Two Patterns of Development: The Labour Process in the British and French Shipbuildiug Industries 1880 to 1930

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Introduction

A number of recent comparative studies focussing on work organization in comparable manufacturing units in France and Britain have observed the tendency for French firms as opposed to British to place greater reliance on their technical and supervisory services in the day-to-day operation of the plant. Correspondingly, British workers have appeared to exercise greater autonomy on the job and to be less deskilled.[1] The statistical manifestation of this difference in the labour process of the two countries appeared in the tendency for supervisory and technical staff to constitute a greater proportion of the total workforce in French firms. In this respect the British and French shipbuilding industries are well representative of the more general trend.[2]

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[1] P. Dubois, (1980); D. Gallie, (1978), pp. 220-24, 307-09; Maurice et al (1980), pp. 70-71. The evidence of Dubois and Gallie indicates that these contrasts are particularly striking in the case of maintenance workes.

[2] In 1975 total technical staff constituted 20 per cent of the total workforce in British shipbuilding and ship repairing, while the comparable figure for the French shipbuilding industry was 30.6 per cent. Professional, technical and supervisory staff were 8.8 per cent

These studies are for the most part concerned with contemporary conditions or with the structural coherence of the different organizations observed, while historical origins and development are relegated to a secondary place. In particular, no supporting evidence is presented to show whether or not these differences were characteristic of an earlier period as well.

The aim of this study is partially to fill that gap by exploring the origins of these differences for the shipbuilding industry as they emerged through the divergent patterns of development that took place during the late nineteenth and early twentieth centuries. For there is every reason to believe that the greater development of supervisory and technical services in French shipyards is not of recent origin but rather has been a persistent feature of the French industry. The following observations were made by M. Pinczon in 1930 in reporting to France's *Conseil National Economique* on the difference between British and French shipyards: [3]

> Supervisory personnel did not appear numerous. It is necessary to note that for a long time the workers have been accustomed to building the same type of vessels. Even though the dimensions may not be the same, when in a yard one builds successively many cargoes or tankers, there is already established a certain routine which allows more initiative to be given to the workers: they know better what they are doing, the order in which it is necessary to do it and how they ought to do it.

It is natural to search for technical differences in explaining different work organization, for the importance of this variable is well documented, and Pinczon's explanation, emphasizing the impact of yard specialization on technical requirements, is essentially of this nature. Yet there are reasons to suspect this explanation. Firstly, during the post-World War II period French yards have been equally if not more specialized than British, yet the difference has persisted. Secondly, it might well be expected that specializing in a particular class of vessel would give greater scope for the introduction of Taylorism or 'scientific' methods of work organization, and so encourage the opposite tendency, a greater development of technical services and less autonomy on the shop floor.

Rather than emphasizing technical features, the explanation I develop here attempts to show how economic/technical variables interacted with political/organizational variables to produce different national patterns of development. In this light the first section of this paper explores the impact of differences in economic forces and structures on the labour process in the two

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of the British workforce, while design, technical and supervisory staff were 20.4 per cent of the French. Source: Department of Employment Gazette and Commissariat General du Plan, VII[e] Plan. La Construction Navale.

[3] PINCZON (1930), p. 95.

countries. The second section then shows how trade unionism and collective bargaining were shaped and contributed to the evolution of divergent development. The first section begins with an overview of the position of Britain and France in the world shipbuilding market, emphasizing the impact of the greater size of the British market on relative performance. Having set out this background, differences in the labour process are examined, the analysis still being restricted to the impact of economic/technical variables. The analysis of industrial relations then follows.

I. Economic Conditions and Divergent Development: 1870–1930

1. *The Product Market and Britain's Dominant Position in World Shipbuilding*

The British shipbuilding industry achieved a dominant position in the world market during the period of transition from wooden to iron hull construction between 1860 and 1880. Unlike many of Britain's capital goods sectors, similarly relying on foreign markets, the shipbuilding industry in good measure maintained this position up to the First World War, and was only marginally affected by foreign competition.[4]

Britain produced on average 78 per cent of world output between 1892 and 1896. Britain's share dropped to 63 per cent in 1900 and fluctuated around 60 per cent until 1914.[5] Britain's market share dropped further during World War I as Britain was cut off from the world market and as other nations, especially the U.S., expanded domestic capacity. After the war, however, with the reconstruction boom, Britain quickly re-established its dominant position, but at a lower level, producing on average 40 per cent of world output between 1921 and 1939. The period, though, was one of chronic over-capacity and stagnation due to the over-expansion of the world fleet during the immediate post-war years. Laid-up tonnage in U.K. ports fluctuated around 500,000 net tons between 1923 and 1926. Output at its highest in 1927 was 80 per cent of its 1913 level.

The decline in Britain's market share during the late 1890s resulted from the expansion of U.S. and continental capacity generally behind protective barriers and frequently with direct government subsidization. German builders, for example, expanded shipbuilding capacity in the 1880's relying primarily on naval orders and the demand of two subsidized mail lines, the Hamburg Amerika line and the North German Lloyd. During the 1890s German producers built various classes of vessels with little subsidization, but they never

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[4] See S. Pollard (1957) for the competitive performance of the British shipbuilding industry between 1890 and 1914.

[5] Output figures taken from *Lloyd's Register of Shipbuilding*.

were able to make inroads into Britain's control of the cargo section of the market. There was little further expansion after the turn of the century.[6]

French builders relied on a series of protective laws, starting with the 1881 law which provided bounties to builders to compensate for customs duties on imports of materials used, principally steel and coal, and also provided a subsidy to owners, though only at half rate for vessels purchased abroad. The legislation, however, proved ineffectual, failing to shift the demand of the French owner decisively toward French builders, despite the apprehension of many builders in Britain.[7] Indeed, comparing the 1870-79 period with the 1880-89 period, the percentage of additions to the French fleet built abroad increased rather than decreased, reflecting the increasing competitive advantage of the U.K.[8] Real improvement only followed the end of the depression in 1896 when output increased nationally from 42,896 tons in 1886 to 166,382 in 1901. During the 1901-02 boom approximately 80 per cent of additions to the French register were built in France. This presumably reflected the impact of the 1893 law which had eliminated the half-subsidy to owners for vessels purchased abroad. The 1893 law, though, provided relatively favourable contions of subsidization for sailing vessels, which resulted in a marked shift in the composition of French output towards steel vessels designed for sail propulsion, a class of vessel rapidly becoming obsolete on the world market. The 1902 law eliminated the worst excesses of this legislation by limiting the tonnage of sailing vessels to which the subsidies applied. It also contributed to a sharp drop in output. Total tonnage produced fell from a peak of 166,382 gross tons in 1901 to 86,019 gross in 1903, a fall of about 48 per cent. During the same period British output declined by only 22 per cent. French builders were helpless to secure their domestic market without the assistance of protective legislation such as the 1893 law. Between 1903 and 1907 on average 38 per cent of additions to the French fleet were purchased abroad.

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[6] S. POLLARD (1957), p. 429.

[7] The provisions of the law which lasted twelve years were as follows: a subsidy of 60 Fr. per ton for iron or steel vessels; 20 Fr. per ton for wooden vessels over 200 tons; 10 Fr. per ton for wooden vessels under 200 tons; 40 Fr. per ton for composite vessels; and 12 Fr. per ton for marine engines and boilers. H. CHARPENTIER, 1945, p. 183; *Royal Commission on Depression of Trade* (1886), c. 4621, p. 205. The law resulted in an extension of French capacity with the creation of the Ateliers et Chantiers de la Loire in 1881 and Chantiers de la Gironde in 1882. L. BASSO (1910), pp. 50-52.

[8] For additions to the French fleet see: *British and Foreign Trade and Industry*, Cd. 4954 (1909). For output of the French industry between 1881 and 1904, see: J. LATTY (1951), p. 249.

[9] The production of steel vessels for sail propulsion peaked at 138,297 gross tons in 1901, accounting for 85 per cent of mercantile output. The tonnage constructed dropped to 66,780 gross tons in 1902 and, starting in 1903, no further vessels of this type were built. J. LATTY (1951), p. 249.

Explanations for Britain's dominant market position have generally emphasized three feature of the industry's position: *firstly*, the greater size of the British market which allowed greater inter-yard specialization; *secondly*, the advantageous location of most British yards; and *thirdly*, the superiority of British labour.

Sidney Pollard has analysed the importance of the size of the British market most thoroughly, arguing convincingly that the success of the British resulted from their having captured the expanding domestic market and much of the foreign market between 1860 and 1880, a period when competing maritime nations lacked developed iron, steel and engineering industries and a sufficient supply of skilled labour to supply shipyards. Having captured these markets, British producers drew a critical advantage from the greater extent of the market they commanded, resulting in a greater continuity of demand for different classes of vessels and allowing British builders to achieve a degree of specialization between yards that proved impossible in France or other martime nations.[10]

A certain amount of specialization occurred on a regional basis. Cargo tramps were built on the north-east coast on the Tyne, Tees and Wear rivers. The Clyde was noted for its liners, while warships were built on the Clyde and in Barrow and Birkenhead. Fishing vessels were built in Aberdeen, Dundee and Leith.[11]

While regional specialization may have resulted in certain economies due to the concentration in one location of labour and suppliers suited to the demands of particular types of builders, yard specialization was more important in terms of influence on productivity. Harland and Wolff, Clydebank, Workaman, Clark and Co., and Swan, Hunter and Wigham Richardson were the only yards building giant express or 'intermediate' liners. Specialization went furthest in the production of cargo tramps, where the dominance of British shipping interests was the greatest; Britain owned 90 per cent of the world's tramps prior to World War I.[12] There was a variety of cargo design types including the "flush decker", "well-decker" and "turret decker" designs. Most of the early "well-deckers" were built in the Hartlepools, and by 1889 some 350 such vessels had been built with an aggregate tonnage of over 500,000.[13] Doxford and Sunderlands developed and specialized in the production of the

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[10] S. POLLARD (1957), especially pp. 433-36 and 443-44; S. POLLARD and P. ROBERTSON (1979), pp. 84-87. A number of French authors have developed the same argument, attributing higher French costs to the lack of continuity in demand for different types of vessels. See L. BASSO (1910), pp. 89-93; J. HARDY (1951), p. 39; M. PINCZON (1930), p. 96; ROUX-FREISSINENG (1929), p. 31.

[11] S. POLLARD (1957), p. 434.

[12] *Ibid.*, p. 432.

[13] G. W. SILVER WRIGHT (1888-89), p. 153. By 1889 "well-deckers" accounted for about 40 per cent of total cargo tonnage. See Holmes, G. L. V. (1906), pp. 102-30.

