Cost engineering and costing in Hawthorn Leslie Shipbuilders, 1886 - 1915

Tom McLean

Room 7.24

Newcastle University Business School

5 Barrack Road

Newcastle NE1 4SE

Telephone: 0191 2081654

e-mail: Thomas.McLean@ncl.ac.uk

On 5th April 2013, this article was accepted for publication in *The British Accounting Review*.

Acknowledgements

I wish to thank the anonymous referees and the Editor of *The British Accounting Review*, Mike Jones, for their helpful comments. Thanks are also due to my colleagues, Tony Appleyard, Shanta Davie and Tony Miller, who commented on earlier drafts of this paper.

Cost engineering and costing in Hawthorn Leslie Shipbuilders, 1886 - 1915

Abstract

This research examines cost engineering and costing in a British shipbuilding firm in the late nineteenth – early twentieth century. The firm maintained separate systems of contract accounting, costing and reporting for directors and employed internal data from these systems in performance measurement, the development of managerial incentives and the enforcement of managerial accountability. An apparent gap in the information required to manage the firm in a cyclical and highly competitive industry during a period of rapid organisational and technological change was filled by an informal and personal cost engineering system developed by the shipbuilding manager. The shipbuilding manager's cost engineering system employed a wide range of both internal and external data for use in cost management and in cost estimation, pricing and tendering. Thus cost engineering and costing developed to serve different purposes and developed in different spheres and along different trajectories.

Keywords: Contract accounting; Cost accounting; Cost engineering; Costing.

1. Introduction

Boyns and Edwards (2007, p.994) note that 'cost calculations have been used for centuries as the basis for planning, decision making and control.' However, they indicate (Boyns and Edwards, 2007, p.980) that the 'question of who were the proper people to operate the (cost and management accounting) function surfaced during the latter decades of the nineteenth century' and they observe that 'fighting for turf' took place between engineers and accountants. Nevertheless, whilst the fact of engineering's involvement in the development of costing is widely known, the precise nature of this involvement has not been subject to a great deal of detailed academic scrutiny.

Those studies which examine the relationship between engineering and costing tend to approach the issue from the accounting perspective. For example, Hopper, Cooper, Lowe, and Capps (1986) found that the dominance of engineers in the National Coal Board was an important factor in failures to develop advanced systems of financial control. However, in their study of cost accounting in the shipbuilding, engineering and metals industries of the West of Scotland, Fleming, McKinstry and Wallace (2000, p.208) indicated that 'armies of (both) estimators and clerks' were employed in the production of costing information. Although Fleming et al (ibid, p.195) noted that an 'engineering culture among management may . . have inhibited the development of costing' they also found that the costing systems that they examined were 'adequate'.

Other research has indicated the existence of engineering-based costing as a discipline in its own right. McKinstry (1999) studied Albion Motors' engineering culture, context and working methods and noted (p.218) the company's use of 'basically adequate (engineering) alternatives to the more modern management accounting techniques' available. McLean and Tyson (2006, p.413) noted that 'the engineering culture of the shipbuilding industry promoted the use of 'alternative', non-accounting measurement systems.' However, even the latter two studies focused primarily on accounting-based costing (hereafter termed simply as costing) rather than on engineering-based costing (hereafter cost engineering).

Cost engineering has been neglected in studies of costing within the accounting history literature and the current research aims to remedy this neglect. It does so by conducting a detailed scrutiny of cost engineering and costing in British shipbuilding in the late nineteenth-early twentieth century, building upon McLean's (2006) paper which is limited to a study of formal accounting systems in Hawthorn Leslie Shipbuilders. In conducting this scrutiny, the current paper contributes to our understanding of the broader history of management accounting in two major ways. First, it emphasises the need to account for an apparent shortfall in management accounting information within a particular firm. Thus, the current research confirms the importance of examining the systems of the individual firm in the context of work practices and information systems developed generally within an industry as a whole. Additionally, the current paper establishes the vital importance of examining informal information systems developed by individual managers. Second, the current research indicates that engineering and accounting may have acted in a complementary rather than a competitive manner in developing information systems within firms and industries.

