I893	£I. 3s. 3 d.	9 d.	2 d.	9s. 8 d.	3s. 2½d.	1s. 5d.	£I.I8s. 6d.
I894	£I. 2s. 3 d.	9 d.	2 d.	9s. 5 d.	3s. 0 d.	1s. 5d.	£I.I7s. 0d.
I895	£I. 2s. 6½d.	9 d.	I½d.	9s. 3½d.	2s. 8½d.	1s. 5d.	£I.I6s.I0d.
I896	£I. 2s. 0½d.	9 d.	I½d.	8s.I0 d.	2s. 9½d.	1s. 3d.	£I.I5s.I0d.
I897	£I. 4s. 7 d.	9 d.	I½d.	8s. 9 d.	2s.I0 d.	1s. 8d.	£I.I8s. 9d.
I898	£I. 5s. 4 d.	8½d.	2 d.	9s.I0 d.	2s.II d.	1s. 9d.	£2. 0s. 9d.
I899	£I. 5s. 7½d.	8 d.	3 d.	I0s. 7 d.	3s. I d.	2s. 1d.	£2. 2s. 3d.
I900	£I. 8s. 5 d.	9½d.	3½d.	I3s. 3 d.	3s. 9 d.	2s. 2d.	£2. 8s. 8d.
I90I	£I. 9s. 8½d.	9½d.	3 d.	I7s. 7 d.	4s. 0 d.	2s. 2d.	£2.I4s. 6d.
I902	£I. 5s. 7½d.	9 d.	4½d.	I4s. 3 d.	3s. 6 d.	2s. 2d.	£2. 6s. 8d.
I903	£I. 5s. 7½d.	9 d.	2 d.	I3s. 6½d.	3s. 4 d.	2s. 1d.	£2. 5s. 6d.
I904	£I. 5s. 5 d.	9½d.	I d.	I3s.I0½d.	3s. 3½d.	2s. 1d.	£2. 5s. 6d.
I905	£I. 5s.I0 d.	Is. 4 d.	I d.	I3s. 8½d.	3s. I d.	1s.11d.	£2. 6s. 0d.
I906	£I. 9s. 4½d.	Is. 5 d.	I d.	I4s. 2½d.	3s. 5 d.	2s. 1d.	£2.I0s. 7d.
I907	£I.IIs. 4 d.	Is. 5 d.	I d.	I3s.II d.	3s. 7 d.	2s. 3d.	£2.I2s. 7d.
I908	£I.I3s. 0 d.	Is. 6½d.	2 d.	I5s. 4 d.	3s.I0 d.	2s. 5d.	£2.I6s. 4d.
I909	£I. 5s. 4 d.	Is. 2½d.	2 d.	I5s. 2 d.	3s.I0½d.	2s. 9d.	£2. 8s. 6d.
I9I0	£I. 7s. 8 d.	Is. 3½d.	I½d.	I4s. 8 d.	3s. 6½d.	2s. 2d.	£2. 9s. 5d.
I9II	£I.I2s. 5½d.	Is. 3½d.	I d.	IIs. I d.	3s. 5 d.	1s. 9d.	£2.I0s. Id.
I9I2	£I.I0s. 8 d.	Is. 3 d.	I d.	I0s.II d.	3s. 4½d.	2s. 2d.	£2. 8s. 5d.
I9I3	£I.I4s. I d.	Is. 3½d.	I d.	I0s. 7 d.	3s. 7 d.	2s. 8d.	£2.I2s. 3d.
I9I4	£I.IIs.II½d.	Is. 5½d.	I d.	I0s. 6 d.	3s.II d.	4s. 5d.	£2.I2s. 4d.

Source: Private Cost Books. (DCRO: D/CO/97, I00 & I0I).

Appendix B.3. (ii)

Bell Brothers Ltd.

Year Ending September	Output	Cost of Ore p.t. of Pig	Cost of Coke	Cost of Labour	Extn. Impr. & Deprec.	Av. Total Cost	Profit per ton
1873	137,477	17s.11d	£1.06s.5d	6s.2d+	10½d	£2.18s.11d	£1.17s.10d
4	134,885	18s.2d	£1.07s.5d	6s2d	11d	£3.00s.3d	17s.10d
5	164,055	17s.9d	£1.00s.3d	5s.10d	1s.3d	£2.11s.6d	5s.0½d
6	215,822	17s.5d	16s.11d	4s.10d	1s.6d	£2.06s.3d	2s7½d
7	203,797	17s.10d	15s.6d	4s.11d	2s.4d	£2.13.11d	Loss 1s.3d L
8	198,476	17s.10d	14s.5d	3s.1d	1.s4d	£2.12.2d	" 8d L
9	201,376	14s.10d	12s.7d	2s.11d	1s.1d	£1.14s.10d	4d L
188 0	278,260	15s.8d	12s.9d	2s.8d	9d	£1.14s.10d	Pr. 7s.2½d
1	281,311	16s.0d	13s.3d	2s.9d	9d	£1.15s.11d	3s.3½d
2	242,923	15s.11d	13s.3d	3s.0d	10d	£1.16s. 6d	5s.5½d
3	247,260	15s.9d	13s.6d	3s.2d	11d	£1.17s.3d	3s.10d
4	225,371	14s.5d	13s.1d	3s.2d	12d	£1.16s4d	5d
5	212,072	14s.3d	12s.3d	3s,2d	11d	£1.14s.4d	Loss 4d. L
6	206,808	13s.9d	12s.0d	3s.1d	1s.1d	£1.13s.7d	2s.6d L
7	166,475	13s.8d	11s.6d	3s.5d	1s.4d	£1.12s.10d	1s.0d L
8	169,003	13s.2d	11s.8d	3s.2d	1s.6d	£1.13s.5d	1s.5d L
9	223,045	17s.0d	11s.10d	3s.2d	2s.7d	£1.13s.4d	Pr. 8d
189 0	232,326	17s.0d	18.s7d	3s.7d	1s.5d	£2.06s.5d	Loss 1s.3d L
1	254,872	17s.4d	15s.8d	3s.2d*	1.s7d	£2.02s.2d	1s.9d L
2	189,817	17s.1d	13s.7d	3s.9d	10d	£2.02.8d	3s.9d L
3	275,366	17s.0d	12s.11d	2s.9d	1s.2d	£1.18s.5d	3s.7d L
4	257,089	17s.0d	12s.7d	2s.10d	10d	£1.19s.3d	4s.3d L
5	312,337	16s.10d	12s.8d	2s.10d	1s.0d	£1.18s.1d	3s.5d L
6	311,937	16s.11d	13s.6d	2s.11d	1s.11d	£1.19s.3d	3s.4d L
7	338,290	16s.11d	14s.0d	2s.11d	2s.3d	£1.19s.10d	2s.6d L
8	326,791	16s.11d	14s.3d	2s.11d		£1.19s 9d	1s.6d L
9**	312532	18s.0d	18s.5d	3s.3d		£2. 6s.9d	Pr. 5s.10d
190 0	323,876	20s.3d	24s.2d	3s.11d		£2.17s.2d	8s.5d
1	341,832	18s.7d	17s.6d	3s.8d		£2.17s.8d	Loss 1d L
2	346,615	17s.5d	17s.4d	3s.4d		£2.05s.5d	Pr. 2s.3d
3	352,479	16s.10d	17s.1d	3s.5d		£2. 6s.6d	2d
4.	352,479	16s.10d	15s.9d	3s.3d		£2.03s.6d	Loss 2d L
5	349,479	16s.4d	17s.0d	3s.4d		£2.06s.3d	7d
6	361,914	17s.9d	19s.4d	3s.7d		£2.10s.8d	8d
7	357,667	19s.1d	20s.11d	3s.5d		£2.13s.1d	1s.10d
8.	383,475	19s.3d	18s.2d	3s.7d		£2.10s2d	7d
9	371,966	18s.6d	17s.4d	3s.3d		£2.10s.2d	9d
1910	348,977	18s.7d	18s.8d	3s.5d		£2.10s.2d	1s0d
1	317,781	17s.9d	17s.3d	3s.5d		£2.08s.8d	1s.0d
12	386,608	18s.8d	21s.6d	3s.7d		£2.14s.8d	Loss 1s.3d L

+ Wages and Salaries
* Wages only
** Year ending December

Source: Profit and Loss Accounts, Cost Accounts &c. of Bell Brothers (Dorman, Long Collection).

APPENDIX B.4.

The Average Cost per ton of No1 Puddled Bar, 1868-1899

Year ending June	Wagers	Pig Iron	Puddling Ore	Coal	Miscellaneous Stores, fettling &c.	Total Cost
1868	15s.11d.	£2. 8s.11d.	7s. 3d.	6s.10d.	3s. 0d.	£4. 1s.11d.
1869	15s. 9d.	£2. 9s. 3d.	6s. 2d.	6s. 5d.	4s. 3d.	£4. 1s.10d.
1870	15s. 7d.	£2. 5s. 9d.	5s. 3d.	5s. 0d.	3s. 5d.	£3.15s. 0d.
1871	15s.11d.	£2. 4s.10d.	7s. 3d.	4s.10d.	4s. 2d.	£3.17s. 0d.
1872	17s. 8d.	£2. 6s. 2d.	8s. 2d.	5s. 8d.	5s. 0d.	£4. 2s. 8d.
1873	21s. 4d.	£3. 1s.10d.	8s. 1d.	10s. 0d.	4s.11d.	£5. 6s. 2d.
1874	21s. 4d.	£3. 0s. 1d.	8s. 8d.	7s. 1d.	4s. 7d.	£5. 1s. 9d.
1875	18s. 6d.	£2.14s.11d.	6s.10d.	6s. 6d.	4s. 2d.	£4.10s.11d.
1876	15s.11d.	£2.10s. 4d.	6s. 9d.	5s.11d.	4s. 2d.	£4. 3s. 1d.
1877	15s. 0d.	£2. 7s. 6d.	5s. 3d.	5s. 6d.	4s. 6d.	£3.17s. 9d.
1878	14s. 7d.	£2. 7s. 0d.	4s. 4d.	5s. 3d.	4s. 3d.	£3.15s. 5d.
1879	13s. 5d.	£2. 0s. 6d.	3s. 4d.	5s. 2d.	2s. 2d.	£3. 4s. 7d.
1880	13s. 9d.	£1.16s. 4d.	5s. 1d.	4s. 6d.	2s. 6d.	£3. 2s. 2d.
1881	14s. 2d.	£1.19s. 1d.	4s. 5d.	4s.10d.	3s. 0d.	£3. 5s. 6d.
1882	14s. 9d.	£1.19s. 7d.	4s. 2d.	5s. 1d.	3s. 7d.	£3. 7s. 2d.
1883	15s. 8d.	£2. 0s. 2d.	4s. 8d.	5s. 1d.	2s.11d.	£3. 8s. 6d.
1884	14s. 6d.	£1.18s. 1d.	2s.11d.	5s. 1d.	3s. 9d.	£3. 4s. 4d.
1885	13s. 4s.	£1.13s.11d.	1s.10d.	4s. 8d.	3s. 6d.	£2.17s. 3d.
1886	13s. 2d.	£1.12s. 8d.	1s. 3d.	4s.10d.	11d.	£2.15s. 9d.
1887	12s. 2d.	£1.12s.10d.	1s. 0d.	4s. 7d.	3s. 5d.	£2.14s. 0d.
1888	12s. 1d.	£1.14s. 5d.	1s. 0d.	4s.10d.	3s. 7d.	£2.15s.11d.
1889	13s. 0d.	£1.16s. 0d.	1s. 1d.	4s.11d.	2s. 0d.	£2.17s. 0d.
1890	15s. 2d.	£1.16s.11d.	1s. 3d.	5s. 8d.	3s. 3d.	£3. 2s. 3d.
1891	15s. 4d.	£1.19s.10d.	1s. 2d.	6s. 2d.	3s. 2d.	£3. 5s. 8d.
1892	14s. 6d.	£1.16s.10d.	1s. 0d.	6s. 3d.	5s. 6d.	£3. 4s. 1d.
1893	13s. 8d.	£1.14s. 3d.	1s. 2d.	6s. 0d.	2s. 8d.	£2.17s. 9d.
1894	13s. 4d.	£1.11s. 3d.	1s. 9d.	5s.10d.	2s. 7d.	£2.14s. 9d.
1895	13s. 5d.	£1.11s. 6d.	2s. 0d.	6s. 3d.	2s. 4d.	£2.15s. 6d.
1896	13s. 3d.	£1.13s. 0d.	1s.10d.	6s. 1d.	2s. 7d.	£2.16s. 9d.
1897	13s. 5d.	£1.15s. 3d.	1s. 7d.	5s. 9d.	2s. 0d.	£2.18s. 0d.
1898	13s. 7d.	£1.15s. 3d.	1s. 7d.	6s. 4d.	2s. 0d.	£2.18s. 9d.
1899	15s. 4d.	£1.11s. 3d.	1s.11d.	6s. 8d.	0	£2.15s. 2d.

Source: Private Cost Books. (DCRO: D/CO/97, 100, & 101).

APPENDIX B.5.