"turret decker" design, and by 1904 had constructed one hundred "turret deckers".[14]

French producers suffered irregular and insufficient demand during the latter part of the nineteenth century. The domestic market, more readily able to be captured with protective legislation, grew at a slow rate relative to Britain's and the French fleet declined from about 6.4 per cent of world tonnage in 1870 to about 3.9 per cent in 1900.[15]

Lacking sufficient continuity of demand, French builders were forced to produce a range of vessel types and never achieved the specialization of Britain's tramp builders on the north-east coast. The experience of the Penhoët yard in this respect was rather typical. The yard was particularly suited for producing a large class of sophisticated vessel, especially trans-Atlantic liners, and had produced such noted passenger liners as the *Rochambeau* (1911) and the *France* (1912). The yard also produced sophisticated naval cruisers and battleships such as the *Condorcet*. But despite the suitability of the yard to this class of vessel, Penhoët also constructed tug boats, cargo vessels, torpedo-boats, and fishing vessels.[16] Needless to say, when producing an occasional cargo ship, the yard could never approach the productivity of a specialist yard such as Doxford and Sunderland in Britain, which specialized in "turret deckers".[17]

Lack of local coal and steel supplies for the major French builders located near Marseilles, in the Loire-Inferieure and on the Seine estuary, was a further handicap. The inability of the French coal industry to produce sufficient to meet the home demand left French shipbuilding, as other sectors, dependent on imports, generally at higher prices than their rivals.[18] But it would be incorrect to overemphasize the importance of this problem. State subsidization during the nineteenth century in France was designed to compensate for import duties

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[14] G. L. V. HOLMES (1906), p. 117. It should be pointed out that these vessels were not standardized or identical vessels in the same sense as Liberty vessels or automobiles of the same make, but rather were similar ships built to the same design patterns. The dimensions, tonnage and size of component parts varied from vessel to vessel. Thus, there was little actual interchangeability of component parts in ship production that might have encouraged the use of mass production techniques. See S. O. KENDALL (1894-95), p. 224.

[15] A. W. KIRKALDY (1919), Appendix XVII.

[16] M. BARBANCE (1945), p. 390.

[17] In 1899 two French yards were established with the aim of specializing in commercial vessels: the Ateliers et Chantiers de France and the Chantiers et Ateliers de Provence. The former intended to follow the British example and specialize in cargo vessels. During the 1905-06 recession, however, the yard was forced to diversify, producing twenty trawlers to foreign account. The latter yard achieved a moderate success prior to the first world war but during the inter-war years similarly was forced to diversify its output. R. CHASSERIAU (1901), pp. 48-49; J. LATTY (1951), pp. 769-773 and 831-34.

[18] T. KEMP (1971), p. 119.

and any price differential in materials. Furthermore, as S. Pollard has noted, two quite successful British yards, Harland and Wolff and Clark and Co. in Belfast, lacked local coal and steel supplies and had to bear the costs of sea transport.[19] During the interwar years material costs in France were, overall, lower than in Britain, yet French builders still offered no effective competition.[20] Clearly, the causes of superior British performance lay elsewhere.

2. *Technology and the Development of the Labour Process in Britain*

It has been noted that the output of British workers was thought superior to their counterparts abroad.[21] When considering the higher productivity of British labour, however, a certain paradox arises, for it might plausibly have been assumed that the greater continuity of demand faced by British producers would have encouraged them to invest in up-to-date machinery and that the higher level of productivity was a result of greater mechanization. In fact, the situation seems to have been much the reverse. In so far as there *were* inter-country differentials in the degree of mechanization, British yards on average showed a preference for more labour-intensive methods.

Sidney Pollard has argued that the severity of cyclical fluctuation in ship-building output encouraged British producers to minimize capital expenditure in order to *avoid* the potentially crippling overhead costs that would be incurred during recessionary periods. The fact that most vessels were expensive custom-made commodities, built with the close consultation of the owner who usually would pay in instalments as the vessel was constructed, meant that a strategy of speculative construction and stockpiling of a standard commodity was not feasible.[22] All shipyards, then, necessarily faced periodic depressions in demand and output. This encouraged British builders to preserve labour-intensive methods and to lay off labour during the cyclical downswings.[23]

Foreign producers, on the contrary (notably American and German), lacking British experience and without a sufficient pool of labour from which to draw, fitted out their yards around the turn of the century with expensive cranes and mechanical haulage equipment that only proved profitable during periods of peak demand. Yet, Pollard argues, the greater mechanization of foreign yards could not compensate for the superiority of British labour.[24]

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[19] S. Pollard (1957), p. 442.

[20] R. Dugas (1930), p. 60.

[21] L. Basso (1910), p. 89; R. Chasseriau (1901), p. 246; S. Pollard (1957), p. 438. Pollard estimated that output per head in British yards was about twice that in American yards and over six times that in French yards at the turn of the century.

[22] A. Reid (1980), pp. 46–47.

[23] A. Reid (1980), pp. 47, 199; S. Pollard and P. Robertson (1979), pp. 29, 42, 46.

[24] S. Pollard (1957), p. 437.

While Pollard's analysis is illuminating in many respects, particularly in developing a connection between the shipbuilding business cycle and techincal choice, I could argue that there are certain deficiencies in it. First of all, if higher labour productivity in Britain cannot be attributed to greater mechanization (much the reverse), then its basis remains unexplored, whether due to superior training or greater motivation, etc. Secondly, in the particular case of France, yard equipment does not appear to have been substantially different from that in Britain during the late nineteenth century, though a clear superiority is documented for the inter-war years.[25] Finally, and most importantly, I would argue that it would be *incorrect* to describe the difference between British and German or American yards as the result of a general strategy of substituting capital for labour, for due to the one-off nature of ship production and its consequent complexities, it was usually impossible to eliminate *skilled* labour from the production process. Rather, American and German builders substituted machinery for *less skilled* labour, particularly in mechanizing their cranes and haulage equipment. It was in this area that differences in the degree of mechanization were most pronounced, and for which British admiration for the boldness of foreign design was evident.[26]

While British producers were also slower in adopting more advanced systems of drive — substituting electric for steam-driven machines — and tended to retain the system of belt-drive from a line shaft longer than competitors, this had little bearing on actual skills.[27] Perhaps the one exception to this general trend was that of pneumatically powered riveting machines which did decrease the required skill for riveting and which were extensively introduced in France and other countries prior to 1914, but not in Britain until the war years.[28] It should be noted, though, that this reflected more the restrictions that the Boilermakers' Society successfully placed on the use of the machines, ensuring that the machines were operated by a full squad of three skilled men despite the need for only two and, as some employers argued, their suitability for semi-skilled labour.

With the idea in mind, then, that the development of shipbuilding technology was *uneven* in nature and *partial* in its impact, it would seem useful to explore its development in some greater detail, considering in particular the impact of mechanization on skill requirements. For, if it is wrong to argue that foreign producers were somehow able to eliminate their need for skilled labour, while

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[25] For the late nineteenth century, see L. E. BERTIN (1885), and for the inter-war years see R. DUGAS (1930), pp. 52-54.

[26] W. A. FAIRBURN (1902), p. 266; T. G. JOHN (1914).

[27] J. CRAIG (1917-18), p. 285; S. POLLARD (1957), p. 436; J. R. HUME (1976), pp. 169-70; W. C. WALLACE (1894-95).

[28] M. BARBANCE (1948), p. 386; Board of Trade Industrial Survey, *South West of Scotland*, pp. 39-40 (1937).

only Britain relied on its labour force, it would be equally wrong to argue that the work was largely artisanal in character, and that hull construction machinery remained unchanged, either in Britain or abroad, from its origins, in Britain tinsmithy and boilershop practice of the 1840s and 1850s.

The basic operations in shipbuilding were to punch and drill holes in plates and angle iron bars, to cut and shape the components and to rivet the pieces together at the berth. The basic machine tool was the combined punching and shearing machine, which was well established in Britain by the 1840s. The lightest of these were hand operated, while the heavier machines designed for the thicker sections operated on steam power transmitted by belt-drive from a line shaft.[29] Originally most plate straightening was done by hand after sections were heated in a furnace. With the switch from iron to steel in the 1880's in Britain, allowing easier manipulation of plates in the cold state, powerful hydraulic bending rolls were generally adopted, which did decrease the amount of skill and expertise required as compared with earlier hand methods.[30]

Punching and shearing machines were produced in increasingly large dimensions and similarly placed on hydraulic drive as plate size and thickness increased with the switch to steel. As J.R. Hume has explained: [31]

> Because rivet holes were normally the same diameter as the thickness of the plate, and since the power required and hence the strength of the machine frame increased as the cube of the diameter, an apparently modest increase in thickness of plate could have a marked effect on machine size. In 1881 a 1½ by 1½ in. punching and shearing machine weighed 21½ tons as compared with 14½ tons for a 1¼ by 1¼ in. machine of similar construction.

Only frame bending continued to require furnacing, with beams being heated red hot and then bent with the use of levers and hydraulic rams or "bears" to the shape of a "set iron" fixed to iron blocks with wedges and pegs.[32]

Shipyard machine tools, then, evolved from rather simple beginnings as adopted from boilershop practice to an increasingly specialized and heavy class of machine tool designed to manipulate large and extremely heavy steel sections. While these machine tools were specialized to the methods of shipbuilding, they were by no means single-purpose tools, designed for the mass production of identical components. This point cannot be stressed enough. The absence of standardization in ship production ensured that shipyard ma-

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[29] J. R. Hume (1976), p. 169.
[30] A. Reid (1980), p. 116-117.
[31] J. R. Hume (1976), p. 160.
[32] *Ibid.*, p. 163; C. A. Holms (1916), pp. 475-76.

chine tools had to remain sufficiently versatile to be used to punch, shear, bend, etc. a variety of components of differing dimensions. Correspondingly, many of the operations performed with these machines required a skilled hand, as considerable precision and care was needed in marking and positioning the components while they were being processed. Furthermore, rather than the pace of production being determined by the tempo of the machine, a hallmark of mechanization in modern industry, the pace remained dependent on the intent and activity of the worker. Indeed, it seems that most machine tools were not necessarily introduced with the intent of eliminating skilled workers, but often with the intent of enhancing their productivity.[33]

For the core set of steel-transformation tasks carried out by platers, angle-iron smiths, blacksmiths and shipwrights, then, British builders, as well as builders abroad, had to rely on methods short of actually displacing skilled labour to increase productivity or lower production costs. British builders relied on a variety of methods. Firstly, as described above, they refined and improved machine tools which, though decreasing skill requirements, continued to rely on manual aptitudes and expertise. Secondly, and concurrently with the process of machine tool development, British producers extended the detailed division of labour, which resulted in the increasing specialization of individual tradesmen. In this manner the original iron workers of the 1830's and 1840's developed into platers, angle-iron smiths, caulkers, riveters, holders-up and their assistants. A similar process sub-divided engineering workers into fitters, turners and drillers. With the increasing specialization and sophistication of vessels, plumbers, electricians, brass moulders, coppersmiths and other outfitters were brought into the industry. A shipyard was much like Adam Smith's pin factory, except that successive categories of workers came to the vessel, adding components to it, rather than passing it from group to group.[34] A detailed division of labour was established within individual trades, being most highly developed in the case of platers and angle-iron smiths. Within the plating squads, the men divided up the work, one man to templating and marking, two to rivet hole punching and shearing, two to bending plates, one man to furnacing plates of awkward shapes, and one to positioning plates at the berth.[35] Furthermore, platers tended to specialize in either light or heavy work.[36] Angle-iron smiths adopted a similar detailed division of labour.[37]

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[33] While German and American producers may have had more up-to-date machines and possibly more machines per worker, the above discussion of the sorts of skill required on metal working machine tools would apply equally to these countries as well as to France, where equipment was comparable to Britain's by the 1880s.