The current paper is based on archival research of both formal organisational systems and informal managerial information and is organised into six further sections dealing with: British shipbuilding: industry and engineering; Hawthorn Leslie Shipbuilders; Herbert Rowell: career and context; Hawthorn Leslie: contract accounting, costing and reporting for directors; Cost engineering; and Conclusions.

2. British shipbuilding: industry and engineering

The period of the late nineteenth - early twentieth centuries was a time of profound economic, social and political change (Appendix A). In Great Britain, this period was also the time of huge technological and industrial changes that have become known as the Second Industrial Revolution (Landes, 2003). In Great Britain, the ship as a product experienced a process of technological transformation during the mid-nineteenth century as steam was substituted for sail, and iron and then steel replaced wood as the major construction material for the hull (Slaven, 1980, p.113). In this transformation process, metal workers replaced woodworkers as the key members of the labour force (McClelland and Reid, 1985) and engineers took over from shipwrights as the dominant professional grouping in the industry. Initially, these

engineers were men who rose from the ranks of tradesmen but, as ships and shipyards became larger and more complex, a professional engineering training became more important and was established as the norm in larger shipbuilding firms by the early twentieth century (Pollard and Robertson, 1979, p.136).

Shipbuilding was a capital goods industry which experienced huge variations in output and was affected very adversely by economic downturns. The depression of the mid-1880s saw the 'bankruptcy or reorganization of a number of well-known yards (and) the slow metamorphosis (of partnerships and family firms) into public companies' (Pollard and Robertson, 1979, p.76). Some shipyards came under the control of 'non-specialist businessmen who made up for their lack of experience in naval architecture by their ability to organize large masses of capital' (Pollard and Robertson, 1979, p.75). Under the direction of shipbuilders and businessmen, forward and backward integration became fundamentals of 'the amalgamation movement' of the late nineteenth – early twentieth century (Pollard and Robertson,1979, p.96). Limited company status and the amalgamation movement stimulated the development of formal systems of accounting and financial reporting in the shipbuilding industry.

In this context of complexity, uncertainty and risk engendered by industrial, organisational and environmental change, Great Britain became the world's leading shipbuilding nation (Jones, 1957), constructing about 80 per cent of the world's competitively built tonnage. British shipbuilders managed the efficient organisation of supplies and sought and maintained markets. Their labour-based construction methods and relative slowness to adopt new equipment helped to limit fixed costs, an important strength given the cyclical nature of the industry (McLean, 1996, pp.124-25; Pollard and Robertson, 1979, p.6). In particular, shipbuilders on the River Clyde in Scotland and on the North East Coast of England exploited comparative advantages of skills, experience and knowledge in already developed regional engineering and metals industries. Thus, they established these regions as the leading sites of the British iron and steel shipbuilding industry (Lorenz, 1991, pp.25-26; Slaven, 1980, p.107).

3. Hawthorn Leslie Shipbuilders

In examining the relationships between engineering, accounting and costing development the current research focuses on the shipbuilding activities of the firm of Hawthorn Leslie, which was situated on the River Tyne in North East England. The industrial and engineering context of Hawthorn Leslie has been examined in the previous section. In its wider contextual setting, the firm operated in a period of fundamental economic, social and political change (Appendix A).