Iron Rails: Annual Average Cost per ton at Consett

Year Ending	Iron	Wages	Stores & Materials	Coal	Estimated Charges	Miscell-aneous	Total Av. Cost
I868	£4.I8s. 8d.	I3s. 9 d.	3s. 6 d.	3s. 6 d.	5s. 9 d.	2d.	£6. 4s.I0d.
I869	£5. 0s. 6d.	I3s. 0 d.	2s.I0 d.	3s. 2½d.	3s. 4 d.	3d.	£6. 3s. I½d.
I870	£4.I6s. 5d.	IIs.I0 d.	Is.II d.	2s. 5 d.	2s. 9 d.	-	£5.I5s. 3d.
I87I	£4.I9s. 0d.	IIs. 4½d.	Is. 9½d.	2s. 4 d.	3s. 5 d.	ld.	£5.I8s. 0d.
I872	£5. 4s. 9d.	I2s. 2 d.	2s. 0 d.	2s.I0 d.	2s. 8 d.	3d.	£6. 4s. 8d.
I873	£6.I3s. 0d.	I5s. I d.	2s. I d.	5s. I d.	3s. I½d.	ls.2d.	£7.I9s. 6d.
I874	£6. 3s. 9d.	I3s. 7 d.	Is.I0 d.	3s. 5 d.	4s. 0 d.	ls.2d.	£7. 7s. 9d.
I875	£6. 3s. 0d.	IIs. 9 d.	2s. 5 d.	3s. 0 d.	4s. 2½d.	ld.	£7. 4s. 6d.
I876	£5. 8s. 6d.	I0s. 3½d.	2s. 0 d.	2s. 9 d.	2s.I0 d.	ld.	£6. 6s. 6d.

Source: Private Cost Books (DCRO: D/CO/97, I00, & I0I).

APPENDIX B.6.

Iron Plates: Annual Average Cost per ton at Consett. (per ton)

Year ending	Cost of Iron	Wages	Cost of Coal	Miscellaneous	Total Av. Cost
1868	£5. 8s. 4d.	£1. 0s. 0d.	5s. 2d.	10s. 8d.	£7. 3s.10d.
1869	£5. 8s.10d.	19s.11d.	5s. 0d.	14s. 7d.	£7. 3s. 9d.
1870	£4.16s. 8d.	19s. 4d.	4s. 1d.	6s. 5d.	£6. 6s. 6d.
1871	£4.17s. 5d.	£1. 0s. 6d.	5s. 0d.	8s. 2d.	£6.11s. 1d.
1872	£5. 3s.11d.	£1. 1s. 3d.	4s.11d.	6s. 5d.	£6.16s. 6d.
1873	£6.12s. 0d.	£1. 5s. 2d.	8s. 9d.	9s. 4d.	£8.15s. 3d.
1874	£6.10s. 9d.	£1. 4s. 8d.	6s. 1d.	8s. 2d.	£8. 9s. 8d.
1875	£5.13s. 6d.	£1. 0s. 2d.	4s.11d.	7s.10d.	£7. 6s. 5d.
1876	£5. 5s. 6d.	18s. 3d.	4s.11d.	6s. 5d.	£6.15s. 1d.
1877	£4.17s. 4d.	17s. 2d.	4s. 4d.	1s. 9d.	£6. 0s. 7d.
1878	£4.15s. 3d.	16s. 9d.	4s. 2d.	4s. 4d.	£6. 0s. 6d.
1879	£4. 2s. 3d.	15s. 7d.	4s. 2d.	3s. 3d.	£5. 5s. 3d.
1880	£3.18s. 6d.	14s. 9d.	3s. 4d.	3s. 7d.	£5. 0s. 2d.
1881	£4. 2s.11d.	14s. 2d.	3s. 4d.	3s. 7d.	£5. 4s. 0d.
1882	£4. 4s. 8d.	14s. 1d.	3s. 5d.	4s. 2d.	£5. 6s. 4d.
1883	£4. 7s. 1d.	14s.10d.	3s. 3d.	3s. 4d.	£5. 8s. 6d.
1884	£4. 0s. 1d.	14s. 1d.	3s. 5d.	5s. 1d.	£5. 2s. 8d.
1885	£3.10s. 1d.	13s. 2d.	3s. 3d.	4s. 3d.	£4.10s. 9d.
1886	£3. 8s. 6d.	13s. 4d.	3s. 4d.	3s. 4d.	£4. 8s. 6d.
1887	£3. 6s. 7d.	12s.10d.	3s. 2d.	3s. 2d.	£4. 5s. 9d.
1888	£3. 9s.11d.	12s.10d.	3s. 6d.	3s. 6d.	£4. 9s. 9d.
1889	£3.12s. 7d.	13s. 8d.	3s. 4d.	3s. 9d.	£4.13s. 4d.
1890	£3.18s. 9d.	15s. 4d.	3s. 9d.	2s.11d.	£5. 0s. 9d.
1891	£4. 3s. 5d.	15s. 8d.	4s. 1d.	3s. 6d.	£5. 6s. 8d.
1892	£3.17s. 5d.	15s. 2d.	4s. 1d.	3s. 9d.	£5. 0s. 5d.
1893	£3.12s.11d.	14s.10d.	3s.10d.	2s. 7d.	£4.14s. 2d.
1894	£3. 9s. 5d.	14s. 2d.	3s. 8d.	2s.10d.	£4.10s. 1d.
1895	£3. 9s. 7d.	14s. 4d.	4s. 0d.	3s. 8d.	£4.11s. 7d.
1896	£3.11s. 5d.	14s. 3d.	4s. 0d.	3s. 3d.	£4.12s.11d.
1897	£3.12s.11d.	14s. 4d.	3s.11d.	2s. 3d.	£4.13s. 5d.
1898	£3.14s. 3d.	14s. 4d.	4s. 3d.	3s. 2d.	£4.16s. 0d.
1899	£3. 9s. 6d.	14s.10d.	4s. 5d.	3s. 4d.	£4.12s. 1d.

Source: Private Cost Books (DCRO: D/CO/97, 100, & 101).

APPENDIX B.7.(i)

Steel Ingots (East & West Shop): Annual Average Cost per ton

Year ending December	Cost of Pig Iron	Cost of Iron Ore	Cost of Coal	Wages	Miscellaneous	Total Av. Cost	Total Av.* cost(N.Shop)
I883	£2.I7s. 6d.	4s. 7d.	4s. Id.	I2s.IId.	6s. 4d.	£4. 5s. 5d.	
I884	£2. 8s. 6d.	3s. 4d.	2s. 2d.	8s.I0d.	3s. 6d.	£3. 6s. 5d.	
I885	£2. 5s. 4d.	3s. Id.	2s. 3d.	7s. 0d.	3s. 0d.	£3. 0s. 7d.	
I886	£2. 2s. 6d.	3s. Id.	2s. Id.	5s. 8d.	Is. 8d.	£2.I5s. Id.	
I887	£2. 3s. 7d.	3s.I0d.	2s. Id.	5s. 5d.	Id.	£2.I4s. 6d.	
I888	£2. 4s.IId.	3s. 9d.	2s. Id.	5s. 5d.	IId.	£2.I7s. 0d.	
I889	£2. 7s. 3d.	4s. 4d.	2s. 3d.	5s. 5d.		£2.I8s. 9d.	
I890	£2.I0s. 2d.	3s.IId.	2s. 6d.	5s.I0d.	I0d.	£3. 2s. 8d.	
I89I	£2. 6s. 7d.	3s. 7d.	2s.I0d.	5s. 4d.	4s. 0d.	£3. 2s. 4d.	
I892	£2. 6s. 9d.	3s. 7d.	2s. 7d.	5s. 3d.	4s. 6d.	£3. 2s. 8d.	
I893	£2. Is. 5d.	3s. 2d.	2s. 4d.	4s.I0d.	3s.IId.	£2.I5s. 7d.	£2.I5s. 0d.
I894	£2. 0s. 7d.	3s. 0d.	2s. 4d.	4s. 8d.	3s. 8d.	£2.I4s. 4d.	£2.I3s. 4d.
I895	£I.I9s. Id.	2s.IId.	2s. 4d.	4s. 7d.	3s. 5d.	£2.I2s. 3d.	£2.I3s. 2d.
I896	£I.I9s. 7d.	3s. Id.	2s. Id.	4s. 7d.	3s. 0d.	£2.I2s. 5d.	£2.I2s. 6d.
I897	£2. 2s. 6d.	2s. 8d.	2s. 2d.	4s. 8d.	3s. 5d.	£2.I5s. 6d.	£2.I5s. 4d.
I898	£2. 3s. 5d.	2s.I0d.	2s. 2d.	4s.I0d.	3s. 4d.	£2.I6s. 6d.	£2.I6s. 6d.
I899	£2. 7s. 2d.	3s. 7d.	2s. 7d.	5s. 6d.	3s. 4d.	£3. 2s. 2d.	£3. 0s.IId.
I900	£2.I7s. 3d.	3s. 4d.	3s. 5d.	6s. 4d.	3s. 7d.	£3.I4s. 0d.	£3.I2s. 6d.
I90I	£2.I2s. Id.	3s. 5d.	3s. 9d.	5s. 7d.	4s. 8d.	£3. 9s. 6d.	£3. 8s. 2d.
I902	£2. 7s. 5d.	3s. 0d.	3s. 5d.	5s. 5d.	4s. 3d.	£3. 3s. 6d.	£3. 2s.I0d.
I903	£2. 7s. 2d.	2s.I0d.	3s. 3d.	5s. 2d.	3s. 6d.	£3. 2s. 0d.	£3. Is. 5d.
I904	£2. 6s.I0d.	3s. 0d.	3s. 7d.	5s. 0d.	3s. 8d.	£3. Is. 7d.	£3. 0s.I0d.
I905	£2.I0s. 2d.	3s. Id.	3s. 0d.	5s. 0d.	3s. 8d.	£3. 5s. 0d.	£3. 4s. 8d.
I906	£2.I5s. 6d.	3s. 4d.	3s. 7d.	5s. 2d.	3s. 0d.	£3.I0s. Id.	£3.IIs. 0d.
I907	£2.I9s. 2d.	3s. 4d.	3s. 4d.	5s.I0d.	4s. 0d.	£3.I5s. 7d.	£3.I4s. 9d.
I908	£2.I3s. 4d.	3s. 2d.	3s.IId.	6s. 7d.	6s. 0d.	£3.I3s. 0d.	£3. 9s. 6d.
I909	£2. 9s. 7d.	3s. 5d.	3s. 6d.	5s. 6d.	4s. 5d.	£3. 6s. 5d.	£3. 5s. 4d.
I9I0	£2. Is. 5d.	3s. 7d.	3s. 4d.	5s. 5d.	I4s. 0d.	£3. 7s. 8d.	£3. 7s. 7d.
I9II	£I.I8s. 2d.	3s. 7d.	3s. 7d.	5s. 7d.	I8s. 4d.	£3. 8s.I0d.	£3. 6s. 9d.
I9I2	£2. 0s. 3d.	3s. 0d.	3s. 4d.	5s. 7d.	I3s.I0d.	£3. 6s. 0d.	£3.I0s. 0d.
I9I3	£2. 3s. 8d.	4s. 0d.	3s. 8d.	5s.I0d.	I4s. 2d.	£3.IIs. 5d.	£3.I5s. 9d.
I9I4	£2. 0s. 7d.	3s. 4d.	4s. 2d.	6s. 2d.	I9s. 2d.	£3.I3s.IId.	

* Year ending June.
Source: Private Cost Books (DCRO: D/CO/97, I00,&I0I).

APPENDIX B.7.(ii)

Steel Ingots: Annual Average Costs per ton at Britannia Steelworks. 1906-1913

Year	Cost of Iron	Cost of Coal	Wages	Miscellaneous	Total Av. Cost
1906	£2.10s. 2d.	3s.11d.	4s. 6d.	12s. 6d.	£3.11s. 1d.
1907	£2.14s. 0d.	4s. 9d.	4s.10d.	13s. 4d.	£3.16s.11d.
1908	£2.10s.11d.	4s. 8d.	5s. 1d.	13s. 7d.	£3.14s. 3d.
1909	£2. 8s. 2d.	3s.11d.	4s.10d.	12s. 9d.	£3. 9s. 8d.
1910	£2.11s. 9d.	4s. 7d.	4s. 5d.	13s.10d.	£3.14s. 7d.
1911	£2.11s. 8d.	4s. 1d.	4s. 6d.	14s. 4d.	£3.14s. 7d.
1912	£2.12s. 4d.	4s. 8d.	4s. 9d.	14s. 8d.	£3.16s. 5d.
1913	£3. 3s. 4d.	5s. 9d.	4s.11d.	16s. 1d.	£4.10s. 1d.

Source: The Dorman Long M.SS.

APPENDIX B.8.