[34] F. Wilkinson (1973).

[35] C. A. Holms (1916), p. 527.

[36] A. Reid (1980), p. 111.

[37] C. A. Holms (1916), p. 473.

Generally, then, independent of any tendency to use labour-intensive methods as a means of avoiding overheads, the ability of firms both in Britain and abroad to eliminate skills was limited due to the custom-made nature of the commodity. While the analysis has largely been concerned with hull construction technology, it equally well applies to most fitting-out work, for even when components such as pipes or electrical fittings could be made in standard runs, the assembly and fitting of these components in a *non-standard* vessel continued to require skill.[38] Mechanization in the sense of using labour-displacing machines was generally limited to the more routinized tasks of hauling and moving components and equipment around the yard and to riveting components together.

3. *A Comparison with France*

French producers faced economic difficulties similar to those of their British counterparts due to cyclical fluctuations, though the situation was more aggravated in France. Between 1880 and 1900 cyclical fluctuations in shipbuilding output were three times as severe in France as in Britain.[39] The French had every much as great an incentive as the British to minimize their capital expenditures in order to avoid overhead costs, and, moreover, enough experience to know the effects of insufficient continuity of orders on financial performance.[40] Like the British, French builders employed improved machine tools over the years, but they were unable to adopt the British model of a highly detailed division of labour due to insufficient and *unstable* supplies of skilled labour reflecting in part a weak attachment to factory employment.

Shortages of labour with the requisite skills were a source of intermittent complaints from the earliest years of iron and steel ship construction. A French naval engineer, L.E. Bertin, made the following observation during his 1884 investigatory mission to Britain: [41]

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[38] A. Reid (1980), Ch. 6 (especially pp. 196-97).

[39] To test this I have computed from the output series for Britain and France for the 1881-1900 period a seven year moving weighted average. The difference of each observation from its corresponding weighted average has then been computed as a fraction of the average. The standard deviation of these two new series are then compared to judge the relative severity of cyclical fluctuations.

[40] The Chantiers Penhoët, created in 1860 at St. Nazaire, was the first yard in France capable of producing iron vessels of a large tonnage (about 3000 gross tons). The yard went bankrupt in 1866 due to a lack of orders, reopened in 1868, and was closed again in 1870. No further production took place on the site until 1881. M. Barbance (1948), pp. 365-67.

[41] Rapport sur une seconde mission en Angleterre: 5 août-15 sept. 1884. L. E. Bertin, Naval Engineer.

> Our general installations, our different manner of working... and our equipment are relatively rich; what we do not possess to the same degree perhaps is a work force raised at the doors of the workshops, seeing work in iron since their youth, instructed by tradition, trained by competition...

In 1909-10 a group of Clyde engineers called in to oversee the construction of two large passenger liners at the Chantiers de l'Atlantique (Penhoët), St. Nazaire, expressed surprise that the French did not follow the British method of an initial rapid erection of the frames on the berth, and rather proceeded in a more piecemeal fashion. The French had adopted this method due to a lack of skilled labour and a need to economise on its use.[42]

In a similar vein, during the 1929-30 boom, Dugas noted the difficulties French builders were encountering in recruiting a stable force of skilled workers: [43]

> Unemployment is practically non-existent, the shipyards do not have any elasticity from the point of view of labour power. They are not able to recruit personnel with a view to a solid increase in production, and are obliged, during the periods where they have few orders, to guard workers who they are not able to fully use due to the risk of losing them permanently.

The solution to inadequate and unstable supplies of labour, or, it might be better to say, the consequence, was to use workers with shipyard skills in a more *flexible* manner, especially during periods of peak demand, and to concentrate technical and supervisory responsibilities in a relatively small cadre of *supervisors* and *technicians* enjoying stable employment.

This latter point can be illustrated by contrasting the templating systems used in French and British yards. Templates were wooden models or replicas used to mark plates for hole punching and shearing. There were two basic types of templates: *transferring* and *pattern*. For the former, manual workers would press flexible wooden battens against the surface of the partially constructed hull to determine shape and positioning of rivet holes. The latter were made in advance of the start of contruction by loftsmen on the basis of information supplied by draughtsmen.[45]

In terms of the allocation of skills and technical expertise, the use of trans-

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[42] M. Barbance (1948), p. 388. This yard was on the site of the former Penhoët yard, founded in 1860.

[43] R. Dugas (1930), p. 59. Also see Pinczon (1930), p. 97.

[44] M. Barbance (1948), pp. 389-90 for the stable employment of technical staff in St. Nazaire. C. Benoist (1905), pp. 322 for the demotion of foremen to manual grade status during the 1903 recession at the Chantiers de la Méditerranée, Graville.

[45] C. A. Holm (1918), Ch. 36.

ferring templates left manual workers in control of determining the disposition of conjoined parts and connecting rivet holes, technical tasks requiring design judgements.[46] In the pattern templating system these conceptual tasks were separated from the shop floor and concentrated in the design offices and mould loft, the responsibility of employees whose competencies were primarily technical.

In France the full pattern system was in use in certain yards prior to 1914 on the evidence available, and was quite general during the interwar years.[47] In Britain, however, while pattern templates were used for certain mid-ship plates and connecting angles where repeat work was possible, the majority of plates were prepared from transferring templates which the plating squads were responsible for preparing.[48] In effect the connection between conceptual or technical tasks and manual tasks was managed in quite different ways in Britain and France, the two being more clearly distinguished and separated in France.

During the First World War, in response to severe shortages of skilled labour and pressure rapidly to increase productivity, a system of scientific management was introduced to the yards of Nantes and St. Nazaire.[49] The principal innovation of the system was the creation of a *Time Study Service* responsible for the overall organization of production.. The service divided up the production process into a series of jobs and estimated a required time for each job which for the most part were assigned to groups of twenty to one hundred workers. Bonus payments were based on a group's performance in relation to the allocated time. So as to economize on skilled labour, a worker with idle periods would concurrently be placed on a number of job contracts. Flexibility was an institutional part of the system.[50]

The flexible use of labour in the French labour process can also be seen in the comments of R. Dugas, who in comparing British and French practice during the interwar years, noted: [51]

> In France production is much more irregular and less homogeneous. The same worker is called upon to work successively on a naval vessel, on a cargo vessel,

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[46] *Ibid.*, pp. 486-88.

[47] C. Benoist (1905), pp. 323-24; M. Barbance (1948), pp. 388-89; M. Pinczon (1930), pp. 92-94.

[48] C. A. Holms (1918), pp. 486-88; J. Montgomerie (1937-38), pp. 156-59 and discussion to paper, passim.

[49] M. Barbance (1948), pp. 540-41; Y. Guin (1976), p. 000-00.

[50] M. Barbance (1948), p. 447; Lavalee (1919), passim. Scientific management, though an innovation, was in many respects an extension of trends already evident in French yards. Such a system would not have been practicable in British yards, nor was any interest expressed in it.

[51] R. Dugas (1929-30), p. 59.

> and in this *on the most diverse parts of the same vessel.* Whatever might be his professional worth, his productivity cannot be the same as if he was really specialized.

These two features of the French labour process — flexibility and coordination from ' above ' — were intimately related. The lack of skilled industrial labour meant that those with shipyard experience were generally deployed on a wider range of tasks than was customary in Britain. This resulted in a failure to benefit from the productivity benefits associated with specialization and long familiarity with particular tasks. The movement of workers accross tasks in conjunction with the fact that at any point in time a substantial portion of the work force was relatively lacking in experience, precluded the use of indirect forms of control based on the semi-autonomous work group or squad as in Britain. The British system relied on the interdependency between and general knowledge of squad members. Thus, while skilled platers specialized in templating, shearing, bending, or furnacing, each had a working knowledge of each other's responsibilities and tasks and consequently could coordinate his own work in relation to that of his squad partners without the need of higher level supervision or instruction. Platers could in effect benefit from the division of labour due to the ' polyvalence ' of their knowledge and expertise. Broader knowledge was the precondition for workable specialization independent of managerial control.

It was precisely this form of indirect control over production which was precluded by the shortage of skilled labour in French shipbuilding regions. To overcome these problems employers first acted to concentrate technical design tasks as evidenced in the use of pattern templating methods. This was a precondition for development of more systematic methods of management and control as evidenced in the use of scientific management after 1914. Taylorism, then, should be seen as an extension of tendencies already at work in the French shipyard labour process.

The scarcity of skilled labour for factory employment was in part a consequence of the general pattern of French XIXth century industrial development.[52] There was on overall slow rate of population growth during the XIXth century, particularly marked after 1850.[53] The peasantry remained the predominant segment of the population and formed a self-sufficient if impoverished majority. The countryside was able to hold a surplus rural population due the highly sub-divided pattern of land holdings and strength of peasant proprietorship, resulting from and consolidated by the revolution of 1789. Peasant proprietorship was on the rise throughout the XIXth century. The

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[52] For general discussions of French 19th century development see: M. Levy-Leboyer (1968) and (1971); T. Kemp (1971), Ch. IX and (1962); P. O'Brien and C. Keyder (1978).