Hawthorn Leslie was formed in 1886 on the merger of the engineering partnership of R & W Hawthorn and the shipbuilding partnership of Andrew Leslie. It was organised into three 'departments': the Shipyard, the Engine Works and the Locomotive Works (Clarke, no date) (See Note 1). Hawthorn Leslie was a limited company with over 70 per cent of its shares being owned by the founding directors who had all been owners of the pre-merger firms. After several changes, in 1889 the 70 per cent of the shares and all of the directorships of the firm became settled on six men. Five of these six men came from R & W Hawthorn: B.C. Browne, a mechanical and civil engineer, became Company Chairman; F.C. Marshall, an apprentice-trained marine engineer, headed the Engine Works; C.E. Straker a non-specialist businessman who had led the Locomotive Works for ten years continued in this role, aided by W. Cross, an engineer; J.H Ridley, a Cambridge graduate, was Company Secretary. Only one shareholder-director came from Andrew Leslie's shipyard. Leslie was the son of a Shetland crofter and had served as an apprentice boilermaker in an Aberdeen iron works and later journeyed south to the River Tyne where he established his iron shipyard and managed it with such success that when he died in 1894 'his will was proved at £161,000' (Clarke, no date, p. 33). A. Coote, the son of a wealthy, self-made man, had served an apprenticeship at the famous Scottish shipyard of Denny & Co. before going into partnership with Leslie and then marrying his daughter. On the merger, Coote was appointed Head of the Hawthorn Leslie Shipyard.

Hawthorn Leslie is regarded as one of Britain's 'important shipbuilders' (Pollard and Robertson, 1979, p. 51) of the late nineteenth-early twentieth centuries. The shipyard employed over 2,500 workers in a good year and was in the vanguard of the technological development of ships (Clarke, no date, pp.50-52; p.67). The opening of the Suez Canal (Appendix A) led to an increased demand for oil tankers and for refrigerated vessels for the Australian and New Zealand meat trade. Increasingly

fraught political relationships between Russia and Japan and between Great Britain and Germany (Appendix A) caused an increase in demand for warships.

Estimating costs and prices for such new and specialised ships proved to be a difficult task and the power of accounting and financial reporting was made apparent when Coote was held accountable and obliged to accept 'personal losses in excess of £16,500' on contracts for the first oil tankers ever built (Clarke, no date, p.50). Furthermore, the Company Secretary informed the Company Chairman that the Shipyard Department was 'much mismanaged (and) though Coote is much anxious and hard-working – still we don't pay a man £2,000 a year to make such blunders'. After further managerial difficulties in the shipyard, in 1891 Herbert Rowell was appointed as Shipyard General Manager (Clarke, no date, pp.50 – 51).

4. Herbert Rowell: career and context

Herbert Rowell was born in 1860. As a young man he obtained a practical training in shipbuilding as a premium apprentice and, later, coupled this with an education in naval architecture at Glasgow University (Rowell, 1996). Rowell's career was as a shipbuilder and manager rather than as an accountant. However, as he was heavily involved in costing and cost management he may be regarded as an 'actor' (Yamey, 1981, p.131) in the history of accounting. The *Dictionary of Business Biography* (Clarke, 1984a, pp.957-961) sketches Rowell's public career, indicating his success and the range of his achievements. In Hawthorn Leslie he advanced from Shipyard General Manager to Company Director and then to Company Chairman. Additionally, he was the first lecturer, part-time, in naval architecture at Armstrong College, subsequently a college of Durham University and, later, part of Newcastle University. Furthermore, he was a Council member of the Institution of Naval Architects; a member of the Institution of Civil Engineers and President of the North East Coast Institution of Civil Engineers; President of the North East Coast Institution of Engineers and Shipbuilders; Chairman of the (River) Tyne Shipbuilders' Association; President of the Shipbuilding Employers' Federation; and Vice-President of the Federation of British Industry. Rowell's success and his contribution to the business world were marked with the award of a knighthood before the First World War and he

became Sir Herbert Rowell, a man both respected and trusted within the business community (Browne, 1914).

Of his initial appointment in the Shipyard Department Rowell (Rowell, 1996, p.98) wrote,

> I realised from the first the vital necessity of watching every point on the commercial side and the equal necessity and more congenial task of earning the confidence of shipowners, if I was ever to re-establish the business and the Company which was at the time in desperately low water.

The extent to which Hawthorn Leslie's formal systems of contract accounting, costing and reporting for directors enabled Rowell to 'watch' the commercial and other aspects of shipyard management will be examined in the next section.