Steel Plates: Annual Average Costs per ton

Year ending	Cost of Slabs & Ingots	Cost of Coal	Wages	Miscellaneous	Total Av. Cost
1884	£5.10s. 1d.	3s. 5d.	14s. 1d.	5s. 0d.	£6.12s. 7d.
1885	£4. 7s. 5d.	2s.11d.	12s. 5d.	3s. 1d.	£5. 5s.10d.
1886	£3.14s. 6d.	2s. 3d.	11s. 2d.	4s. 2d.	£4.12s. 1d.
1887	£3. 3s. 4d.	1s.10d.	9s. 1d.	3s. 5d.	£3.17s. 7d.
1888	£3. 9s. 0d.	1s.11d.	8s. 2d.	4s.10d.	£4. 3s.11d.
1889	£3. 9s. 8d.	1s.10d.	8s. 3d.	4s. 2d.	£4. 4s. 0d.
1890	£3.14s.11d.	1s.11d.	8s.10d.	4s. 1d.	£4. 9s. 8d.
1891	£3.16s. 2d.	2s. 0d.	9s. 0d.	3s.10d.	£4.11s. 0d.
1892	£3.14s. 4d.	2s. 1d.	8s. 7d.	3s.10d.	£4. 8s.10d.
1893	£3. 9s. 1d.	2s. 0d.	8s. 7d.	3s.11d.	£4. 3s. 7d.
1894	£3. 6s. 4d.	2s. 0d.	8s. 6d.	3s. 7d.	£4. 0s. 5d.
1895	£3. 3s.10d.	2s. 1d.	9s. 0d.	3s. 8d.	£3.18s. 7d.
1896	£3.10s.11d.	1s.11d.	8s. 7d.	2s. 1d.	£3.13s. 6d.
1897	£3. 3s. 1d.	1s.11d.	9s. 1d.	2s. 5d.	£3.16s. 6d.
1898	£3. 4s. 8d.	2s. 1d.	9s. 1d.	2s. 9d.	£3.18s. 7d.
1899	£3. 6s. 6d.	2s. 1d.	9s. 5d.	4s. 0d.	£4. 2s. 0d.
1900	£3.18s. 4d.	2s. 5d.	10s. 4d.	3s. 2d.	£4.14s. 2d.
1901	£4.11s. 7d.	2s.10d.	10s.11d.	3s. 5d.	£5. 8s. 8d.
1902	£4. 1s. 5d.	2s. 7d.	9s.11d.	3s. 2d.	£4.17s. 1d.
1903	£3.17s. 1d.	2s. 6d.	9s. 5d.	2s.11d.	£4.11s.11d.
1904	£3.17s.11d.	2s. 4d.	9s. 1d.	1s. 8d.	£4.11s. 0d.
1905	£3.17s. 7d.	2s. 4d.	9s. 1d.	2s. 7d.	£4.11s. 7d.
1906	£4. 1s. 4d.	2s. 2d.	9s. 2d.	2s. 7d.	£4.15s. 4d.
1907	£4. 8s. 5d.	2s. 4d.	9s.11d.	2s. 8d.	£5. 3s. 4d.
1908	£4.16s. 7d.	3s. 0d.	11s. 2d.	4s. 6d.	£5.15s. 4d.
1909	£4. 5s. 2d.	3s. 2d.	10s.11d.	3s. 2d.	£5. 2s. 6d.
1910	£4. 4s. 3d.	2s.10d.	10s. 5d.	3s. 6d.	£5. 1s. 0d.
1911	£4. 4s.11d.	2s. 6d.	10s.10d.	3s. 1d.	£5. 1s. 4d.
1912	£4. 3s. 0d.	2s. 5d.	11s. 0d.	3s.10d.	£5. 1s. 2d.
1913	£4. 7s. 1d.	2s.10d.	11s. 1d.	4s. 6d.	£5. 5s. 6d.
1914	£4.13s. 8d.	3s. 1d.	12s. 1d.	5s. 6d.	£5.14s. 5d.

Source: Private Cost Books (DCRO: D/CO/97, 100, & 101).

APPENDIX B.9.

Average Cost per ton of Steel Angles, 1893-1913

Year ending	Slabs	Wages	Coal	Miscellaneous Scrap, Stores &c.	Total Cost
1893	£3. 9s. 6d.	9s.11d.	3s. 0d.		£4. 6s. 9d.
1894	£3. 6s. 0d.	7s.10d.	2s. 1d.	5s. 5d.	£3.18s. 4d.
1895	£3. 4s. 2d.	8s. 1d.	2s. 8d.	4s.10d.	£3.15s.10d.
1896	£3. 3s. 1d.	7s. 3d.	2s. 4d.	2s.11d.	£3.12s. 0d.
1897	£3. 4s.10d.	7s. 2d.	2s. 3d.	3s. 2d.	£3.13s. 6d.
1898	£3. 6s. 8d.	6s.10d.	2s. 4d.	2s. 6d.	£3.13s. 9d.
1899	£3.10s. 2d.	6s. 5d.	2s. 2d.	2s. 6d.	£3.15s. 8d.
1900	£4. 1s. 9d.	7s. 2d.	2s. 5d.	2s. 7d.	£4. 5s. 9d.
1901	£4.12s. 2d.	7s. 9d.	2s.11d.	2s.11d.	£4.18s. 1d.
1902	£4. 0s. 4d.	7s. 3d.	2s.10d.	3s. 0d.	£4. 7s. 8d.
1903	£3.15s.11d.	7s. 3d.	2s. 9d.	3s. 0d.	£4. 3s. 6d.
1904	£3.16s. 4d.	7s. 6d.	2s. 9d.	2s.10d.	£4. 3s. 6d.
1905	£3.16s. 9d.	7s. 3d.	2s. 8d.	2s. 6d.	£4. 4s. 1d.
1906	£4. 4s. 0d.	7s. 0d.	2s. 7d.	3s. 0d.	£4.10s. 6d.
1907	£4.13s. 4d.	7s. 8d.	2s. 9d.	3s. 1d.	£5. 0s. 0d.
1908	£4.16s. 3d.	9s. 2d.	3s. 4d.	3s. 4d.	£5. 4s. 9d.
1909	£3.19s.10d.	9s. 0d.	3s. 7d.	3s. 4d.	£4.13s. 4d½
1910	£4. 7s. 2d.	8s. 1d.	3s. 3d.	2s. 2d.	£4.12s.11d.
1911	£4.10s.10d.	8s.10d.	3s. 1d.	2s.11d.	£4.16s. 5d.
1912	£4. 4s. 4d.	8s. 3d.	2s.10d.	3s. 2d.	£4.11s. 0d.
1913	£4.12s. 8d.	8s. 6d.	3s. 3d.	4s. 2d.	£5. 0s. 9d.

Source: Private Cost Books (DCRO: D/CO/97, 100, & 101).

APPENDIX C.I.

Annual Summary of Production for the Consett Iron Company, 1865-1914

Year ending	Coal Raised	Coke Produced	Pig Iron	Puddled Bars	Iron Plates	Iron Rails	Steel Ingots	Steel Plates	Steel Angles
1865	354,499	132,158	86,804	47,651	17,898	13,893			
1866	394,009	144,294	92,068	48,595	18,318	18,901			
1867	442,912	139,722	62,203	41,113	18,599	11,782			
1868	492,227	179,362	78,129	59,774	30,335	14,502			
1869	496,407	189,415	67,690	58,832	25,367	21,179			
1870	495,843	191,051	87,493	74,404	27,636	30,152			
1871	522,589	206,987	100,122	86,910	33,669	32,027			
1872	524,664	202,815	106,884	90,025	40,838	24,689			
1873	620,433	200,661	115,445	99,413	46,721	25,836			
1874	667,416	243,078	124,790	105,896	50,368	29,321			
1875	704,708	229,957	124,573	113,815	53,488	28,684			
1876	706,034	289,327	108,773	98,218	47,251	17,708			
1877	760,612	344,575	103,717	77,046	56,668	2,479			
1878	713,343	318,916	102,290	13,743	56,237				
1879	715,062	322,942	104,809	75,330	57,493				
1880	851,538	365,533	144,221	92,133	69,576				
1881	1,061,388	481,355	190,568	111,381	86,020				
1882	1,056,265	492,237	181,906	105,744	83,209				
1883	1,054,655	489,071	209,827	110,384	81,933		393		
1884	958,318	458,078	172,349	83,364	69,175		9,454	5,544	
1885	850,462	413,899	163,785	71,024	58,776		21,088	12,914	
1886	834,318	401,956	162,761	48,978	42,360		43,841	26,934	
1887	834,598	412,810	167,466	40,427	34,442		58,214	40,184	
1888	847,351	394,975	160,606	32,648	26,148		103,927	66,951	
1889	904,821	408,256	193,455	34,740	20,707		154,273	107,161	
1890	1,033,534	472,224	209,033	35,481	20,515		161,410	112,136	
1891	1,100,545	470,234	202,856	33,628	21,412		173,690	119,515	
1892	823,002	320,258	142,478	16,417	14,770		176,487	118,146	
1893	985,422	374,230	171,197	15,641	12,957		179,634	109,250	7,037
1894	1,137,143	404,536	192,119	16,152	12,366		218,864	111,583	46,391
1895	1,147,851	438,740	230,648	14,752	11,498		215,007	109,925	45,836
1896	1,185,817	446,131	212,660	16,594	11,859		238,486	119,353	55,000
1897	1,282,247	501,980	261,464	21,606	16,152		266,242	122,081	67,987
1898	1,394,486	509,493	254,921	21,328	15,636		253,180	122,711	75,237
1899	1,484,991	539,993	258,730	4,103	3,220		277,410	123,841	83,847
1900	1,520,114	613,108	241,919				268,670	121,185	76,484
1901	1,462,752	524,326	236,566				258,545	117,242	69,004
1902	1,400,662	452,150	206,090				248,239	113,451	59,123
1903	1.500,506	489,715	223,601				253,829	121,911	72,934
1904	1,600,590	491,837	234,524				300,470	142,362	72,688
1905	1,668,198	501,042	241,456				297,511	140,583	76,833
1906	1,819,120	540,228	242,932				310,216	144,720	88,001
1907	2,053,438	570,084	245,306				302,564	141,374	89,106
1908	2,052,393	536,490	222,522				255,504	113,227	64,933
1909	2,241,563	464,508	177,520				223,811	99,775	55,321
1910	2,316,145	598,329	256,105				296,604	126,398	80,437
1911	2,341,216	567,871	266,326				300,839	127,466	74,002
1912	2,118,642	464,959	235,080				295,061	125,561	86,687
1913	2,348,839	555,198	271,508				314,091	138,078	91,149
1914	2,171,505	469,296	231,258				269,112	118,053	64,098

Source: 1865-1871 - Profit & Loss Accounts (DCRO: D/CO/89).
1872-1939 - Private Cost Books (DCRO: D/CO/97, 100, 101, 102, 103).

CHART C.1

OUTPUT OF COAL FROM CONSETT'S COLLIERIES, 1865-1914
(Semi-logarithmic Scale)

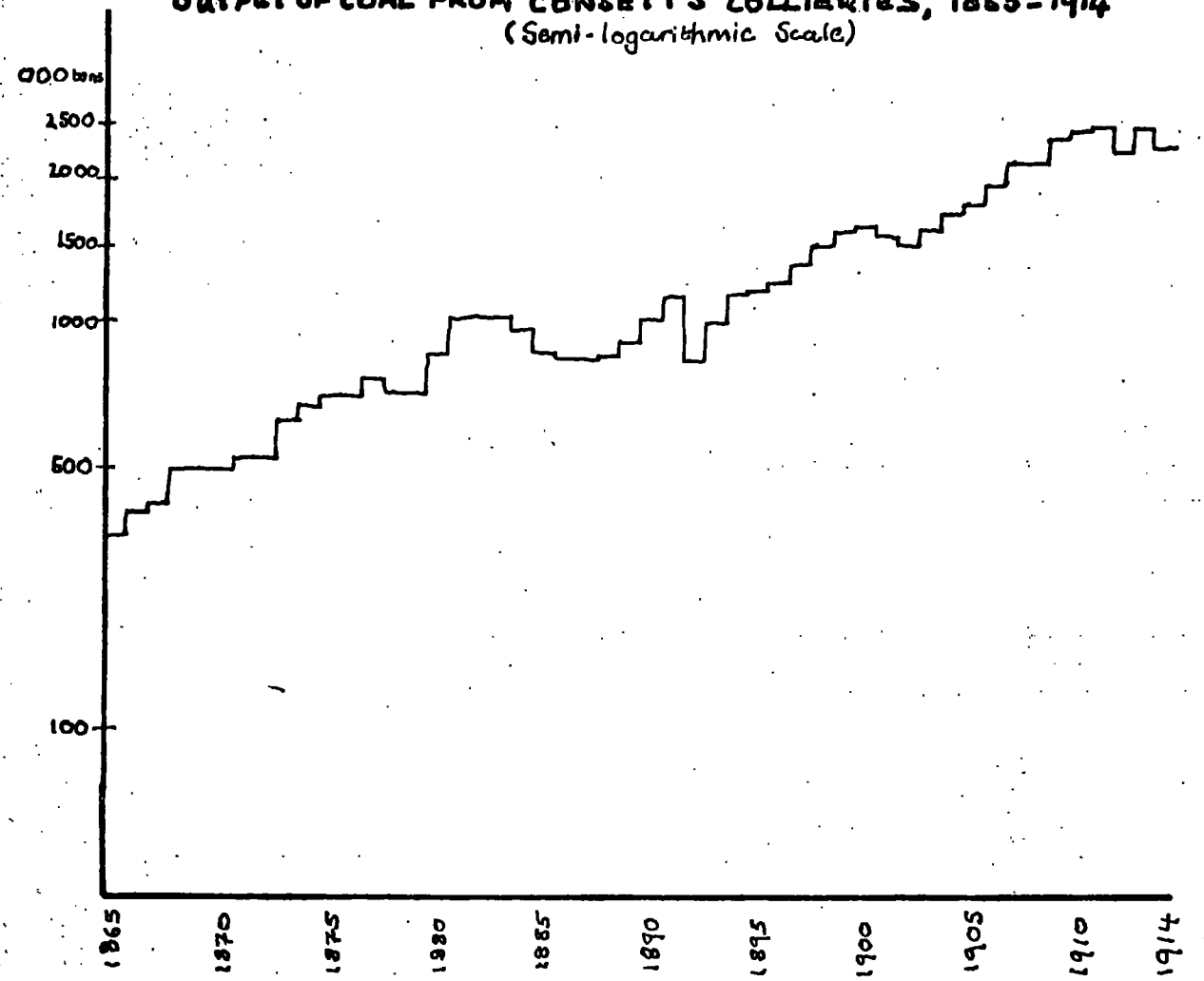


CHART C.2

OUTPUT OF COKE FROM CONSETT'S OVENS, 1865-1914.
(Semi-logarithmic Scale).