[53] Y. Lequin (1970) for the development of labour supply.

labour force engaged in agricultural production rose from 7.20 million in 1865-74 to 8.56 million in 1905-13, or from 65 to 58 per cent of the labour force engaged in commodity production.[54]

There was no major enclosure movement in France as in Britain and a permanent and stable proletariat and developed market for wage labour was much longer in the making. The contrast with Britain is quite striking. The half century before 1830 in Britain witnessed major structural shifts in employment between agriculture and manufacture, mining and construction. By the 1835-44 decade industry accounted for about 63 per cent of the labour force engaged in commodity production. This percentage steadily rose over the XIXth century, attaining about 84 per cent in 1905-13.[55] From this perspective what is significant about enclosure in Britain is that in circumscribing the peasantry as a political force it checked any possibility that the land might absorb an additional 2 million inhabitants over the XIXth century as took place in France.

By the late XIXth century British industrialists could rely on stable regional concentrations of wage labour, for the most part permanently attached and habituated to the conditions of industrial employment. Structural rigidities and stagnant population growth in France meant that French industrialists had to rely on a limited movement of surplus agricultural labour into industry — whose attachment to the factory was often weak and *temporary* [56] — and increasingly on foreign immigrants.[57] These features no doubt contributed to the slow rate of industrial growth after 1815 and to the prevalence of small scale artisanal modes of production catering for fragmented local markets.

While the shipyards of Nantes, St. Nazaire, Marseilles and Le Havre by no means retained the characteristic of small scale artisanal production, and rather were large scale enterprises hiring over one thousand workers,[58] — they still faced the structural difficulties of the French labour market. When the Chantiers Penhoët was first set up in St. Nazaire in 1860 by John Scott and Co. of Greenock, Scotland, under contract with the *Compagnie Générale Transatlantique* the firm drew on peasant labour from the neighbouring parish of Brière, whose families continued to cultivate plots.[59] Reflecting back on his experiences in France in 1860 during the meetings of the 1886 *Royal Commission on Depression of*

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[54] P. O'Brien and C. Keyder (1978), p. 94.

[55] *Ibid.*, p. 94.

[56] Jean-Paul de Gaudemar (1979), pp. 40–46.

[57] Immigrants constitued about 6.4 per cent of the French working population just prior to the First World War. Y. Lequin (1970). On Lequin's account this group constituted a secondary work force, largely relegated to the less skilled and less desirable jobs.

[58] M. Barbance (1948), pp. 373, 386; Y. Guin (1976), p. 377.

[59] M. Barbance (1948), pp. 367, 493.

Trade, J. Scott noted that some three hundred to four hundred of his initial workforce would absent themselves three times a year from the yard; in the sowing period, the reaping period, and in the summer to cut peat.[60]

In St. Nazaire and Nantes, as in other parts of provincial France, a section of the labour force retained its attachment to the land. These workers were really half peasant, half wage labourers, and they developed neither the habits of industriousness nor the degree of organization and sense of working-class consciousness that characterized workers in Britain. While these features of the French labour market have frequently been noted, the fact that they continued to characterize France well into the twentieth century is less well known. In 1920 the peasants from Brière, who still formed an important part of the shipyard workforce in St. Nazaire, were still leaving the yards during the summer to cut peat.[61]

While the lack of skilled labour was a consequence of the structural features I have discussed above, I would argue that the greater severity of the cycle in France was a factor as well. The more extreme nature of the fluctuations, and so more sharply varying labour requirements of the yards over the cycle, exacerbated the problems of recruiting and training an adequate supply of labour for periods of peak demand. As R. Dugas had noted, and probably overstated: [62]

> They (employers) are obliged, during the periods where they have few orders, to guard workers who they are not able to fully use due to the risk of losing them permanently.

Given the severity of the French cycle there was probably much truth in this. During the 1882-91 cycle in Nantes, for example, output increased rapidly from 1,210 gross tons in 1881 to 11,952 in 1883. It then fell to 923 gross tons in 1885, remained at a low level in 1886 and then expanded to 6,120 tons in 1889 and peaked at 8,662 tons in 1891.[63] Fluctuations of this severity were unknown in the shipbuilding centres in Britain and, barring their ability to return to their village of origin, as a fraction of the workforce could, or being retained by the employer, as the most highly qualified were, the only choice was to seek alternative employment, quite possibly outside the region.[64] But retention costs prevented employers from holding onto a supply of labour adequate for periods of peak demand or even periods of moderate and low de-

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[60] *Royal Commission on Depression of Trade*, 1886, 3rd report, qn. 12,013.

[61] M. Barbance (1948), p. 556.

[62] R. Dugas (1929-30), p. 59. Also see M. Barbance (1948), p. 387.

[63] See P. Thebault, p. 71.

[64] This was certainly the case in St. Nazaire where the community was highly dependent on shipbuilding. M. Barbance (1948), pp. 425.27.

mand. During the 1910 slump, for example, when output in St. Nazaire was 1,544 tons, down from 23,642 in 1908, employers complained about a lack of skilled riveters despite the fact that labourers were unemployed.[65] Employers were forced to adopt economizing methods, that at the same time would balance their need to keep capital expenditures at a moderate level. The solution was to use a less specialized, more generally trained workforce.

II. The Role of Industrial Relations

The discussion has so far considered the role of economic forces and structures in the development of the British and French shipbuilding industries. The differences in the labour process that emerged, however, were not solely the result of the choices made by management as constrained by different market conditions, but also were influenced by the systems of industrial relations that developed and the sorts of resistance offered by organized labour to managerial choice. Briefly stated, the difference was as follows. In Britain professional groups (platers, shipwrights, carpenters, etc.) engaged in corporate or sectional struggles aimed at *controlling* the job content of their profession, and to a certain extent their greater autonomy on the job derived from this action. In France, on the other hand, workers' efforts to control the job were comparatively limited, and insofar as such action was taken it tended to be of an *all-trades* nature rather than corporate or exclusive. The aim of this section is to explain this difference and to consider its implications for the labour process.

1. *Job Control and the Labour Process in Britain*

The most obvious manifestation of the desire of trade groups to 'control the job' in Britain was the sectional disputes that occurred as a consequence. These were of two principal sorts: *demarcation* disputes, or competitive struggles between groups of skilled workers over the allocation of work; and *dilution* disputes, or struggles by skilled workers aimed at preventing the substitution of less-skilled grades in their traditional sphere of activity. The emergence and intensification of these disputes during the second half of the nineteenth century was intimately related to the development of trade unionism and the establishment of collective bargaining. As Alistair Reid has shown, such conflict only became endemic to the industry with the strengthening of trade union institutions and

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[65] The scarcity of skilled labour also was due to the absence of a well developed system of apprenticeship. *Ibid.*, pp. 498-99.

control during the 1880's and 1890's, as each society attempted to secure or perhaps enlarge its share of the available work.[66]

By the end of the nineteenth century a high degree of union organization had been achieved by the skilled trades, with seventeen unions organizing the majority of the skilled workers and the closed shop prevailing in the major yards.[67] The inter-professional disputes that occurred must, on occasion, have given the impression of internecine warface. Only a few of the more prominent conflicts will be mentioned here.

The Boilermakers Society, which organized platers, angle-iron smiths, caulkers, riveters and holders-up, became involved in a demarcation conflict with the Shipwrights Association over the fairing of plates and the making of templates for plates. These conflicts intensified during the latter half of the 1890's.[68] The Society also disputed the rights to angle-iron smithy work with the Blacksmiths and Engineers[69] and became involved in jurisdictional disputes with an independent drillers' union. In the latter case the efforts of the drillers to be admitted into the Boilermakers as a corporate group were consistently rebuffed, which eventually led the drillers into a merger with the Shipwrights Association in 1910.[70] The Boilermakers also became embroiled in dilution conflict with platers' helpers following the simplification of plating work in the 1880's.[71] Amongst the outfitting trades notable disputes were those between the Plumbers and Engineers Societies over copper piping work [72] and those between the Shipwrights and Carpenters over wooden fittings. The latter disputes considerably intensified during the 1880's.[73]

In trying to understand the development of strong, but highly exclusive and sectional trade unionism in Britain, a number of the economic characteristics of the industry discussed in the previous section are clearly of importance. The secular expansion of the industry prior to 1914, admittedly marked by severe cyclical fluctuations, and Britain's dominant position in the world market,

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66 A. Reid (1980), Ch. 7 (especially pp. 211-215). For the following treatment of nineteenth century unionism in British shipbuilding I am heavily indebted to the innovative work of A. Reid. Also see S. Pollard and P. Robertson (1979), pp. 156-63, for the development of trade unionism.

67 The most important unions organizing skilled trades were the United Society of Boilermakers, the Associated Shipwrights Society, the Associated Blacksmith Society and the Amalgamated Society of Engineers. There were a number of unions catering to the unskilled of which the most important were the Tyneside, and National Labour Union and the Amalgamated Shipyard Helpers Association.

68 A. Reid (1980), pp. 148–49.

69 A. Tuckett (1974), pp. 83–84.

70 A. Reid (1980), pp. 146-47; J. E. Mortimer (1973), pp. 159-60.

71 A. Reid (1980), pp. 117-21; J. E. Mortimer (1973), pp. 110–11.

72 A. Reid (1980), pp. 174–75.

73 D. Dougan (1975), pp. 62-65.

created the appropriate economic environment for the establishment of collective bargaining and the strengthening of trade unionsim, for employers were in a position to make concessions to organized labour without seriously jeopardizing their competitive position. The following figures provide an indication of the relatively favourable conditions enjoyed by shipyard workers in Britain:[74]

	Britain Av. Weekly Earnings All Trades	*France* Av. Weekly Earning All Trades
1900	£ 1.55	£ 1.38
1905	£ 1.42	£ 1.23
1910	£ 1.52	£ 1.28
1913	£ 1.94	£ 1.38

Source: British figures for the Leven Shipyard, Wm. Denny and Bros., see Pollard, S and Robertson, P., p. 24. French figures for Nantes Shipyard, see Dubigeon, G., p. 53.

This, however, tells us little about the structure and aims of trade unionism.

The finely subdivided division of labour resulting in a high degree of specialization between trades (though frequently with overlapping or similar aptitudes and skills) no doubt created the necessary organizational conditions for such conflict. The tendency for British employers to rely on skilled workers for the details of work organization, on the other hand, strengthened the bargaining power of the work group, the level at which job-control conflict emerged. This, however, does not explain why such conflict occurred, merely that it was feasible given the labour process.