5. Hawthorn Leslie: contract accounting, costing and reports for directors

Hawthorn Leslie maintained separate systems of contract accounting, costing and reporting for directors. The double-entry contract accounting system encompassed all three 'departments' and remained essentially unchanged between 1886 and 1914 (McLean, 2006). This system enabled the calculation of the profit or loss for each individual contract and, on an annual basis, for each 'department' and for the company as a whole. A company balance sheet was prepared at the year-end. In addition to its financial accounting and reporting functions, this contract accounting system also acted as a database for a memorandum (i.e. non-double-entry) costing system and for a system of reporting for directors. Hawthorn Leslie's memorandum costing system also remained essentially unchanged between 1886 and 1914. In the costing system, data were extracted from the contract accounting system and were used to prepare cost schedules for each ship, engine and locomotive during, and on completion of, the construction process. In 1897, Hawthorn Leslie instituted a formal system of monthly Reports for Directors' Meetings, consequent upon the appointment of a new Company Secretary and a series of changes in directorships.

Together, these systems of contract accounting, costing and reporting were used, *inter alia*, to develop incentives for the firm's senior managers and to hold these managers accountable. In the negotiation of his personal contract with Hawthorn Leslie in 1892, Rowell 'agreed to a salary of £800 per year plus 2% of the shipyard profits for two years, and thereafter 4%' (Clarke, no date, p.51). In the enforcement of accountability, Rowell's predecessor as Head of the Shipyard had been obliged to accept personal liability for losses on contracts (Clarke, no date, p.50) and in 1895 Cross was dismissed from the Locomotive Works on incurring losses of £8,395 on a contract with Ceylon Railways (Clarke, no date, p.56).

While Rowell accepted the use of 'departmental' profit as an overall, macro-level measure of performance it is apparent that he was less content with the use cost and profit information in enforcing accountability at the micro- level of the individual contract. As a matter of routine, on the completion of contracts the Heads of Hawthorn Leslie's three Departments each used data derived from the formal cost accounting system in order to provide the Board of Directors with a Report detailing comparisons of actual and estimated cost, together with explanations of cost differences (McLean, 2006, p.113).

In exceptional circumstances, Rowell displayed his dissatisfaction with these data and with the system. When he presented a Report to the Board in 1901 on the 'very unsatisfactory cost for the hull of the S.S. Canadian' (DS.HL/1/13, p.137), Rowell undertook a fundamental critique of the data produced by the formal system. He noted that the formal cost accounting system reported a loss of £8,945 on the hull based on a price of £101,205. However, in order to portray financial reality as he saw it, Rowell made a series of adjustments not considered by the formal cost accounting system. He calculated the impact of: benefits resulting from terms of payments agreed with the owner, profits on internal shipyard transactions, the excess cost of additional overheads apportioned and the excess cost caused by using steel issue prices which were higher than actual purchase prices. Rowell insisted that his calculations showed the 'True net cost' and that, in fact, the loss on the hull was only £825 (DS.HL/1/13, pp.137 - 8).

In this instance, Rowell showed not only his facility for cost calculation but also demonstrated his knowledge of business practices not captured at the micro level of the individual contract by the formal cost accounting system and, in doing so, indicated his understanding of the consequences for cost and profit calculation of this system's routine procedures. Furthermore he delivered his message to the Directors, the men at the very pinnacle of the firm, and left them in no doubt as to his view that the information produced by the formal cost accounting system was inadequate for purposes of managerial reporting while his own personal, engineering-based costing provided the 'true' picture on which managerial control should be based. Nevertheless, there is no evidence that Rowell continued in these efforts and, outside these exceptional circumstances, he continued to use accounting-based numbers in his Reports on contract costs, prices and profits.