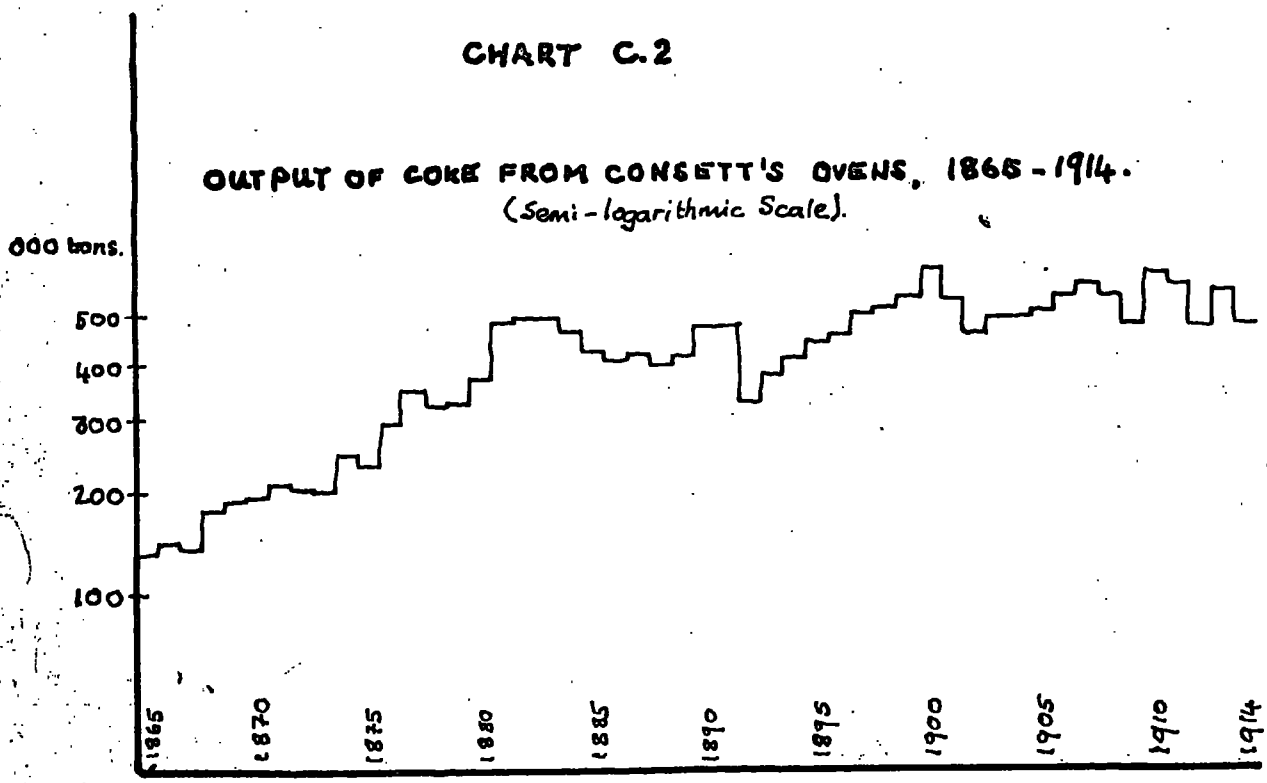


CHART C.3

OUTPUT OF PIG IRON AT CONSETT, 1865-1914. (Semi-logarithmic Scale).

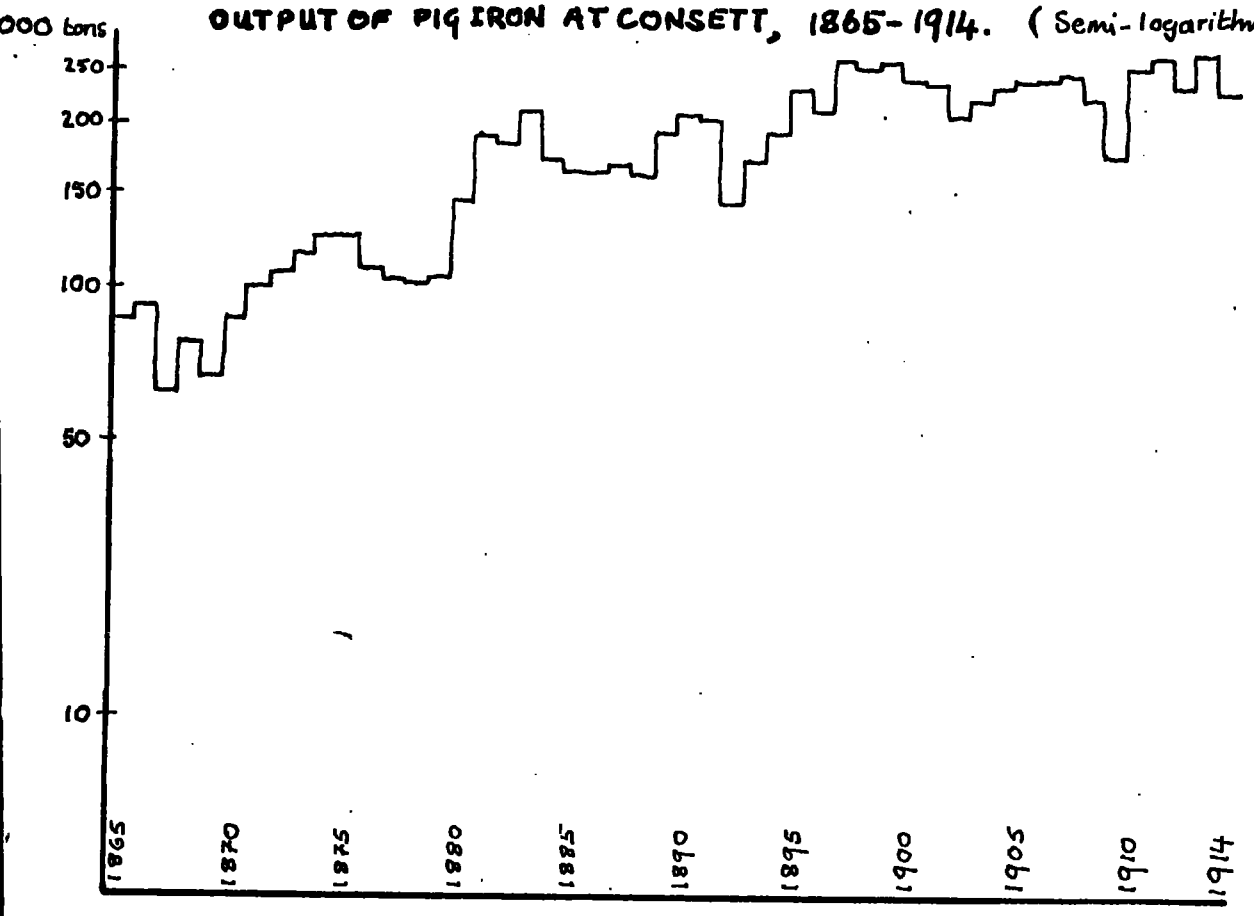


CHART C.4

OUTPUT OF PUDDLED BARS AT CONSETT, 1865-1899.
(Semi-logarithmic Scale).

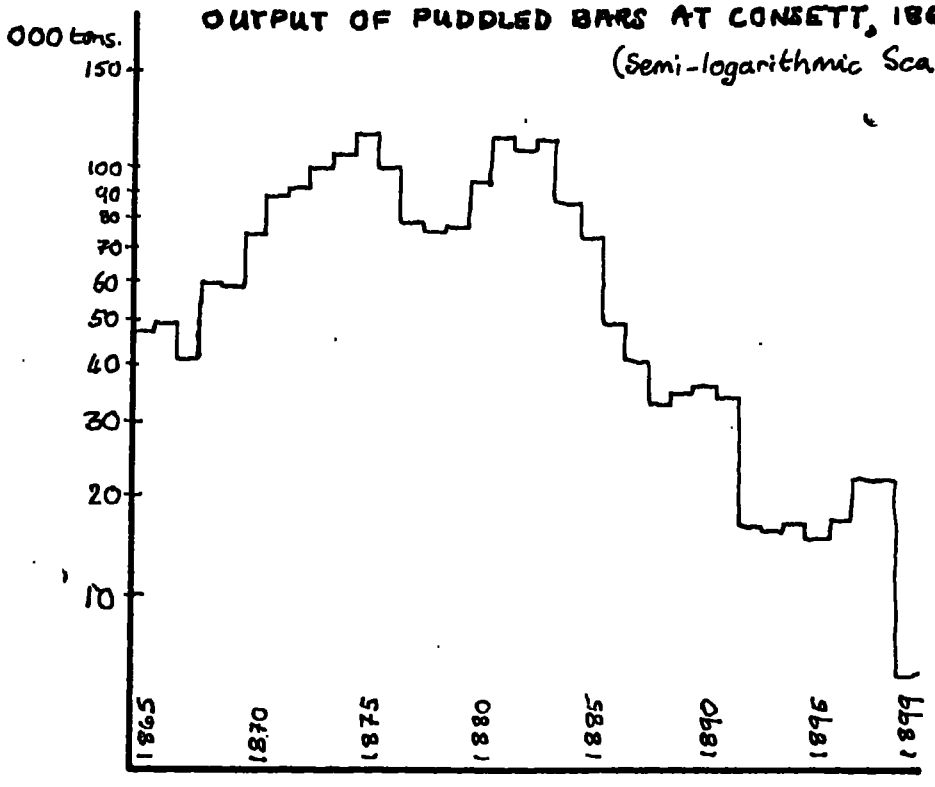


CHART C.5

000 tons. OUTPUT OF IRON PLATES AT CONSETT, 1865-1899.

(Semi-log. Scale).

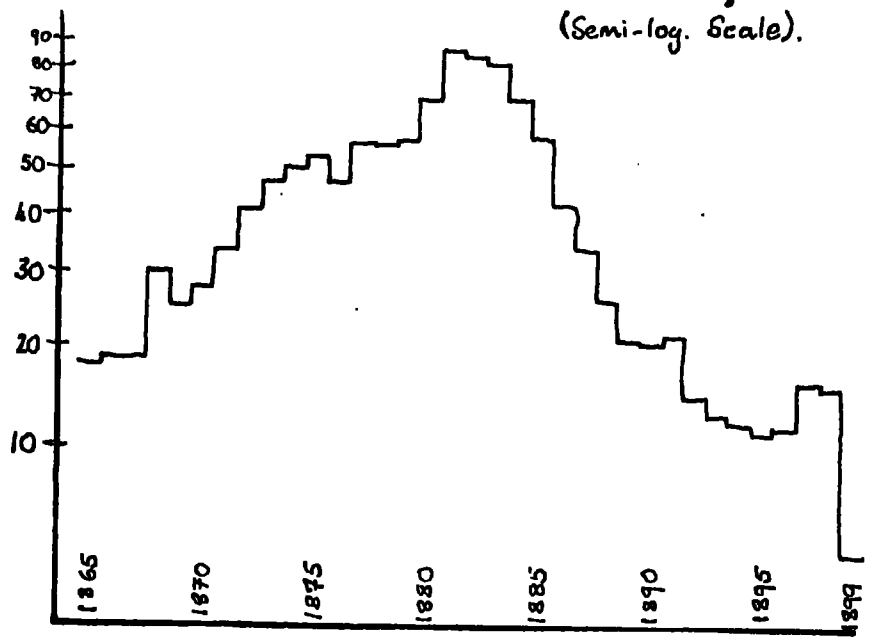


CHART C.6

OUTPUT OF STEEL INGOTS AT CONSETT, 1884-1914.

(Semi-log. Scale).

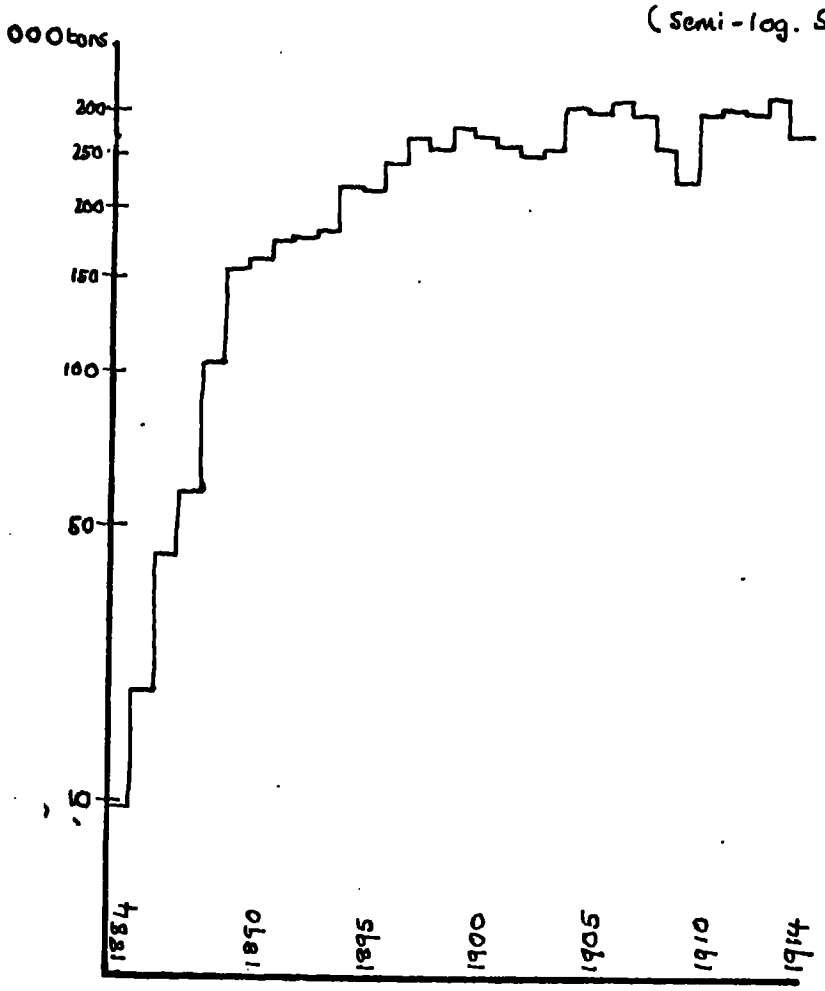


CHART C.7

OUTPUT OF STEEL PLATES AT CONSETT, 1884-1914.