Despite the evident strength of craft unionism in the British shipbuilding industry, sectional job-control conflict suggests that the position of the skilled trades was *not* entirely *secure*, for the fundamental purpose of engaging in demarcation or dilution conflict was to capture or secure a *position* in the division of labour. Other institutional controls of craft unionism point in the same direction. The closed shop, restrictions on apprenticeship and inter-union conflict over recruitment suggest a perceived need to establish greater control over the labour market.[75]

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[74] Hours of work between 1880 and 1914 were fifty-four in Britain and sixty in France.

[75] See A. Reid (1980), pp. 100–03, 171–73, 176–78 and 212–13. There was little conflict over recruitment after 1900 until the creation of a new trade, the shipwelder, in the 1930s.

The basis for this insecurity lay in a number of factors. Firstly, the severity of cyclical fluctuation in output and demand for labour meant that employment insecurity was ever present for most manual workers.[76] Secondly, the constant change in construction materials and the increasing sophistication of ship fittings during the late nineteenth century disrupted established allocations of work, creating a certain ambiguity over trade 'rights' which was frequently resolved through strike action.[77]

While these factors were indisputably of importance, the feature of the industry I would like to emphasize here is the process of mechanization and changing skill requirements over the late nineteenth and early twentieth centuries that I developed in the first section of this paper. I emphasized in that discussion that mechanization, though simplifying certain tasks and eroding certain skills, was not of a sufficient extent to allow a general substitution of semi-skilled machine operators for skilled workers, as characterized the automobile industry, for example. There was no *general* choice between capital intensive and labour intensive methods. What should be emplasized here is the *unevenness* and *partiality* of the mechanization process, both in its impact on the skills of the different trade groups within *one* union, and as it affected the skill requirements for the tasks 'belonging' to one trade.

The importance of this feature can be illustrated by briefly describing the conflicts and negotiations that took place between employers and the Boilermakers Society over the introduction of pneumatic machine tools for riveting, caulking, drilling and hole cutting between 1900 and 1905. The Society organized a number of trades with their own corporate interests: platers, angle iron smiths, riveters, holders-up and caulkers. Though drilling was claimed by the Society as a traditional, though perhaps neglected, part of caulkers' work, it had come to be recognized as an independent trade by the employers with the establishment of collective bargaining arrangements with a number of independent drillers' societies during the 1890's.[78]

The decade after 1900 was characterized by increasing industrial relations strife in the industry, with conflicting tendencies towards unilateralism on the one hand and towards more formal and nationally centralized bargaining proceedures on the other. These centrifugal tendencies in large measure resulted from employers' concern to assert their managerial prerogatives over such craft related issues as apprenticeship and machine manning. This followed a period in which trade unionism and craft institutional controls over job allocation had strengthened.

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[76] See L. Jones (1957), pp. 169-76, for an analysis of demaracation emphasizing this feature of the industry.

[77] For a treatment stressing this feature, see S. Pollard and P. Robertson (1979), pp. 166-69, and R. Okayama (1979), p. 11.

[78] J. E. Mortimer (1973), pp. 133-34; A. Reid (1980), pp. 145-47.

Employer initiatives found greater coordination and concert through the formation of the Shipbuilding Employers Federation in 1899, a reorganization of 1889 National Federation of Shipbuilding and Engineering Federation, following the engineers' formation of their own national organization in 1896. The general tenor of industrial relations was set by the S.E.F.'s refusal to renew the terms of the 1893 apprenticeship agreement with the Boilermakers which had expired in 1889. The agreement had stipulated a 2 to 7 ratio of apprentices to journeymen in all yards. In 1901 negotiations led to a new agreement which removed all restrictions on the numbers.[79] This led the Society to resort to unilateral controls on apprenticeship. The Society's 1901 'New Rules' called for district action if the traditional ratio of 1 to 5 was surpassed and a 1906 Executive Committee resolution explicitly allowed strike action in any case of 'overstocking'.[80]

The S.E.F. first raised the question of pneumatic tools in January 1901 with the formation of a special committee to investigate manning conditions and remuneration.[81] A March 1902 interim report called for unilateral employer discretion in determining manning and piece-rates. This reflected the view that satisfactory terms could only be achieved with non-unionized men, unaquainted with existing hand-work conditions and terms.[82] By this time, however, the Boilermakers Society had unilaterally made a claim for the working of all pneumatic tools at standard rates:[83]

> All riveting machines used in shipbuilding where piecework is done must be worked by a full set of riveters, who must be members of our society. Any member working shorthand, or any member working on such with a non-member, shall be fined 5s. for each offence.
>
> All riveting machines used in boiler shops or bridge yard must be worked by our members at riveters' rates.
>
> Caulking, cutting, and other machines, whether hydraulic, electrical, or pneumatic, etc., to be worked by our members at recognized rates.

Concurrently with these national level initiatives, yard-level job control struggles were taking place in yards where pneumatic plant had been introduced. The main area of conflict proved to be caulking tools. This somewhat surprising result was due to the technical difficulties certain yards experienced in using pneumatic riveters in the case of imperfectly aligned work, and the general ability of riveters to enforce the use of a full squad of four on the machines,

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[79] H. CLEGG et. al., (1964).

[80] Boilermakers Society 1901 Rule Book; J. E. MORTIMER (1973), pp. 155-56.

[81] SRNA Archives, Federation Circular no. 15, Jan., 1901.

[82] SRNA Archives, Federation Circular no. 152, 14 March, 1902. Also see the comments on Wm Simon and Co. on the use of unskilled labour, SRNA, Federation Circular no. 194, Oct. 1902.

[83] Boilermakers Society 1901 Rule Book, Rule 43, Section 2.

despite the need for only three, and to limit deductions on hand rates to a minimum. This had discouraged a number of yards from introducing the equipment, among them J. Laing and Sons, A. Stephens and Sons, London and Glasgow Co. and W. Gray and Co.[84]

In the case of drilling tools, on the other hand, most firms secured substantial reductions of hand rates (50 to 70 per cent), thus presumably reflecting the weaker collective organization of drillers and the fact they were non-unionized in certain yards such as Vickers, Son and Maxim.[85]

The conflict over caulking tools centred around the employers' ability to make free use of apprentice labour on the terms of the 1901 apprenticeship agreement, a step taken after unsatisfactory results with skilled caulkers. The success of firms in this direction depended on the ability of the fully skilled caulkers to influence the output of apprentice labour.[86] Conflict came to a head at Wm. Gray and Co. in May, 1904 with a strike of *all* members of the Boilermakers Society over the use of apprentice labour on a bridge deck.[87] This strike led directly to national level negotiations on rates and manning for pneumatic caulking, chipping and hole cutting tools in August, 1904. The S.E.F.'s initial proposal was for a 60 per cent reduction on hand rates for shell work and 50 per cent for inside work, terms which the Boilermakers Society rejected. Settlement came in November 1905 with 45 per cent and 35 per cent deductions off hand rates and the aggreement of one man to a machine.[88]

A number of points emerge from this brief digression into factual detail. Firstly, the impact of mechanization on skills was highly uneven, being minor in the case of riveters and more pronounced in the case of caulkers who faced possible dilution. Further, the new tools did not affect the nature of employers' dependency on the skills of platers or angle-iron smiths. On the basis of this more general dependency of employers, the Boilermakers Society was able to take effective collective action in support of its claim to pneumatic caulking, as evidenced in the strike at Gray's which involved all trades organised by the Society. In short, the collective strength of the Society benefited from the uneven pace of technical change.

Secondly, there was a symbiotic relationship between yard level action on job control and national level coordination and initiatives, both being crucial

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[84] SRNA Archives, Federation Circulars, Report of the Pneumatic Tool Committee, June, 1904. See report of John Brown and Co which concluded that pneumatic riveters could only be used on perfectly alligned work. Federation Circulars, April, 1902.

[85] *Ibid.* Report of Pneumatic Tool Committee, June, 1904.

[86] *Ibid.*

[87] Federation Circular no. 275, 17 May, 1904.

[88] Conference Between Pneumatic Tool Committee and Boilermakers Society representatives 23 Aug., 1904. Memo of Agreement, re. Working of Pneumatic Chipping, Caulking and Cutting Tools, Federation Circular, 14 Nov., 1905.

to the Society's success in capturing the new machinery and retaining its position in the division of labour. Yard level struggles were vital in forcing employers to abandon unilateralism in favour of national level negotiations which had the effect of legitimizing the Boilermarkers' control over pneumatic caulking and cutting tools. Yard level action in turn found important coordination in National Executive rules on manning and rates which precluded one district from being set against another.

The important role of national level coordination was a general feature of industrial relations in the industry. During the 1940's, for example, it was only on the basis of mounting an effective national campaign that the Boilermakers managed to secure control of semi-automatic oxyacetylene burning equipment for its members, and this despite vehement opposition from certain employers.[89]

Trade union strength, then, was an important factor in the ability of shipyard workers in Britain to pursue job control. In the process of establishing their unions and engaging in job control conflict they both preserved a degree of autonomy on the shop floor and influenced the labour process. The division of labour in British shipbuilding in effect developed through the resolution of the conflict that emerged when management attempted to alter machinery and methods.

2. *The Development of Trade Unionism in the French Shipbuilding Industry*

> There was not solidarity between the different trades because there did not exist between them a trade union link; instead of struggling together for common aims, the trades fought separately and achieved only, of course, a minimum of success.[90]

It is with these words that F. Blanco (Secretary of the St. Nazaire Union of Metallurgists) in a retrospective *memoire* described trade unionism in the shipbuilding and engineering firms of St. Nazaire prior to the fusion of the crafts into a general metallurgists'union just before the First World War. The references to weakness aside, his description might well have applied to the craft unions of the British shipbuilding industry. Despite the evident similarity, though, there was a critical difference between trade unionism in France and in Britain, for there is no evidence in Nantes or St. Nazaire (Loire-Inférieure) [91] of demarcation conflict or other *sectional* struggles related to craft control over

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[89] SRNA Archives, Federation Circulars, 1944-45, passim. Reid has argued that the unions most affected by mechanization tended to have more highly centralized and nationally structured controls over the allocation of work. A. Reid (1980), pp. 223-24.

[90] *Le Travailleur de l'Ouest*, 8 July 1922 (A trade union weekly of St. Nazaire).