Reports for Directors' Meetings also included analyses of work in progress and these reveal very different approaches to information preparation and analysis. Reports presented by the Heads of the Engine Works and the Locomotive Works were prepared by the firm's Counting House and were couched in financial terms. However, as the Head of the Shipyard, Rowell always prepared his own Reports and always expressed them in physical terms (DS.HL/1/13, p.111). Similarly, in submitting proposals for capital expenditure to the Board of Directors, the Heads of the Engine Works and the Locomotive Works generally included a financial justification in their proposals while the Head of the Shipyard usually relied upon justifications based on improvements in technical efficiency and working practice. Thus, whether in relation to reporting on work in progress or on capital expenditure proposals, the Head of the Shipyard took an approach somewhat at variance with that of the other two engineers.

However, such differences in approach are not unexpected. As noted by McLean (1996, p.122), general engineering and shipbuilding were very different industries. General engineering had long experience of control systems not suited to or adopted in the very different craft-controlled, non-standard product engineering environment of the shipbuilding industry. Nevertheless, the Heads of Hawthorn Leslie's three departments were unanimous in support of the Company Secretary when in 1912 he 'proposed that a better system of reporting costs...should be introduced'.

Nevertheless, even though the ‘importance of the proposal was recognised unanimously by the Board, and it was considered several times eventually it was shelved, no explicit reason being given’ (McLean, 2006, p.113), although it may be noted that Hawthorn Leslie was always keen to avoid the fixed costs of clerical labour. However, the firm was willing to sanction new developments when these were felt necessary. In 1907, a new accounting-based system of capital expenditure reporting was instituted and in 1916 the new position of Company Treasurer was created (McLean, 2006, p.118). Thus, the development of a new costing system to provide management information was rather lower down Hawthorn Leslie’s list of priorities than were developments in the financial management of the firm.

Nevertheless during this period Hawthorn Leslie Shipbuilders was a successful player in a very competitive, cyclical market and managed rapid change in the size and type of ship constructed, and in the materials, methods and workforce employed. Thus, in this dynamic shipbuilding environment, the directors of Hawthorn Leslie chose to operate formal contract accounting, costing and reporting systems which provided relatively little information for management and which they developed only to a very limited extent. Although in the shipyard craft control of the construction process did mitigate the need for the development of the costing system to some extent, nevertheless, the lack of formal management information in Hawthorn Leslie Shipbuilders is curious given the firm’s size, complexity, growth and success. The management information available was historic and focused internally. There was a complete lack of forecasting, planning and external market-based data. This lack points to either a gap in the information available in the firm or to a gap in our state of knowledge, or, perhaps, to both of these. Accordingly, a search of the Hawthorn Leslie archive was undertaken. This revealed that, in fact, the apparent information gap was filled by Herbert Rowell’s informal and personal cost engineering system. Rowell’s cost engineering system consisted of significant personally-prepared data in the form of a memorandum book (DS.HL/5/1) and a series of pocket notebooks (DS.HL/5/2/1-15) containing costing and managerial analyses detailed for his own use. The contents of the memorandum book and the notebooks are analysed in the following section, after a consideration of the general arrangements and systems of cost engineering on the River Tyne.

6. Cost engineering

6.1 Cost engineering on the River Tyne: general arrangements and systems

Boyce (1995, p.362) notes that British shipowners of this period did not operate anonymously through market mechanisms or rely exclusively on management accounting systems for control purposes. Rather, they garnered information through inter-organisational and inter-personal networks and, in this context, exchanges were based on co-operation, personal reputation and trust. Boyce's findings reflect the generally accepted view of how information was developed and exchanged between shipowners and also between shipowners and favoured shipbuilders (Pollard and Robertson, 1979) but this is not the accepted view of relationships between shipbuilder and shipbuilder. In their classic study of the British shipbuilding industry between 1870 and 1914, Pollard and Robertson (1979, p. 149) state that,

> Despite the ties that grew from being associated in the same industry, (ship) yard owners always regarded each other as competitors to whom it would be foolhardy to give away any information unless something tangible could be gained in return.