(Semi-log. Scale)

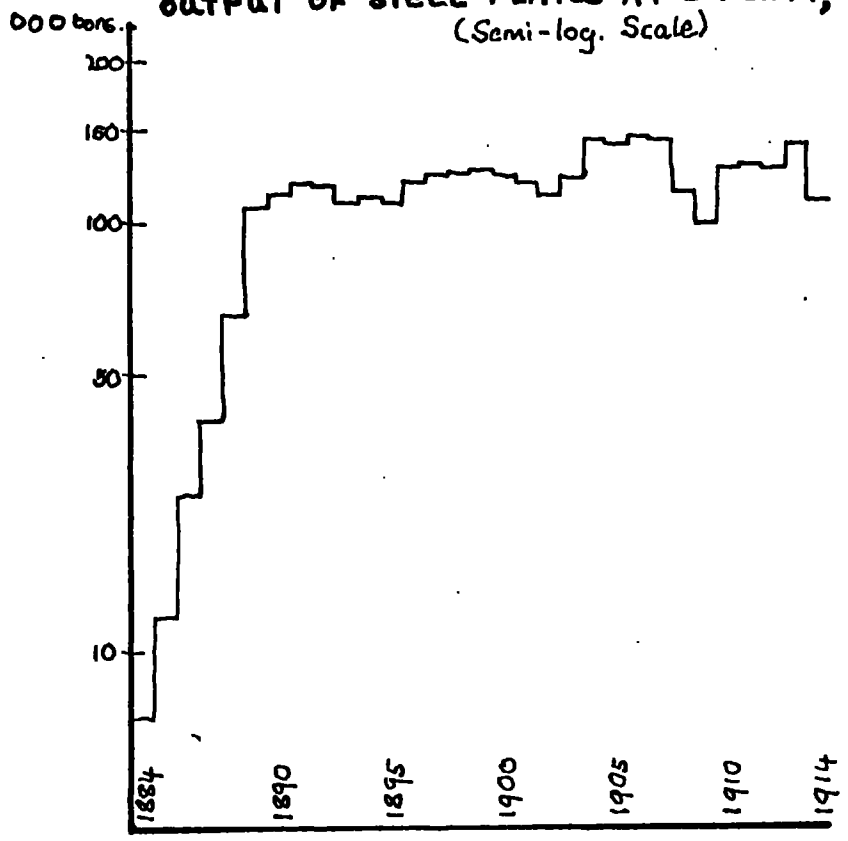
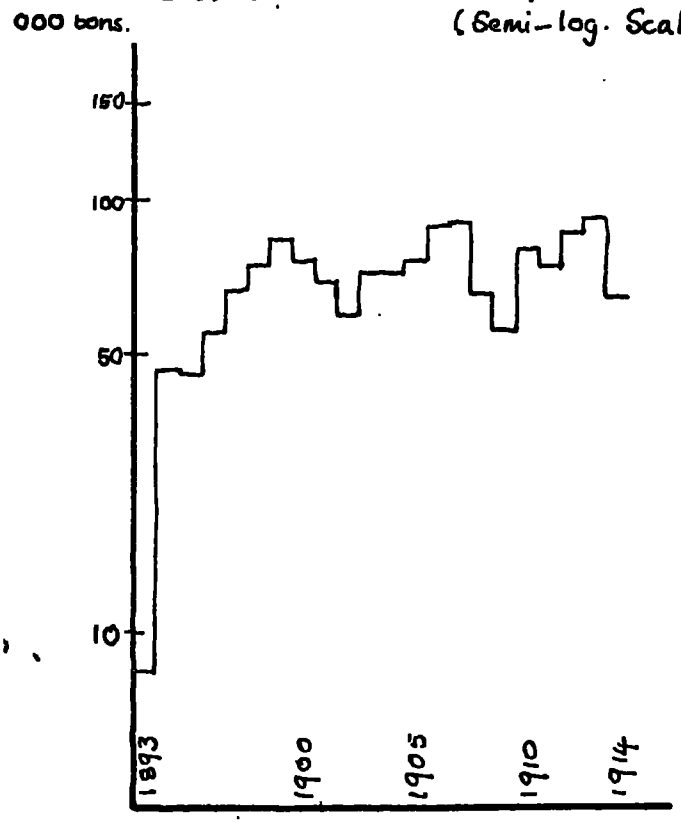


CHART C.8

OUTPUT OF STEEL ANGLES AT CONSETT, 1893-1914.

(Semi-log. Scale).



APPENDIX D.I.

Number of Men Employed at Consett's Collieries 1896-1914

Year	Langley Park	Garsfield	Chopwell	Westwood	Consett (6 Pits)	Total
1896	519	586		541	1878	3524
1897	520	540	222	549	2006	3837
1898	553	584	219	585	2088	4029
1899	639	549	336	598	2062	4184
1900	650	578	405	610	2107	4350
1901	688	593	527	169	2211	4188
1902	783	592	674	28	2228	4305
1903	909	617	757	33	2219	4535
1904	1045	700	899	29	2270	4943
1905	1104	780	1238	40	2339	5501
1906	1084	904	1392	451	2359	6190
1907	1056	937	1513	594	2416	6516
1908	1172	1070	1745	631	2498	7116
1909	1326	1226	2075	721	2607	7955
1910	1320	1199	2243	767	2659	8188
1911	1378	1183	2344	775	2350	8030
1912	1400	1142	2176	809	2532	8059
1913	1332	1013	2296	838	2435	7914
1914	1299	964	2295	617	2195	7370

Source: N.C.B. Statistical Returns (DCRO)

APPENDIX D.2.

Wage Adjustments in the Durham Coal Trade. I872-I906

Date at which the Adjustment took effect	% Advance	% Reduction	Date at which the Adjustment took effect	% Advance	% Reduction
February I872	20		March I893		5
July I872	I5		October I893	5	
February I873	I5		May I895		7½
April I874		I0	October I895		2½
November I874		9	August I897	2½	
April I875		5	May I898	2½	
February I876		7	October I898	2½	
SeptemberI876		6	AprilI899	2½	
April I877		7½	July I899	2½	
May I879		8¾	November I899	3¾	
July I879		I¼	February I900	5	
December I880	2½		May I900	7½	
April I882	3¾		August I900	I0	
August I882		I¼	November I900	I0	
May I885		I¼	February I90I		I¼
May I886		I¼	May I90I		II¼
February I888	I¼		August I90I		7½
May I888		I¼	November I90I		5
August I888		I¼	February I902		I¼
November I888	I¼		May I902		2½
February I889	I¼		August I902		2½
August I889	I0		February I903	I¼	
December I889	I0		May I903		I¼
March I890	5		August I903		I¼
December I890	5		February I904		I¼
June I892		I0	May I904		2½
November I904		I¼			
February I906	I¼				
August I906	2½				
November I906	I¼				

Source: I872-I906, John Wilson, "A History of the Durham Miners' Association I870-I904", Appendix II PP. 356-357.

APPENDIX E.2.

Coal and Coke Sold by the Consett Iron Company

Year Ending June	Consett		Westwood		Langley Park		Chopwell & Garesfield		Grand Total	
	Coal	Coke	Coal	Coke	Coal	Coke	Coal	Coke	Coal	Coke
1868	16044	74,129							16044	74129
1869	13794	98375							13794	98375
1870	16476	87494							16476	87494
1871	16852	88755							16852	88755
1872	15337	80996	2000	2229					17337	83225
1873	10524	69065	28411	28411					10524	97476
1874	8148	72856		40591					8148	113447
1875	17333	79070		50081					17333	129151
1876	16903	93,572		60898					16903	154470
1877	17103	119116		68363	61	19631			17164	207110
1878	17982	92632		64774	288	27974			18270	185380
1879	18041	84023		59130	214	51021			18255	194174
1880	19961	51677		76098	79	73713			20040	201488
1881	21491	86044		90682	119	81285			21610	258011
1882	20491	100267		93383	203	92227			20694	285877
1883	14537	64012		88494	263	93713			14800	246218
1884	9266	82549		86730	225	92033			9491	261312
1885	16401	49382		86997	251	79130			16652	215509
1886	17537	27960		85281	330	91263			17867	204504
1887	9929	32727	2803	79452	418	93998			13150	206177
1888	12498	25251	6076	87947	493	90897			19067	204095
1889	8848	1232	7558	86467	599	94939			17005	182638
1890	9542	1935	12232	87516	1057	118683	14529	19601	37360	227735
1891	12861	2917	16837	81464	972	111123	36589	37965	67259	233469
1892	10893	1524	25930	63172	492	77657	51390	18359	88705	160712
1893	10409	670	25704	70573	211	105839	76435	18944	112759	196026
1894	43464	1177	33100	72188	13074	112187	95079	24280	184717	209832
1895	10727	1690	28166	58678	7847	111860	88035	35498	134,775	207726
1896	14386	1688	17661	72222	8356	118067	99633	39513	138036	231490
1897	15868	808	24111	79166	11959	115516	82763	48759	134701	244248

APPENDIX E.2. continued

Year ending June	Consett		Westwood		Langley Park		Chopwell & Garesfield		Grand Total	
	Coal	Coke	Coal	Coke	Coal	Coke	Coal	Coke	Coal	Coke
1898	8778	743	42443	78810	75878	122123	*42797 64984	47385	234880	249071
1899	14320	3666	50039	76779	123788	126781	47955 62700	*13710 50751	298802	271687
1900	15350	20765	45923	79508	145705	126352	18264 57131	58006 51713	282373	336344
1901	18075	1429	45449	55446	156802	116393	47503 74717	58815 44451	342556	271534
1902	22982	646	-	-	166588	123432	133973 80400	43767 52725	403943	220570
1903	10987	-	-	-	196776	121658	127888 86170	73236 52635	421821	247529
1904	11348	-	-	-	237045	117744	159163 95670	67635 51116	503226	236500
1905	9253	-	-	-	263057	123562	184654 102557	70577 52478	559521	246617
1906	8462	3167	12951	23067	277212	128061	188906 141626	85458 54004	629157	293757
1907	7282	11877	64910	55660	256769	129056	218471 174234	101695 52970	721666	351078
1908	49630	18678	72561	61047	221614	126420	250735 183955	101480 52089	778495	359714
1909	83491	20614	122788	43884	276599	126344	388108 225172	100385 51732	1096158	342959
1910	8540	756	127346	38746	234099	123547	479544 197905	102817 51532	1047434	317398

Appendix E.2. continued

Year ending June	Consett		Westwood		Langley Park		Chopwell & Garesfield		Grand Total	
	Coal	Coke	Coal	Coke	Coal	Coke	Coal	Coke	Coal	Coke
1911	7808	377	139280	27842	272299	11402	212798 489451	49319 102257	1121636	291177
1912	9819	888	164730	7596	267902	83050	173164 460012	44531 84477	1075637	220542
1913	9242	1431	200765	-	256789	116553	182154 467186	49613 96242	1116496	263839
1914	7647	5557	229691	-	251954	87778	170813 484602	35499 82795	1144707	211629

APPENDIX F.

Copy of a letter to Sir Edward Grey, Bart. re: Ouenza Mines DIR.MIN. January 16th 1914. p.172,D/CO/43.

"Sir,

Well shall be much obliged if you can see your way to give us some assistance in Paris in the matter of the deposits of Hematite Iron Ore situated at Ouenza in Algeria.

A statement of the history of the findings and subsequent action taken by us, in conjunction with others, of these deposits is enclosed.

We fear that the situation is now getting beyong our control and that unless some pressure can be brought to bear in the most influential quarters in Paris, this valuable deposit will be lost to the British Steel Trade.

We should like to point out that the Consett Iron Company is entirely dependent upon foreign ores to supply its steelworks. In the year 1872, this company went into partnership with three other firms (important iron-making firms) to form the Orconera Iron Ore Company, which has since worked very large deposits of iron ore, near Bilbao, in Spain. The Orconera Company, anticipating the exhaustion of these deposits, acquired additional and somewhat extensive deposits in the neighbourhood of Santander, but these also are within measurable distance of being worked out. With a view to replacing these resources Consett Company took a large interest in the Dunderland Iron Ore Company formed to work deposits in Norway, but so far has not been successful.

We are receiving from Breira in Algeria, and supplied a great part of the money required for opening up these mines.

We mention this to show what efforts have been necessary in the past to keep ourselves supplied with ore, and what a serious thing it will be to be deprived of our share of these deposits at Ouenza. These deposits, which were looked at askance by French Works a dozen years ago, are now recognised by them as valuable. This recognition of the value of the deposits would appear to have had some connection with the efforts that have more recently been made to deprive the foreign firms of their initial interest, and to favour the French Steel makers.

We are told by the two German firms concerned (Gewerk Schaft Deutscher Kaiser, Hamborn and the Gelsenkirchener Bergwerks Aktiengesellschaft, Hochofen, Gelsenkirchen) in the Ouenza scheme, that the German Government are moving in Paris to protect the interests of their traders, and we venture to hope that our Foreign Office may be able to use its influence on our behalf.