[91] The Loire-Inférieure was France's principal shipbuilding centre, accounting on average for about 40 per cent of gross tonnage produced before World War I.

the allocation of work and machinery.[92] It may be that the more flexible deployment of labour which characterized French shipyard practice discouraged job control conflict, since workers would have less *need* to assert their rights to specific tasks. The tendency of Frence yards to emphasize hierarchical forms of control may have had the same effect by diminishing the bargaining power of the work group. It is likely, though, that the late development and organizational weakness of craft unionism were more important factors. The first craft unions in France were formed during the 1860's. Due to the collapse of the Paris Commune (1871) and the subsequent Versailles repression, the movement suffered a serious setback. In the Loire-Inférieure, for example, there were only ten strikes in all industrial sectors between 1871 and 1880.[93] It was only in the early 1890's, during the " leap " in union membership, that the French craft unions began to achieve the necessary strength to challenge employers, and between 1900 and 1914 collective bargaining was established in certain sectors.[94] Unions, however, remained remarkably weak amongst metallurgical workers, with less than 5 per cent unionized nationally, and no collective agreements were signed in shipbuilding or engineering prior to World War I.[95] The relatively poor competitive position of the industry internationally,limiting employers' ability to make concessions, as well as the organizational strength of employers, grouped in a national federation since 1901,[96] were undoubtedly important factors in trade union weakness.

It would be incorrect, then, to confuse the craft unions of France with their British counterparts, increasingly national in the scope of their activities and frequently with strong national executives and a centralization of finances. The *Syndicat des Chaudronniers* (boilermakers) of Nantes or the *Syndicat des Riveurs et Parties Similaires* (riveters and assistants) were strictly local organization, entirely independent of the similar unions which sprang up after 1870 in the shipbuilding centres of Marseille, Bordeaux and Havre.[97] Much as the organizational strength of British craft unions on both a regional and national level was an important factor in the ability of trade groups to carry out successful job-control strikes in the yards, the lack of organizational strength in

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[92] In my examination of police strike reports for the Loire-Inférieure, 1894-1936 I have not come across any reports of demarcation disputes. Archives Nationales, series F7 13606.

[93] Y. Guin (1976), pp. 246-47.

[94] See V. Lorwin (1954), pp. 20-26 for the development of collective bargaining in France.

[95] Gras (1971), p. 96; Stearns (1968), p. 495.

[96] The *Union des Industries Metallurgiques et Minières.*

[97] While these unions were for the most part affiliated to the *Confédération Cénérale du Travail*, after its formation in 1894, this had no influence on the local character of the action they took over professional issues.

France constituted an important check to any pretensions the craft groups may have had to carry out similar action.

With the increasing pace of mechanization and the more systematic application of science to industry, associated with the rise of large industrial units, French engineering workers proved ineffective in their limited struggles against the expropriation of control over the labour process.[98] It was on the basis of generalized deskilling in certain sectors of engineering that the majority within the C.G.T. after 1900 came to argue for the amalgamation of the engineering, foundry workers' and general metallurgists' unions into a national industrial federation. Yet, in the debates within the C.G.T. the pro- and anti-industrialists tended to divide along political lines, the revolutionary majority favouring industrial unionism. Not that there was anything inherently revolutionary about industrial unionism, but that the logic of craft unionism requiring the protection of particular interests appeared inconsistent with the pursuit of class revolutionary aims, and amalgamation was seen as a means of rallying the reformist minority to the revolutionary majority. In the National Trades Congress of 1908 the principal opposition to industrial unionism under Coupat, leader of the Engineers Federation, accused such pro-industrialists as Merrheim and Latapie of being politically motivated.[99] After the formative congress in 1909 a number of engineering unions split from the C.G.T., though the majority of these rallied back by 1914. In the years after 1909 the logic of the amalgamation was worked out on the local level in shipbuilding and other industrial sectors with the merger of engineering and metal working unions, until by 1919 only thirteen local and regional craft unions were still attached to the national Federation of Metallurgists.[100] The shipbuilding industry was effectively entwined in a movement that bore little relation to its specific technical conditions.

During the war years a considerable strengthening of trade unionism took place in Nantes and St. Nazaire based upon the organizational *link* that had been forged between the crafts before the war. Formal recognition was bestowed on the union by the local employers' association and collective bargaining machinery was established. The state played a critical role in this development. Through the local 'Controller of Manpower', the Ministry of Munitions increased its control over labour relations in the principal shipyards and engineering works which were engaged in munitions production. The resolution of industrial conflict by means of conciliation was actively encouraged and an attempt was made to integrate the union apparatus into

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[98] For a well popularized example, see Collinet's discussion of dilution at Renault's Billancourt factory. COLLINET (1951), pp. 41-45.

[99] Archives Nationales, Series F7 13771, 1908 Congress.

[100] COLLINET (1951), pp. 31-32.

he industrial mobilization effort.[101] Between September and December of 1916 *Commissions Mixtes* formed of union and employer representatives were created in Nantes and St. Nazaire and arrived at collective agreements establishing cost of living allowances, eliminating wage differentials between the yards and determining certain conditions pertaining to the recently introduced system of 'scientific management' in the shipyards and engineering works.[102] The principal concessions were that piece rates should be determined in a precise and clear manner, allowing for verification by the workers, and that an average bonus of 30 per cent should be guaranteed.[103]

Unlike Britain, where the strengthening of trade unionism resulted in an intensification of sectional conflict over the division of labour, in France the pre-war fusion of the crafts contributed to a different outcome—greater *unity* and *cooperation*. This is not to suggest that the *Syndicat des Métallurgistes* acted to suppress craft consciousness or somehow managed to surpass it. On the contrary, in certain respects the craft or trade group remained the basis of trade union organization. Rather than suppress craft identity, the union saw its task as the forging of *links* between the trades which still retained a legitimate and recognized identity.

The complexity of the interrelations can be illustrated by considering the initial meetings of the *Commission Mixte* of Nantes, which took place between the 7th and 17th December 1916, and which concluded with the signing of a collective agreement. Rather than holding meetings with general representatives from yards and engineering works, the meetings took place on a trade by trade basis, an initial meeting devoted to the engineering trades, to be followed by a meeting with the boilermakers and a further one with shipwrights and platers, etc. In this manner the *specific* interests of the crafts were accommodated.[104] Yet at the same time the union leadership showed a keen interest in forging links between workers and creating greater unity. In the concluding all-trades meeting the employers' proposition calling for a hierarchy of cost of living allowances related to a skilled worker's average daily wage was rejected as apt to create divisions between workers. The union demanded, and received, allowance payments independent of sex or earnings and based solely on the extent of a worker's family obligations.[105]

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[101] Unfortunately, there is not the space here to go into the question of the state's role in any detail. For a general discussion, see R. PICARD (1927), especially pp. 55–69.

[102] *Le Travailleur de l'Ouest*, 8 July 1922.

[103] It is notable that at the Chantiers de la Loire, St. Nazaire, the agreement was only applied after two strikes and the intervention of the local Commandant des Forges, pointing out the importance of state intervention. See *Le Travailleur de l'Ouest*, 8 July 1922, and Archives de la Loire-Inférieure, 1 M 644, 'Surveillance des Usines de Guerre'.

[104] Archives de la Loire-Atlantique, 1 M 2339.

[105] *Ibid.*

The desire to create greater unity was also evident in the struggles the union waged over the labour process. These were directed against the system of 'scientific management' which aroused a continuous protest during the inter-war period, with frequent demands for the elimination of the Time Study Service.[106] The basic concession the union gained, though, was to have the unskilled helpers included in the payment-by-result wage system so as to improve their relative earnings, this despite employer opposition.[107]

The efforts of the *Union des Métallurgistes* to create solid links between the trades, however, were not entirely successful. In 1921 a group of skilled platers and shipwrights from the yards of St. Nazaire, dissatisfied with the decline in their relative earnings, formed a separate craft union, the *Unoin Corporative des Charpentiers-Toiliers* (U.C.C.T.).[108] Though initially unsuccessful, the union was finally admitted to the 1928 meeting of the St. Nazarie *Commission Mixte* and received its long-demanded reclassification. Although the U.C.C.T. disappeared during the 1930s depression, its temporary successes were no doubt a set-back to the pretensions of the *Union des Métallurgistes* to achieve strength through intertrade unity.

Conclusion

Many of the themes developed in this paper are in contrast to those associated with the economic historian's account of comparative industrial development in general and technical change in particular. This approach, which has proved a rewarding line of enquiry in many instances, lays stress on the one hand, on the role of variations in factor prices and supplies in determining the choice of technique, and on the other hand the importance of advances in scientific knowledge for improving the productivity of factors. Habakkuk's well known study of XIXth century technology in the United States and Britain points to the usefulness of a focus on relative factor supplies. He presents a stimulating and provocative account of the role of labour scarcity in the United States due to the frontier in shaping the propensity to introduce labour saving techniques.[109] Landes' study of European economic development arguably presents the best account of the process of scientific and technical advance from the beginning of the industrial revolution in Britain onwards. To a considerable extent his essay is devoted to describing the development of new technical processes and machinery in the first industrial nation and their gradual diffusion to the continent. In particular, industrial

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[106] M. Barbance (1948), p. 450.
[107] *Ibid.*, pp. 540, 550.
[108] *Ibid.*, pp. 556–57.
[109] H. J. Habakkuk (1962).

retardation in France is explained primarily by the tardy application of new techniques.[110]

The assumption made in economic histories such as these is that each technique of production requires investment in a particular outfit of specialized capital equipment which in turn is most ideally suited to a particular scale of production. Correspondingly, differences in labour productivity between nations is attributed primarily to variations in the quantity or vintage of the capital goods used. While not wishing to discount the importance of these factors, the result of these emphases has been a systematic undervaluation of the importance of organizational variables in relative productivity and performance; in particular of differences in product specialization and the division of labour or the allocation of expertise and responsibilities in the factory.

The account of the shipbuilding industry presented here does point to the role of improvements in systems of drive and the capacity of machinery and berths in the growth of the industry. On the other hand, it is apparent that Britain's dominance of world shipbuilding can not be attributed to the quality or quantity of its plant and equipment. All evidence points to an average older vintage and the use of more labour-intensive techniques, this despite relatively higher wages than on the continent. The critical factors in British success were greater product specialization and a more highly detailed division of labour at the yard level related to more ample and stable supplies of skilled labour. This paper, then, provides an argument for a more careful exploration of the role of work organization in comparative industrial development.

Given this, the point needs to be stressed that the division of labour was a social product, the outcome of labour conflict, resistance and compromise and not solely the result of the play of broad economic forces such as labour supply, product market size and technology. The purpose of the discussion around the introduction of pneumatic machine tools in Britain was to illustrate and emphasize this line of argument by showing how the allocation of work and the evaluation of skills was the product of a process of conflict and compromise between employers and organized labour. The importance of compromise and negotiation in this process should not be neglected. It was the existence of established collective bargaining institutions and the willingness of the Boilermakers Society to negotiate reductions in piece rates with changes in technology that allowed a settlement to be arrived at that employers could live with, both sides partially benefiting from improvements in productivity. Further, the very formality of the bargaining process served to legitimize and reinforce craft control and the Society's rights to operate the new machinery.