The plan we have always worked on is to secure ourselves a certain proportion of the ore produced by any mine in which we have an interest at a figure below the market price, in the case of the Ouenza, the arrangement was that we should receive 120,000 tons of ore per annum at 1 franc per ton f.o.b. above the cost price, and this it was estimated would be about 5 francs per ton below the average price. Since 1901 the value of Hematite has been enhanced. You will therefore see what a serious thing it is for the Consett Iron Company to be deprived of this.

We think that the French Government, in view of the fact that we are prepared to and in fact did take up this scheme years ago before the value of these deposits was fully recognised, should see that our share of the ore is reserved for us on favourable terms. It has not been our fault that the Railway has not been built. The Government of Algeria reported very much in our favour, and the Commission appointed by the French Government also reported to the small effect - the delay has been caused by the French Parliament itself.

The statementenclosed has been made up in a condensed form. Should, however, there be any points on which more information is required we shall be glad to give it."

Geo. Ainsworth.

Copy of letter from the Foreign Office

2nd January 1914.

Gentlemen,

With reference to your letter of the 22nd ultimo. respecting certain mines in Algeria, I am directed by the Secretary Sir E. Grey to inform you that the case has been referred to His Majesty's Ambassador at Paris for such action as he may consider advisable to take in the matter.

A. Law.

APPENDIX G. 1.

An Estimation of the Change in the Real Cost of Manufacture at Consett.

The change in the real cost of manufacture is the index of accounted money cost adjusted for the factor of inflation by some suitable price index. The precise method used for this exercise is continued in an Appendix.

If the real cost of manufacturing a product remained constant over time then there would be no addition to or substraction from total productivity. Since productivity changes are a function of an educational process and changing technology - they are an indicator of the performance of management, though nothing is assumed about the constraints within which management operates.

Declining real costs are therefore indicative of an increasingly skilled labour force and / or a changing technical input. The following tables show the movement of real costs for the Consett Iron Company in five of its iron and steelmaking departments.

TABLE G.1.

The Real Cost Index of Producing Pig Iron, 1870-1913.

Year	Real Cost	Year	Real Cost	Year	Real Cost
1870	100.0	1885	92.02	1900	85.37
1871	102.55	1886	92.94	1901	90.09
1872	97.37	1887	93.37	1902	87.64
1873	101.64	1888	91.40	1903	85.66
1874	106.36	1889	88.65	1904	86.86
1875	110.53	1890	88.47	1905	86.11
1876	104.06	1891	91.03	1906	88.52
1877	107.48	1892	89.71	1907	87.93
1878	102.78	1893	89.08	1908	89.20
1879	99.42	1894	86.92	1909	89.19
1880	94.08	1895	85.56	1910	86.54
1881	94.41	1896	84.15	1911	86.70
1882	93.17	1897	82.81	1912	85.65
1883	93.26	1898	82.75	1913	87.06
1884	92.10	1899	82.38		

Table: Real Cost Index of Producing Steel Ingots

(East & West shops) I883-I9I3

Year	Real Cost	Year	Real Cost	Year	Real Cost
I883	97.77	I694	80.70	I905	76.26
I884	90.I2	I895	79.69	I906	76.87
I885	88.64	I896	79.36	I907	76.24
I886	88.99	I897	78.48	I908	76.4I
I887	90.80	I898	76.78	I909	76.I4
I888	88.39	I899	77.38	I9I0	96.39
I889	89.06	I900	76.5I	I9II	II9.76
I890	86.29	I90I	75.09	I9I2	95.92
I89I	80.57	I902	75.82	I9I3	93.22
I892	8I.98	I903	74.92		
I893	8I.I3	I904	79.66		

Table: Real Cost Index of Producing Steel Ingots

(North shop) I893-I9I3

Year	Real Cost	Year	Real Cost	Year	Real Cost
I893	I00.0	I900	99.47	I907	96.28
I894	98.5I	I90I	95.25	I908	93.52
I895	I0I.0I	I902	96.52	I909	96.03
I896	I00.39	I903	95.93	I9I0	96.2I
I897	98.67	I904	95.24	I9II	96.I4
I898	98.55	I905	96.3I	I9I2	99.89
I899	I00.II	I906	96.44	I9I3	99.58

Table: Real Cost Index of Producing Steel Angles

I894-I9I3

Year	Real Cost	Year	Real Cost	Year	Real Cost
I894	I00.0	I90I	98.29	I908	I0I.72
I895	I0I.30	I902	98.07	I909	I0I.46
I896	97.9I	I903	98.0I	I9I0	99.88
I897	98.43	I904	98.82	I9II	I00.30
I898	97.59	I905	98.75	I9I2	98.8I
I899	97.56	I906	97.7I	I9I3	99.69
I900	97.43	I907	98.54		

Table: Real Cost Index of Producing Steel Plates, I894-I9I3

Year	Real Cost	Year	Real Cost	Year	Real Cost
I884	I00.0	I894	89.06	I904	9I.25
I885	95.67	I895	88.40	I905	89.96
I886	94.I5	I896	84.80	I906	89.28
I887	88.24	I897	85.58	I907	90.5I
I888	90.65	I898	85.2I	I908	94.07
I889	89.65	I899	83.63	I909	92.74
I890	89.II	I900	83.28	I9I0	92.26
I89I	88.58	I90I	89.36	I9II	9I.I8
I892	87.70	I902	9I.I0	I9I2	9I.9I
I893	88.44	I903	90.I2	I9I3	90.99

In addition a measures was made of the change in total productivity in the manufacture of pig iron, using the method derived by D.N. M^{c}Closkey(I). The measures used by M^{c}Closkey for steel ingots and ship-plates proved unsuitable, since his assumption of perfect competition is soundly invalidated by the formation of the Plate and Angle Makers Association after I904.(2). In addition to the annual change an index of productivity growth has been derived.

Table: Productivity Change and Growth in the Production of Pig Iron, I872-I9I0

Year	% Change	Index of Growth	Year	% Change	Index of Growth	Year	% Change	Index of Growth	Year
I87I/2	0.00	I04.9	I884/5	0.62	II7.6	I897/8	-0.0I.07	I45.7	
I872/3	0.I2	I05.I	I885/6	-0.52	II7.0	I898/9	-4.I8	I39.6	
I873/4	-0.I9	I04.4	I886/7	-0.36	II6.6	I899/I900	-3.39	I34.8	
I874/5	-6.64	97.9	I887/8	-0.83	II5.6	I900/I	-I.6I	I32.7	
I875/6	7.64	I05.4	I888/9	4.I8	I20.4	I90I/2	I.9I	I35.2	
I876/7	-I.68	I03.6	I889/90	0.06	I20.5	I902/3	2.64	I38.8	
I877/8	0.II	I03.7	I890/I	-0.I0	I20.4	I903/4	-5.63	I3I.0	
I878/9	3.47	I07.3	I89I/2	6.64	I28.4	I904/5	2.75	I34.6	
I879/80	7.50	II5.4	I892/3	3.87	I33.3	I905/6	-I.73	I32.3	
I880/I	-0.52	II4.8	I893/4	I.33	I35.I	I906/7	I.23	I33.9	
I88I/2	0.75	II5.6	I894/5	I.93	I37.7	I907/8	-0.79	I32.8	
I882/3	I.23	II7.I	I895/6	-0.34	I37.3	I908/9	-0.55	I32.I	
I883/4	-0.I4	II6.9	I896/7	6.23	I45.8	I909/I0	7.07	I4I.4	

(1) D.N. McCloskey, "Productivity Change in British Pig Iron, 1870-1939," Quarterly Journal of Economics, LXXXII (1968). pp. 281-296.

(2) D.N. McCloskey, "Economic Maturity and Entrepreneurial Decline: The British Iron and Steel Industry" (Harvard University, Ph.D. Thesis, 1970) pp. 93-100.

Paradoxically the real cost rose during the early I870's after the programme of reconstruction. This is in part due to the limitations of the wage index used to deflate costs and also to the changes in the types of pig iron produced. In I875 the make of Cleveland and Hematite pig iron rose to 70% of the total make as opposed to a nonn of between 45-55 per cent in previous and subsequent years. This created the necessity to use more low grade iron ore and the input of ore rose from 42-79 cwts in I873-74 to 45.53 in I874-5, approximately a 6 per cent increase(3)

After this apparent aberation in the early and mid-seventies there is a market downward trend between I877-I88I and this can be accounted for by the decrease in the consumption of coke.

Table: Consumption of coke per ton of Pig iron in the last six months of the year, I872-I899

Year	Coke Consumption	Year	Coke Consumption	Year	Coke Consumption	Year	Coke Consumption
I872	22.39	I879	23.I8	I886	24.38	I893	I9.52
I873	23.25	I880	23.83	I887	23.62	I894	I9.77
I874	24.33	I88I	22.85	I888	22.68	I895	20.02
I875	23.52	I882	22.72	I889	22.88	I896	I9.65
I876	26.79	I883	22.5I	I890	23.58	I897	I9.90
I877	25.76	I884	23.73	I89I	22.49	I898	20.49
I879	24.43	I885	25.38	I892	20.94	I899	22.I3

Source: Private Cost Book, I868-I905. (DCRO: D/CO/97).

The improvement was achieved by increasing the power of the blowing engines in the late I870's, thus ensuring a more effective blust through the whole of the burden in the furnace. The figures were also given a boost by the completion of a new furnace in I880.

The level of real cost remained fairly stable through the I880's but began to fall again in I888-9, possibly as a consequence of three furnaces being blown in after relinning and one furnace being blown out after ten years in blast. (see Diagram II). Another factor was also the improvement of the Whitwell stores, through this was probably not significant for in I89I Jenkins began seriously to contemplate the replacement of Whitwell stores by Cowper stores. (4). The gradual

(3). Private Cost Book, I868-I905. (DCRO: D/CO/97)

(4). See Section iii, I886-I894: The Zenith of Consett's Enterprise, p.216.

The clearest feature in all the series is the deceleration or even retardation in the downward movements in real costs after the turn of the century. This is confirmation of the trend described in the preceding sections, and adds strengh to the suspicion that it was the Edwardian decade during which the British steel industry really began to lose its competitive edge.

The succeeding sections are to be devoted to the analysis of the movements, in an attempt to isolate the innovations which made the contributions to the declining real costs, and also to attempt to explain more particularly why real costs ceased to move downwards after 1900.

Innovation and Productivity in Pig Iron Production.

Diagram I below shows the movements of real costs of pig iron, the inverse of which would be reflected in the advances in productivity.

CHART I : THE INDEX OF THE REAL COST OF PRODUCING PIG IRON.

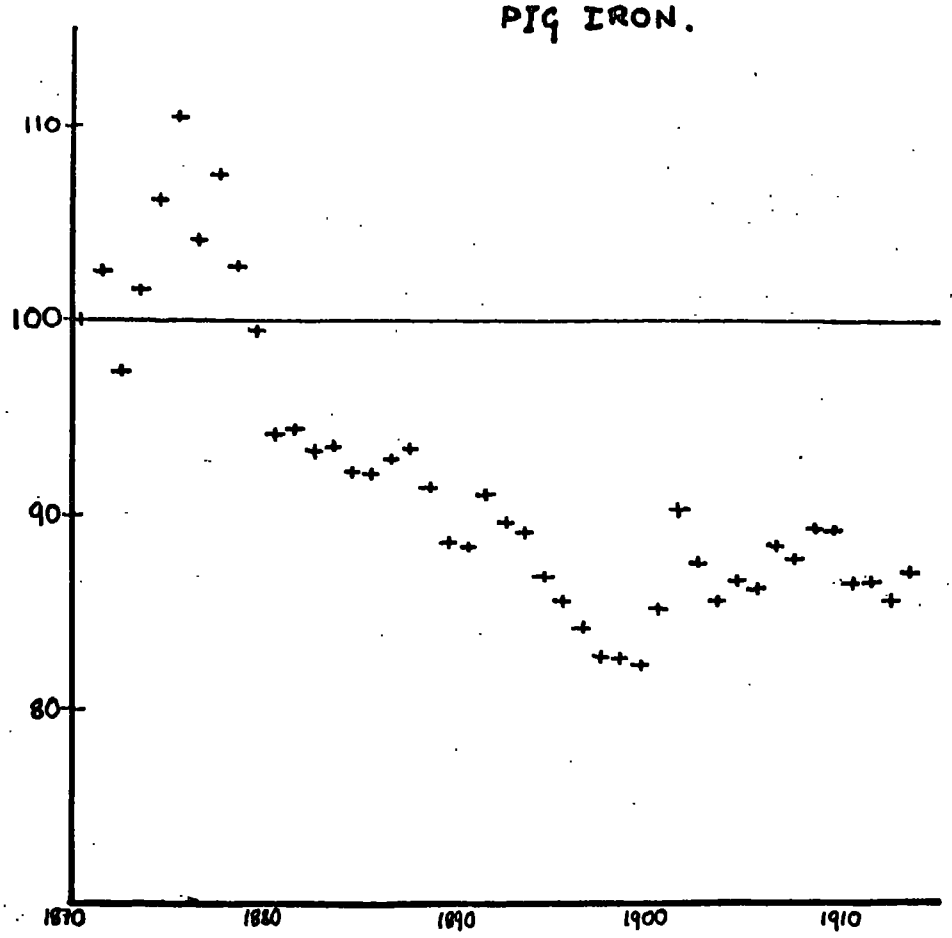
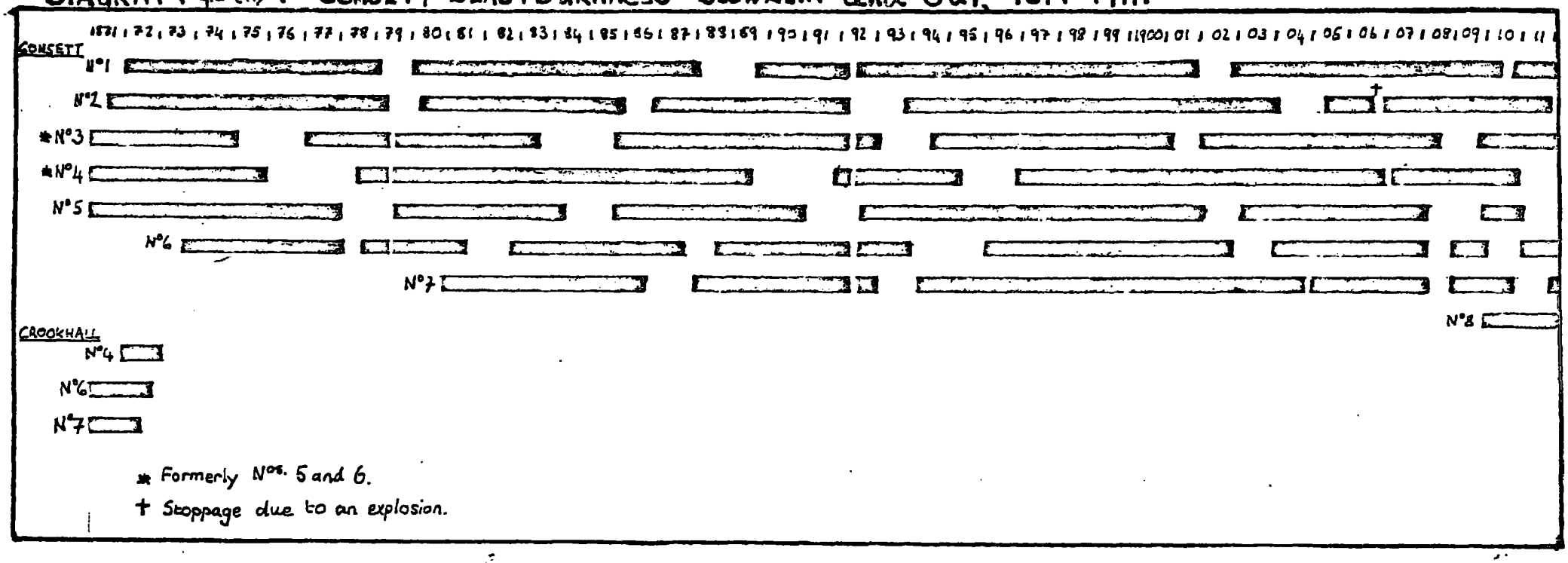