Numerous other examples could be cited illustrating how the balance of power and conflict influenced the division of labour. One of the most striking

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[110] D. S. LANDES (1972).

is provided by the differences in the demarcation of tasks that evolved in the Royal Dockyards. Here, with the transition from wooden to iron hull construction during the 1860's and 1870's, woodworking shipwrights, well established and organized, successfully captured a range of tasks which came to be recognized as belonging to the metal-working trades in private yards. The dockyard shipwright was a shipwright, a plater, a sheet metal workers, a plumber and eventually a welder after 1930. Further, such trades as riveter and caulker were classified as 'skilled labourers', an intermediate category between skilled and unskilled.[111] The point to be made is not only the well accepted one that skill classification was a social process, but also that the very occupational structure of the shipbuilding industry and definition of craft was a political process in the broad usage of the term.

It is not necessary to juxtapose trade unionism and economic forces as polar explanations in this process. Rather, they appear in the shipbuilding case to have been reinforcing factors, the balance of importance between which varied over time. The evidence suggests a conservative and highly pragmatic approach by most employers in the face of expanding technical and organizational options, and in the absence of labour resistance it is likely that economic conditions would have encouraged many to organize work in not radically different ways. Yet the intensity of job-control conflict suggests that some employers almost certainly would have moved in the direction of more systematic forms of coordination and control from above. The hypothetical balance sheet is hard to reckon.

To a large extent the general context of unionism has been taken as given in this essay, with no attempt to delve into the more distant late XVIIIth or early XIXth century origins or the relation of trade unionism to the wider political mobilization of the working class and formation of political parties. The emphasis has been more narrowly on the relations between workers' organizational and technical experience on the shop floor and trade unionism. When we contrast the British and France industrial relations experience, though, it is apparent that trade unionism had a dynamic independent of shop floor conditions, a dynamic which derived in part from the broader societal context. This dimension of the problem emerged from the discussion of the transition from craft to industrial unionism in French shipbuilding, a transformation attributable to tendencies in the wider labour movement and the nature of political affinities and divisions. These issues are raised here not only to point out the limitations of a study focusing primarily on the work place, but also to mark out fruitful areas of research.[112]

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[111] P. INMAN (1957), pp. 84, 126.

[112] See M. B. STEIN (1978) for a sensitive treatment of these issues in the case of French railway workers.

Further, it should be pointed out that the French shipbuilding industry ought not to be considered as the exactly polar case to the British industry, with management enjoying unambiguous unilateral control over the workforce. The relative weakness of trade unionism, its regional as opposed to shop floor orientation and the relative unimportance of sectional forms of job control-eased the introduction of new machinery and the establishment of bureaucratic systems of management. Yet despite this, collective action at the regional level had a significant bearing on the relative status and earnings of the less skilled.

The question of the generality of the sorts of differences described between British and French shipbuilding will now briefly be raised. The argument has been that the more systematic coordination of production from 'above' in France, the emphasis on technical and supervisory services, reflected in part broad economic trends, particularly labour supply contraints and the manner in which the industrial proletariat was formed. If this is a valid line of reasoning then we would expect like trends in other industries with similar technological characteristics: mechanical engineering, metal tranformation and assembly industries. There are difficulties in pursuing this line of inquiry, though, for comparative and historical studies of sufficient detail to show such subtle differences as those between systems of templating described here simply do not exist.

It may be possible to proceed in a somewhat more indirect manner, though, through an interpretation of the relative receptiveness of industrialists in Britain and France to F.W. Taylor's system of scientific management prior to and during the First World War. In considering the question from this angle, it is important not to overestimate the practical importance of the scientific management movement in any country prior to 1914. In France Taylor's works were widely read with the appearence of translations sponsored by Le Chatelier of *Shop Management* in 1907 and *The Principles of Scientific Management* in 1911.[113] Applications remained few and scattered prior to the war, though, the most fruitful sector being the automobile industry. The war years then saw a considerable increase in the number of applications, particulary in the state controlled munitions sector.[114]

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[113] A. Moutet (1975); A. Heron (1975); and P. Devinat (1927), pp. 211-16 and 232-45 for general discussions of scientific management in France.

[114] On the account of P. Friedenson (1978) 1 per cent of French manufacturing firms applied a version of scientific management prior to the war, exactly the same percentage as in the United States. For applications in the automobile industry see De Ram (1909) and M. S. Laux (1972). For other pre-war applications see Abaut (1913) and the studies summarized by Le Chazelier and de Freminville in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* (1914). For war time applications see the series of reports by Nusbaumer, Compagnon, Lavalée and Lecier and Charpy in the same journal in 1919.

Though the balance sheet of applications in France is not impressive, the contrast with Britain is nonetheless striking. Not only is there no evidence of applications in British industry prior to the war, but opinion amongst industrialists, in sharp contrast to France, ranged from apathy to hostility.[115] *The Engineer*, for example, one of the two principal voices of the engineering world, took a distinctly adverse stance.[116]

The reasons for this are multifarious. A tradition of pragmatic and empirical modes of thought, a conservativeness born of industrial leadership and anticipated labour resistance were no doubt factors. But the major practical organizational consideration must have been the continued prevalence at this time in Britain of indirect forms of labour control based on some modification of the internal contract system. In the case of the shipbuilding industry it was the metal working squads who organized the details of hull contruction and supervised the unskilled. Similar arrangements could be found in the textile, mechanical and heavy engineering, auomobile and glass industries.[117] Well into the XXth century, many British industrialists remained highly dependent on their skilled workers for control and organization.

Arguably a factor in the greater receptivity of French industrialists to Taylor's ideas and methods was that certain of the practices of scientific management were not without precedent. The most striking example of this is the set of proposals formulated by G. Ply in 1888 for setting up a technical service to coordinate series production of arms. These proposals were based on his experience at the Manufacture d'Armes in St. Etienne. Ply's comments make it clear that the emphasis was on careful preplanning and coordination of the stages of production: [118]

> First of all, before attempting manufacture,one ought to lay out a general plan comprising the establishment, the work tables, that of the series of operations and the organization of the work shops. This plan, if need be, will be completed and corrected later.

The munitions sector was also the site, from as early as 1835, of experiments in the use of time study to establish work norms.[119] Beyond this, mention should be made of Fayol's study, *Administration Industrielle et Générale* which though only appearing during the war, was, on his account, the result,

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[115] LITTLER, C.R. (1979) and URWICK and BRECH (1948), Littler notes that there is no evidence of time and motion study being used prior to the First World War.

[116] LEVINE, A.L. (1967), pp. 60-68 for the commentary of *The Engineer*.

[117] LITTLER, C.A. (1979), pp. 162-63.

[118] PLY, G. (1888), p. 4.

[119] See the reference in A. VIELLEVILLE (1914), p. 39 to its use by General Poncelet during the 30's and the reference by B. MOTTEZ (1966), p. 132 to its use for shell production in Bourges in 1893.

of some 25 to 30 years of prior research.[120] In sum, it can plausibly be argued that scientific management was relatively well received because similar tendencies were already at work in the metal transformation sector.

From the perspective of the structure of the French economy as a whole, the greater interest of industrialists during the late XIXth and early XXth centuries in systematic methods of management and work organization is surprising, for it is generally accepted that the industrial structure was highly decentralized. Further, a common view is that the prevalence of artisanal and family enterprise was closely related to slow rates of growth during the second half of the XIXth century.[121] In 1906 productive units with less than ten workers accounted for 56 per cent of the industrial work force, in 1926 for 41 per cent and in 1936 for still 39 per cent.[122] This indicates the importance of petty proprietor modes of production in which bureaucratic systems of management would not play a role.

Recent research suggests, however, that it is more appropriate to view the French economy as having a dual structure, rather than a uniformly more decentralized one than found in its competitors. If we restrict our attention to the largest firms (more than 1000 employees) in such sectors as shipbuilding, engineering and metal tranformation, then the average size of firms in terms of number of employees is comparable to Britain, the United States or Germany. What distinguishes the French economy from others is the relative importance and continued vitality of the small-scale artisanal forms of production.[123] It need not surprise us, then, that only a small percentage of firms attempted to adopt a version of scientific management, since these efforts were restricted to the larger firms, primarily in mechanical engineering and metal transformation.

To explore the basis for French XIXth century industrial structure is not only beyond the scope of this essay, but would detract from the central focus. Most recent analyses stress the role of product specialization, market structure and the nature of tastes.[124] It is useful, though, to consider the effects of this industrial structure on labour supply and the formation of the industrial proletariat. It has already been argued that the strength of peasant proprietorship allowed the land to absorb additional labour during the XIXth century, limiting the supply to industry. The other important pole of attraction in France was petty proprietorship, the vitality of which promised an attractive

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120 FAYOL, H. (1916).

121 KEMP, T. (1971) p. 287; LANDES, D.S. (1963) pp. 340-46.

122 LEVY-LEBOYER, M. (1976) p. 98.

123 *Ibid.* pp. 87-100.

124 See SABEL, C. and ZEITLIN, J. (forthcoming) for a comparison of the French and British patterns of economic development. I would like to thank these authors for allowing me to refer to their forthcoming article. Also see: LEVY-LEBOYER, M. (1968) and (1976); O'BRIEN and KEYDER, (1978).

alternative to factory employment.[125] To a considerable extent what was at stake here was a question of values and preferences. As Kemp has noted, independent proprietorship had a considerable allure.[126]

> The hereditary proletariat in such fields (small workshops) was not an industrial worker of a modern type but had more affinity with the old handicraftmen; politically he turned to Proudhon rather than Marx. Where other conditions were favourable for the establishment of factory production, employers found it difficult to recruit and discipline the labour force which they required. Factory labour for a long time was regarded as degrading, fit only for the more poverty stricken fringes of the rural population who made up the immigrants to the towns.

In effect, the large-scale enterprise faced a double squeeze in the labour market: on the one side from agriculture and on the other side from the small workshop. As a consequence these firms often had to do with what de Gaudemar has called a 'floating' proletariat.[127] The problem facing factory employers was not merely one of training or human capital, but was a question of the origins, attitudes and instability of the industrial workforce. This is the broader social context which should be kept in mind when investigating the development of more systematic methods of management in certain industrial sectors. More specifically, one should not be too quick to adopt established American parables about the role of Taylorism in overcoming craft resistance and control to the case of France. For, in the shipbuilding case, at any rate, it has been shown that craft workers never enjoyed a considerable amount of control they could lose.