DIAGRAM G I (ii) : CONSETT BLASTFURNACES BLOWN IN and OUT, 1871-1911.



* Formerly Nos. 5 and 6.

† Stoppage due to an explosion.

adoption of these new stoves after I89I led to an unbroken downward movement in real costs until I899. Then in I900 there was a sharp reversal and the condition of the furnaces deteriorated through the whole of the Edwardian decade. The principle cause of this was the high average age of the blast furnaces in I900 when all were in blast at the same time (see Diagram G.I (ii)). The average age was marginally above 7 years at the end of I900 and as the normal life of a furnace was 8-I0 years, all were at the wrong end of the age scale to produce their best productive performances. The slight improvement after I9I0 was probably due to the blowing in of the new larger No.8 furnace and the generally lower average age of the furnaces.

On the whole Consett compares favourably with the movements in productivity nationwide, because the downward trend in real costs is maintained through until 1899 whereas for the nation as a whole the downward trend halted at the end of the 1880's. (5) A more direct comparison of productivity for Consett and the national average was the coke productivity Index used by McClosky - Consett maintained a lower consumption of coke per ton of pig iron than was the national average throughout the whole period. (6)

Consett's better than average performance in pig iron production was probably due to the fact that the Company was at a competitive disadvantage in thid department of production, when compared with the Teesside Ironworks.

Productivity and Innovation in Steel Ingots

In the production of steel ingots the two main causes of productivity growth were the increasing size of the furnaces which resulted in greater economies of fuel and in extending the length of 'campaign' each furnace could endure.

The principal economy in melting pig iron and scrap in a Siemens or open hearth furnace was gained by reducing the amounts of loss of heat by radiation. As the size of the furnace was increased the consumption of fuel decreased. In good practice a 10 - 12 ton furnace would use 10 - 12 cwts of fuel whilst a 60 ton furnace would use about 5 cwts of coal per ton of product.(7)

Before 1894 the melting furnaces in the West Shop were all raised to 20 tons capacity; six had originally been 17 tons, and two only 13 tons. Also in 1887 nine new furnaces were added by building the East Shop, and these had a capacity of 25 tons, thus having a beneficial effect on the overall productivity of the plant. (See Diagram G.I. (iii)).

From 1894 improvements to the melting furnaces are not well documented in the records, but by 1913 the capacity of each furnace

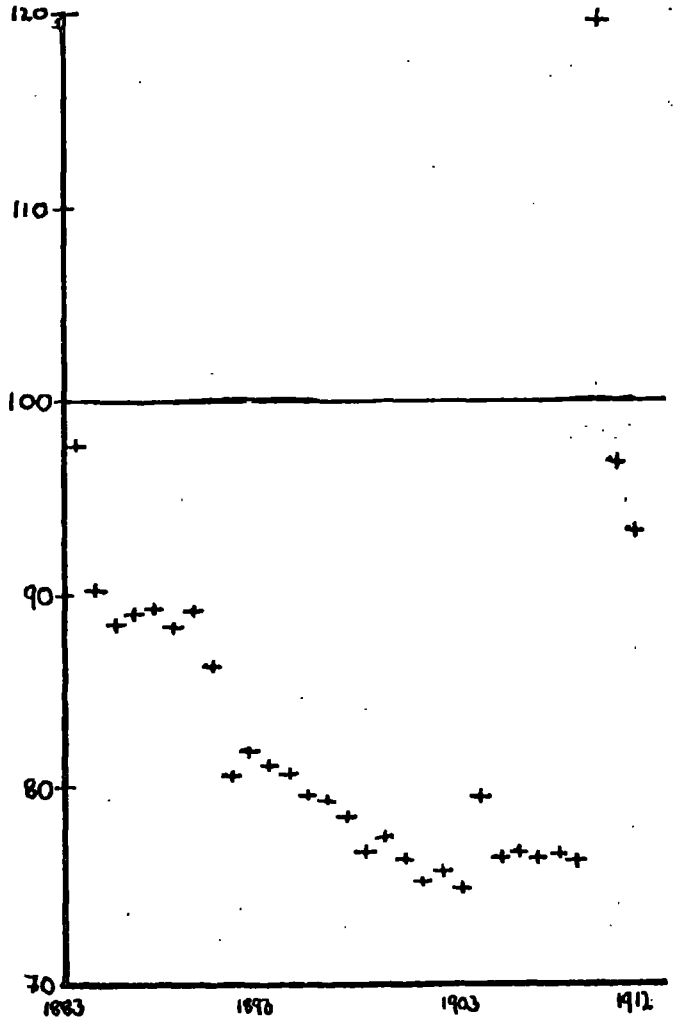
(5) D.N. McCloskey, "Productivity Change.....," Quarterly Journal of Economics. LXXXII (1968) pp. 283-4.

(6) D.N. McCloskey, Economic Maturity..... p.86., Chart I.

(7) H.J. Skelton, op.cit.,p.232.

CHART

THE INDEX OF THE REAL COST OF PRODUCING STEEL INGOTS.
(EAST & WEST SHOPS).



had been raised to 35 tons from the estimation of the real cost of producing steel ingots it would appear that these extensions to capacity were carried out in the decade before I903. The sharp rise in the real cost in I9I0, and then even more markedly in I9II was due to the increasing use of scrap metal instead of pig iron. The reasons for this we difficult to ascertain but it may have been caused by inadequate capacity at the blast furnaces, and thus a temporary shortage of pig iron. It was therfore necessary to substitute the more costly scrap.

Though the capacity of the North Shop was doubled between I894 and I9I3 without any addition to the number of melting furnaces, there was not any spectacular decrease in real cost, and they were almost as high in I9I3 as they had been in I894.

The second way of increasing productivity, was to extend the life of the furnace before it required relining. This can be ascertained from the falling costs allocated to ganister, the silica material with which the furnaces were lined, and cement. The slight rise in cost after I899 can be attributed to the general price rise of these years, which would have affected labour costs in mining the ganister thus raising its price.

One interesting aspect is the stickiness of the productivity

Table: The Cost of Ganister and Cement per ton of steel in the last six months of each year, at the East and West Shops: Five yearly intervals.

I884-I9I3	
Year	Cost of Ganister & Cement per ton of steel ignot.
I884	3.00d
I889	I.2Id
I894	0.50d
I899	0.I8d
I904	0.20d
I909	0.32d
I9I3	0,32d

Source: Private Cost Books. (DCRO: D/CO/97, I00 & I0I).

in the late I880's for this may have been due to the restrictive practices and inexperience of the labour force. Richard Evans complained to David Dale in I887:

"... we have also indications of trouble from the workmen in this "department (new East Shop), more expecially the young hands which were put " on from the Puddings and who have not yet learned their business- "Their aim is to reduce the make by restricting the charge". (8)

These early years were marked by the ebb and flow of industrial conflict as both sides attempted to secure the stronger bargaining position.

Productivity and innovation in the Rolling Departments.

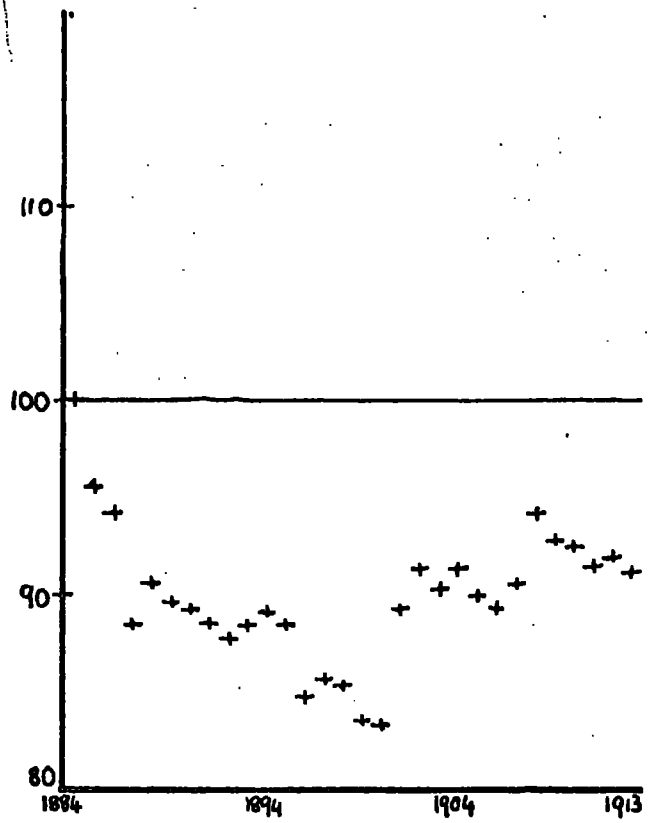
There was a steady progress maintained in the growth of productivity in rolling steel plates down to I900, when there was a sharp reversal. There are a number of feasible explanations for this; firstly the modernisation of the mills in the late I880's which improved their suitability for rolling steel plates. Secondly, throughout the I890's the industry was strving to meet the excess demand and so the mills were running at near full capacity. However, after the boom of I900-0I subsided it became evident that the position was reversed, and there existed excess capacity. The Scottish makers were the first to respond to this forming an Association to restrict competition, but in I904 they were joined by the North-east Coast firms. The effect was that prices were maintained and output was cut back, thus the mills were run at below capacity with consequently higher costs-productivity fell and real costs rose. There is further evidence given in George Ainsworth's report on the steelworks in I905 that the mills were running below their optimal capacity because of inadequate capacity in the blast furnace and steel making departments. (9) Added to this was the absence of any significant investment in new mill machinery after I900, the combination led to a situation where the productivity of the steel plate mills was no better in I9I3 than it had been in I887.

There were no significant advances made in the Angle Mills, and those that were made during the late I890's were probably due to a learning process on the part of the labour force, since there were no material improvements

Footnotes (8) and (9) on page 392.

CHART

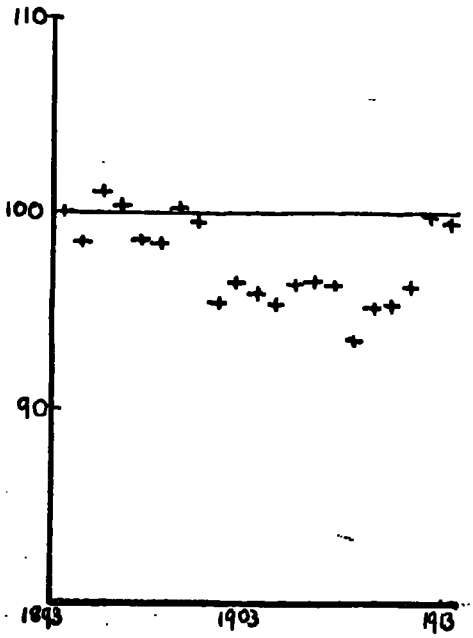
THE INDEX OF THE REAL COST OF PRODUCING STEEL PLATES.



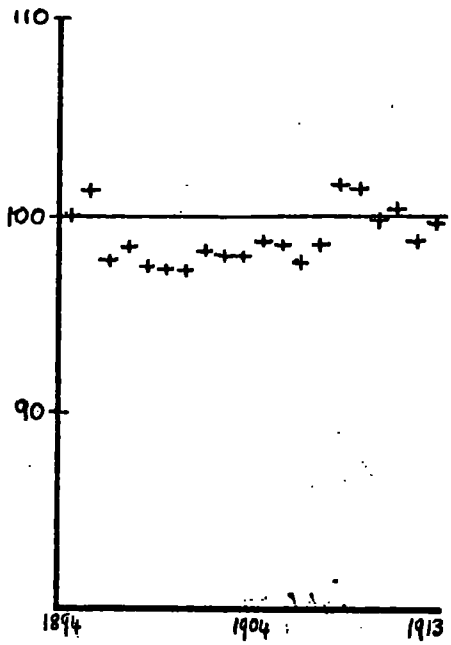
CHART

THE INDEX OF THE REAL COST OF PRODUCING STEEL INGOTS (NORTH SHOP) AND STEEL ANGLES.

(i)
STEEL INGOTS



(ii)
STEEL ANGLES



recorded as being made to the plant until 1911 when new cogging engines were installed. (10)

It can be seen from the above results that the postponements and modifications made to investment plans in the late 1890's and early 1900's had clearly detrimental effect upon the efficiency of the Consett Iron Company's iron and steelworks.

(8) R. Evans to David Dale, 4 April 1887. (DCRO : D/CO/68).

(9) Directors' Minute, 5 September, 1905. pp. 77-82. (DCRO : D/CO/40).

(10) Directors' Minute, 2 May, 1911. p.158. (DCRO : D/CO/42).

APPENDIX G.2.

Estimation of the Real Cost of Manufacturing Pig Iron, Steel Ingots, Steel Angles and Plates.

1. Method.

The method has simply been to deflate the component costs in the manufacture of each of the products. The cost is deflated by price data given in the Cost Books; where there was no price data, as in the case of labour and the miscellaneous category, other sources have been used. With labour, recourse was taken to sliding scale agreements and the reductions and advances in wages recorded under these agreements. For the miscellaneous products Rousseau's Price Index for miscellaneous industrial products was used except in the case of steel ingots, where there was a heavy bias in the miscellaneous category towards the scrap metal input, in this case a price index was derived from the Cost Books of the price of scrap and this was used to deflate the costs.

Since this method required the construction of indices, the aggregation of the components real costs, to give the total average real cost index, was done by weighting each component index. The weighting used was the share of the component cost in total average cost in that year.

Below is the Real Cost Equation:-

$$R_{ij} = \left\{\left[\left(\frac{C_i^1}{T_i}\right)\left(\frac{I_i^1}{P_i^1}\right)\right]+\left[\left(\frac{C_i^2}{T_i}\right)\left(\frac{I_i^2}{P_i^2}\right)\right]\cdots\cdots+\left[\left(\frac{C_i^n}{T_i}\right)\left(\frac{I_i^n}{P_i^n}\right)\right]\right\} * 100$$

R = Total average real cost, T = Total average cost, C= Component Cost
subscript i = product, I = Component Cost = Index, P = Price Index.
subscript j = year
numbers 1 - n = inputs.

2. Inputs

Each of the products was divided into the following inputs:-

Product:	Inputs:
Pig Iron	Iron ore, Coke, Coal, Limestone, Labour & Miscellaneous (stores, estimated charges &c.)
Steel Ingots	Pig Iron, Coal, Labour, & Miscellaneous (Scrap, sand, casts, estimated charges).
Steel Plates	Steel Ingots, Coal, Labour & Miscellaneous (Estimated charges &c.)
Steel Angles	Steel Ingots, Coal, Labour & Miscellaneous (Estimated charges &c).

3.Sources.

i) Costs: All the costs were derived from the Private Cost Books of the Consett Iron Company (DCRO : D/CO/ 97, 100 &,101). Since Consett had an accounting year from June to June, costs given are the average costs for the year ending in June, thus a cost for 1866 is the average cost over the last six months of 1885 and the first six months of 1886.

In the case of Steel ingots in the East and West Shops and Stee angles the years are in fact calender years.

ii) Prices: Most of the prices were also derived from the Private Cost Books, however the price index for labour and the miscellaneous categories had to be derived from elsewhere. The price for blastfurnacemen's wages had to be estimated from a number of sources; between 1870-78 there was no sliding scale agreement which could be used as an estimate, and therefore it was necessary to construct an hypothetical index. This was done by using the sixth sliding scale agreement of 8th April 1891 (R.C. on Labour, P.P. 1892 [c 6795 - iv] XXXVI Appendix XXIII) to compute advances and reductions based upon the price of No.3 Cleveland Pig. The most serious weakness in this technique is that it probably overestimates the extent to which wages rose during the boom between 1872 - 74. It also suffers in that it uses a scale set in the 1890's, by which time there had been a secular price decline, and pig iron was an affected commodity. Thus the standard base was for a price of £1.18s0d. whereas it would probably in the 1870's have been in the area of £2.05s.0d to £2.10s.0d. The net result of this is that the gains in labour productivity are underestimated over the whole period. The period between 1879-1891 was estimated on a similar basis to that of 1870-78, but using the price of Pig iron quoted in the R.C. on Labour P.P. 1892 [c 6795 - iv] XXXVI, Appendix XXV.) The yearly average in this case was arrived at by aggregating the four quotations and dividing by four. Between 1891-94 the Price of No.3 Cleveland was used again to find the wage index, and then from 1894 - 1913 advances and reductions given on the scale were quoted in the Directors' Minutes, of the Consett Iron Company.

The Average wages of Consett's steel smelters, which was used for the calculation of both the East and West Shop was for 1883-1894 computed from material in the Company Letterbooks and the Directors' Minutes. Between 1894-1905 quotations of advances and reductions were given in the Directors' Minutes, whilst between 1905-1913 the British Steel Smelters' Reports 1913 were used (Manchester: Co-operative Printing Society Ltd., 1914, p.693).

The Averages for the Steel Millmen were calculated from the price for steel plate between 1884-1886; from 1887-1901 advances and reductions were given in the Ironworkers' Journal, whilst from 1901-1913 the Consett Iron Company's Directors' Minutes were used.

The Rousseaux Indices (B.R. Mitchell & P. Deane, Abstract of British Historical Statistics) was used as the price index in the data for miscellaneous prices. His category of 'Principal Industrial Products' was taken as the index (ibid. pp. 472-73.)

4. Conclusion

The five series produced are intended to show trends in the movement of the Company's real costs, which are in themselves an indicator of changes inproductivity. The index for Pig Iron which is the most defective because of the bias created by the price of labour, is supplemented by the Productivity Index used by D.N. McCloskey (Q.J.E., 1968); the method and sources used in this are discussed in the following Appendix.

APPENDIX G.3.

A Measure of Productivity Change in the Manufacture of Pig Iron at Consett

The method used is that derived by D.N. McCloskey to measure the change in total productivity in the British Pig Iron Industry. (1) The method was adapted by McCloskey from R. Solow's work upon economic growth and technological change. (2) The equation takes the following form:

$$\frac{\Delta A}{A} = \frac{\Delta Q}{Q} - \left\{ Sc.\frac{\Delta C}{C} + So \cdot \frac{\Delta O}{O} + Sl.\frac{\Delta L}{L} + Sk \cdot \frac{\Delta K}{K} \right\}$$

where A = technical change function
Q = Output
C = Coke
O = Iron ore or ironstone.
L = Labour
K = Capital.
S = Share in total cost
Δ = Change in the function

Sources of the data.

Inevitably in historical research there is a gulf between the ideal statistical series and those actually to hand. These calculations have not been immune to the malady, however the results produced by the data correspond well with those arrived at by the previously described real cost calculations.

The main source was the Private Cost Books of William Jenkins and George Ainsworth. (3) These contained information on the output of pig iron and the inputs of coke and ore, however there was no readily available measure for capital input. This problem has been overcome by using a measure which could be called 'blastfurnace weeks', that is an aggregation of the number of weeks each furnace was in blast during the year (4). The data for the measurement of labour input was even more sparse, and so it was simply assumed that there was proportionality between the amount of capital used and the quantity of labour employed. This has the serious disadvantage of taking no account of reductions or additions to the labour force because of changing technology - however Consett's blastfurnace plant was fundamentally the same over the whole period.

The next problem was finding the proportion of the component cost in total cost; this was straightforward for coke, ore and labour which were accounted in the Private Cost Books. Capital was more awkward since there was no account of capital costs, thus it was necessary to sift through the Directors' Minutes and extract as far as possible all references to expenditure on blastfurnace plant.

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(1) D.N. McCloskey, Economic Maturity and Entrepreneurial Decline; British Iron and Steel, 1870-1913 PP.83.92.
(2) R.M. Solow, Technical Change and the Aggregate Production Function Review of Economics and Statistics, XXXIX, 1957.
(3) Private Cost Books, (DCRO : D/CO/97, 100, & 101).
(4) Production and Stock Books, 1869-1913 (DCRO : D/CO/107-109.)

This was then written off over a thirty year period, by dividing the sum by the output over thiry years. The result was a sum of 10d per ton which in fact approximates to the amount charged for capital by Bell Brothers. (5)

(5) Bell Brothers, Ltd. Profit and Loss Accounts, Cost Accounts &c. (North Riding County Record Office).

Annual Summary of Makes

Year ending June	Coal	Coke Beehive	By-Products	Pig Iron	Ingots	Plates	Sectional
1913	2,348,839	280,019					
4	2,171,505	281,644	189,277	231,258	269,112	118,053	64,098
5	1,812,974	180,901	164,496	206,223	251,535	103,490	73,152
6	1,737,555	205,167	305,678	210,212	249,789	89,689	84,232
7	1,700,259	231,370	341,289	258,594	263,525	119,497	82,636
8	1,572,806	197,594	342,374	290,723	266,028	125,726	87,722
1919	1,455,303	176,630	329,847	219,206	212,573	93,136	72,178
1920	1,629,220	114,416	326,404	212,662	215,640	96,007	71,913
1	1,153,986	46,332	247,360	171,469	104,064	77,090	36,424
2	1,894,333	40,715	256,533	100,793	55,843	28,681	15,813
9months							
3**	1,656,680	83,334	254,992	79,151	9,116	2,059	736
4	2,258,705	54,616	363,782	132,409			
5	2,316,678		614,964	173,065		New Steel Works	
6	1,144,628*	27,817	487,524	167,842	64,887	30,549	8429
7	709,525	13,842	287,570	153,600	98,407	44,666	23,595
8	2,090,688	47,425	632,547	298,397	250,431	98,333	68,535
9	2,131,053	50,205	680,841	235,134	216,857	92,743	70,707
1930	2,314,753	52,893	1,041,076	267,676	316,272	127,137	90,885
1	2,205,059	32,781	920,816	237,630	179,095	74,730	60,203
2	1,955,797	34,291	628,936	98,995	147,625	44,872	53,505
3	1,839,141	32,577	641,818	96,227	134,913	49,248	52,867
4	1,886,084	16,024	803,653	116,484	225,673	78,344	78,399
5	2,094,334	46,651	1,043,808	210,675	294,310	100,560	97,146
6	2,022,368	20,378	1,043,412	202,281	326,846	119,589	113,208
7	1,992,177	50,246	1,108,782	258,093	371,654	159,992	131,199
8	2,029,892	47,224	1,139,037	325,419	379,503	187,274	132,697
9	1,703,052	-	882,195	233,773	276,552	119,545	85,244
1940							

*Accounted for by 782,161 produced at Consett Collieries.
** Year ending March.
During 1937-38 Consett purchased 91,989 tons of Ingots.

Chemicals produced by CONSETT IRON COMPANY. 1914-1939

	Tar	Templetown Sulphate of Ammonia	Crude Benzole (Gall.)	Tar	Fells of Ammonia	Rectified Prod. (Gall.)	Gas mn Cu.ft.	Tar	Langley Park s of Ammonia	Rectified Products (Gall.)
1914	9026	2570	663,603							
5	7285	2105	531,956					705	238	18,128
6	8047	2274	526,169					6714	1939	333,823
7	8639	962	551,838					6966	2043	406,751
8	8674	644	620,574					6696	2298	395,571
9	8517	2076	586,097					6518	2077	431,816
1920	8326	2389	593,699					6545	2029	456,330
1	6201	1736	382,906					4641	1376	304,145
2	6247	1728	360,936					5100	1723	368,510
3	6313	1825	410,277					5374	1599	374,384
4	8707	2499	606,345					7928	2451	491,277
5	8457	2299	586,568	13055	3160	646,574	3,608,372	7755	2292	474,826
6	7543	2082	533,131	14590	3423	637,563	3,678,845	2216	617	113,830
7	3818	1055	225,808	7413	1907	504,407	2,151,106	2892	716	122,676
8	8324	2229	519,600	15244	3765	1998,889	4,138,911	9509	2302	421,635
9	7447	2319	533,848	14583	3635	1087,213	4,346,851	9334	2337	441,376
1930	7666	2310	500,956	15413	3852	1140,867	4,497,701	9286	2228	414,425
1	7822	2184	503,661	12969	3250	1020,345	3,850,039	8740	2217	432,561
2	1072	291	78,934	10848	2352	558,610	2,755,556	6632	1662	284,197
3	*	-	-	11918	2872	555,327	3,053,035	6504	1613	296,289
4	3466	992	290,627	13419	3254	896,738	3,630,427	7209	1807	352,654
5	9332	2610	670,347	14556	3587	1200,852	5,782,163	8506	2124	508,672
6	10066	2713	674,695	14356	3363	1184,276	4,393,115	8604	2123	561,935
7	10021	2758	683,868	14401	3402	1220,989	4,228,449	8622	2203	556,818
8	9550	2705	696,474	14678	3542	1211,340	4,379,651	8686	2230	529,944
9	5385	1412	396,225	12167	3023	839,424	3,627,540	7147	2023	495,980