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[125] Petty proprietorship constitutes a viable channel of social mobility for wage labour even today. See MAYER, N. (1977).

[126] KEMP, T. (1962), p. 341. Marx's characterization of attitudes made during the mid-1860's is much to the point. "The position of a proprietor, the possession of a house, of a plot of ground, is the chief object also of the factory operative, and also of almost every poor man who has not already a property; in fact all look to the land." Marx, K. (1976), Appendix, pp. 1075–76.

[127] DE GAUDEMAR, J.-P. (1979), pp. 46–48.

REFERENCES

ABAUT, " Travail d'Usine ", *Revue de Métallurgie*, Sept., 1913.

BARBANCE M., *Saint Nazaire: Le Port, La Ville, Le Travail*, These, Faculté de Droit, Université de Rennes, 1948.

BASSO L., *Les Entreprises Françaises de Construction Navales*, Thèse, Faculté de Droit, Université de Paris, 1910.

BENOIST C., *L'Organisation du Travail: La Crise de l'Etat Moderne*, Tome I, Librarie Plon, Paris, 1905.

BERTIN L.E., Rapport sur une seconde mission en Angleterre: 5 aout-15 sept. 1884, Bibliotheque de la Marine Marchande.

CHARPENTIER H., *La Construction de navires marchands*, Paris, 1945.

CHASSERIAU R., *De la Protection de l'Industrie des Constructions Navale*, Thèse, Faculté de Droit, Université de Paris, 1910.

CLEGG, FOX and THOMPSON, *A History of British Trade Unions Since 1889, Vol. 1, 1889-1910*, Oxford, 1964.

COLLINET M., *L'Esprit du Syndicalisme*, Les Editions Ouvrières, Paris 1951.

CRAIG J., ' Some Effects of War on Merchant Shipbuilding ', *Transactions of the Institution of Engineers and Shipbuilders in Scotland*, Vol. LXI, 1917-18.

DE RAM, ' Notes sur un Essai d'Application du Systeme Taylor dans un Grand Atelier de Mécanique (Usines Renault) ', *Revue de Métallurgie*, 1909.

DEVINAT P., *Scientific Management in Europe*, I.L.O. Studies and Reports, Series B, No. 17, 1927.

DUBOIS P., ' Niveaux de main-d'oeuvre et organization du travail ouvrier. Etude de cas Français et Anglais ', *Sociologie du Travail*, No. 3, 1980.

DOUGAN D., *The Shipwrights*, Newcastle-upon-Tyne, 1975.

DUBIGEON C., *Du salaire ouvrière dans la métallurgie Nantaise de 1914 à 1927*, Thèse, Faculté de Droit de Rennes, 1928.

DUGAS R., *L'Industrie de la Construction Navale*, Conseil National Economique, 1930.

FAIRBURN W.A., ' Methods of Handling Material over Shipbuilding Berths in American Shipyards ', *Transactions of the Institute of Naval Architects*, Vol. XLIV, 1902.

FAYOL H., *Administration Industrielle et Generale*, Paris, 1916.

FRIDENSON P., ' The Coming of the Assembly Line to Europe ', Krohn, Layton and Weingart eds., *The Dynamics of Science and Technology, Vol. II*, Dordrecht, Holland, Reidel, 1978.

GAUDEMAR JEAN-PAUL DE, *La Mobilization Générale*, Editions du Champs Urbain, Paris, 1979.

GRAS C., ' La Fédération des métaux en 1913-1914 et l'évolution du syndicalisme revolutionnaire français ', *Le Movement Sociale*, No. 77, 1971.

GUIN Y., *Le Movement ouvrier Nantais*, Editions Maspero, 1976.

HABAKKUK H.J., *American and British Technology in the XIXth Century, The Search for Labour Saving Inventions*, Cambridge University Press, 1962.

GARDY J., *L'Industrie des constructions navales en France*. Thèse, Faculté de Droit de Rennes, 1951.

HERON A., ' Le Taylorism Hier et Demain ', *Les Temps Modernes*, 1975.

HOLMS C.A. *Practical Shipbuilding*, London, 1916.

HUME J.R., ' Shipbuilding Machine Tools ', Ch. 10 of J. Butt and J.T. Ward edition, *Scottish Themes: Essays in Honour of Professor S.G.E. Lythe*.

JOHN T.G., 'Shipbuilding Practice of the Present and Future', *Transactions of the Institute of Naval Architects*, 1902.

JONES L., *Shipbuilding in Britain: Mainly Between the Two World Wars*, Cardiff, 1957.

KEMP T., 'Structural Factors in the Retardation of French Economic Growth', *Kyklos*, XI, Fasc. 2, 1962.

KEMP T., *Economic Forces in French History*, London, 1971.

KENDALL S.O., 'Turret-Decker Cargo Steamers', *Transactions of the North-East Coast Institution of Engineers and Shipbuilders*, Vol. XI, 1894-95.

KIRKALDY A.W., *British Shipping*, London, 1914.

LANDES D.S., *The Unbound Prometheus*, Cambridge University Press, Cambridge, 1972.

LATTY J., *Traité d'économie maritime: Tome 1, La Construction navale dans l'économie nationale*, Paris, 1951.

LAUX M.S., 'Travail et Travailleurs dans l'Industrie Automobile' Jusqu'en 1914', *Le Movement Social*, No. 80, 1972.

LAVALÉE L., 'Resultats Obtenus par l'Application des Nouvelles Methodes de Travail dans un Chantier de 3000 Ouvriers', *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, 1919.

LEQUIN Y., *Labour in the French Economy Since the Revolution*, Cambridge Economic History of Europe, Vol. VII, Pt. 1, 1977.

LEVINE A.L., *Industrial Retardation in Britain, 1880-1914, London*, 1967.

LEVY-LEBOYER M., 'Les Processus d'Industrialisation: Le Cas de l'Angleterre et de la France', *Revue Historique*, No. 239, 1968.

LEVY-LEBOYER M., 'La Décéleration de l'Economie Française dans la Seconde Moitié du XIX^{e} Siècle', *Revue d'Histoire Economique et Sociale*, No. 49, 1971.

LEVY-LEBOYER M., 'Innovation and Business Strategies in Nineteenth and Twentieth-Century France', in Carter, Forster and Moody eds., *Enterprise and Entrepreneurs in Nineteenth and Twentieth-Century France*, John Hopkins Press, 1976.

LITTLER C.A., 'Internal Contract and the Transition to Modern Work Systems; Britain and Japan', D. Dunkerley and G. Salaman eds., *The International Yearbook of Organisational Studies*, 1979.

LORWIN V., *The French Labor Movement*, Harvard University Press, 1954.

MAURICE M., SORGE A., WARNER M., 'Societal Differences in Organizing Manufacturing Units: A Comparison of France, West Germany and Great Britain', *Organizational Studies*, No. 1, 1980.

MAYER N., 'Une Filière de Mobilité Ouvrière: L'Accès à la Petite Entreprise artisinale et Commerciale', *Revue de Sociologie*, 18 (1977).

MARX K., *Capital*, Vol. 1, 1976.

MCGOVERN J., 'Some Notes on Shipbuilding Methods', *Transactions of the North-East Coast Institute of Engineers and Shipbuilders*, Vol. XXXVIII, 1921-22.

MONTGOMERY J., 'Shipbuilding Practice Abroad', *Transactions of the North-East Coast Institute of Engineers and Shipbuilders*, 1937-38.

MORTIMER J.E., *History of the Boilermakers' Society*, George Allen and Unwin, 1973.

MOTTEZ B., *Systèmes de Salaires et Politiques Patronales*, CNRS, Paris 1966.

MOUTET A., 'Les Origines du Systeme Taylor en France', *Le Movement Social*, No. 93, 1975.

O'BRIEN P. and KEYDER C., *Economic Growth in Britain and France: 1780-1914, Two Paths to the Twentieth Century*, George Allen and Unwin, 1978.

PINCZON M., *Mission en Angleterre et en Ecosse avec la délégation du Conseil National Economique*, 1930.

PLY G., *Etude sur l'Organisation du Service Technique dans le Manufacture d'Armes*, Paris, 1888.

POLLARD S., 'British and World Shipbuilding, 1890-1914: A Study in Comparative Costs', *Journal of Economic History*, 1957.

POLLARD S. and ROBERTSON P., *The British Shipbuilding Industry, 1890-1914*, Harvard University Press, 1979.

REID A., *The Division of Labour in the Shipbuilding Industry, 1880-1920, With Special Reference to Clydeside*, Ph. D. Thesis, University of Cambrisge, 1980.

ROUX-FREISSINENG M., *L'Industrie des Constructions Navales en France*, Thèse, Faculté de Droit d'Aix, 1929.

SABEL C. and ZEITLIN J., 'Historical Alternative to Mass Production', (forthcoming 1985) *Past and Present*

SILVERWRIGHT G.W., 'The Development of the "Well-Deck" Cargo Steamer', *Transactions of the North-East Coast Institution of Engineers and Shipbuilders*, Vol. V, 1888-89.

STEIN M.B., 'The Meaning of Skill: The Case of the French Engine-Drivers, 1837-1917, *Politics and Society*, Vol. 8, No. 3-4, 1978.

THEBAULT P., *L'Activité economique de la Bas-Loire de 1852-1939*, Mémoires de Maîtrise, Université de Nantes.

TUCKETT A., *The Blacksmiths' History*, Lawrebce and Wishart, 1974.

URWICK L. and BRECH E., *The Making of Scientific Management*, Lol. *II, Management in British Industry*, London, 1946.

VIELLEVILLE A., *Le Système Taylor*, Thèse, Faculté de Droit, Paris, 1914.

WALLACE W.C., 'Electrical Transmission of Power in Shipyards', *Transactions of the Institution of Engineers and Shipbuilders in Scotland*, XXXVIII, 1894-95.

WHITE W.H., 'The Connection Between Mechanical Engineering and Modern Shipbuilding', *The Engineer*, May, 5, 1899.

WILKINSON F., *Demarcation in Shipbuilding*, Working Paper, University of Cambridge, Department of Applied Economics, 1973.

Archive Sources

Shipbuilders and Shiprepairers National Association Archives, National Maritime Museum.

Archives Nationales, Paris, Séries F7, Police Générale.

Archives de la Loire Atlantique, 1 M 2339-2342, Contrats de Travail, Bordereaux de Salaires, Arbitrage, Chomage.