However, the Transactions of the North East Coast Institution of Engineers and Shipbuilders (the Institution) present a rather different picture, revealing collaborative relationships within the shipbuilding industry, as well as pointing to key issues of concern in the business of shipbuilding. The Institution was founded in Newcastle Upon Tyne in 1884 during a period of rapid and fundamental technological, organisational and structural change in shipbuilding and marine engineering (Clarke, 1984b). In this context, membership of the Institution grew to 452 in 1884 and averaged over 1,000 in the early 1900s (Clarke, 1984b, p.6). Membership was drawn from the industry's owners, directors, engineers, shipbuilders, accountants and other professionals but throughout the current research period its senior officers and Presidents, including Rowell, were drawn solely from the very upper echelons of the industry. The objective of the Institution (Clarke, 1984b, p.5) was,

> The advancement of the science and practice of engineering and

> shipbuilding, and *the interchange of ideas and information among its members* (italics added), by means of meetings for the reading and discussion of papers relating thereto, and placing on record its transactions (hereafter, Transactions).

Despite some initial qualms (Transactions, Vol. 1, p.17), it is apparent that the papers and discussions represented a "very remarkable frankness in the exchange of detailed information" (Clarke, 1984b, p.60). Although many topics were addressed in the Institution's proceedings, key areas of concern to shipbuilders were highlighted (Transactions, Vol. 3, pp. 9-17) by W.T. Doxford, the Sunderland shipbuilder, during his 1886 inaugural address as President of the Institution,

> (Ship)owners . . have . . found that the larger a vessel is the better she will pay . . . Now, it is our duty as engineers and shipbuilders to assist this development by studying carefully the problems involved in the designing and construction of these enormous vessels and their engines and boilers ever bearing in mind the great desideratum that the cargo shall be taken in at one port, carried safely to, and discharged at the other, at the lowest possible cost per ton.

That these were indeed major areas of key concern to shipbuilders during the research period is apparent from the papers on ship design and construction and ship operating costs presented at the Institution. However, although there was a free exchange of information on shipbuilding contract accounting and costing systems in the national literature (e.g. Bruce, 1911; Burton, 1900; Plumpton, 1895), only a limited number of papers on systems and methods of management, cost engineering, costing and accounting was presented at the Institution. Thus, when Rowell discussed costing and estimating during a Presidential address to the Institution (Transactions, Vol. 33, pp. 89-90) he made clear his view that 'with regard to methods and systems of cost-keeping . . . there was far too much secrecy' and he encouraged greater openness and sharing of information.

Overall, it is apparent that during the research period the Institution worked towards its objective of "the interchange of ideas and information among its members"

(Clarke, 1984b, p.5). In part this was done by the presentation of papers and debates and the reproduction of these in the Transactions and, additionally, by visits to examine the operations of various shipyards at home (e.g. Transactions, Vol.16, p.101; Vol.17, p.1) and abroad (e.g. Transactions, Vol.29, p.343). Thus, the Institution promoted cooperation within the industry and provided a formal, public arena to inform the working lives of members such as Rowell. Generally, there was a remarkable openness in the sharing of technical information, but information that had a direct bearing on the commercial, managerial or financial aspects of the shipbuilding industry was much more closely guarded in this public forum.

By the late-nineteenth century engineers had exploited their specialist knowledge and skills base and had taken over from shipwrights as the dominant professional grouping in shipyard management. In this powerful position they understood, accepted and derived benefit from the traditional industry practice of craft control of the construction process and, moreover, they may 'have had a politically and socially grounded commitment to uphold the independence of skilled labour within the capitalist system' (McLean, 1996, p.130). Thus, in this context, the development of accounting-based labour control systems was precluded. When formal costing systems were required, shipbuilders used and promoted those of engineering rather than of accounting design. Shipbuilders employed ''alternative', non-accounting measurement systems such as cost curves' (McLean and Tyson, 2006, p.413) in providing estimated and actual data for the planning and control of construction costs, work-loads and time-lines. These arrangements and systems served to ensure that, generally on the River Tyne, formal costing development was engineering rather than accounting-based in the areas of operational planning and control. The specific cost engineering system developed by Herbert Rowell in Hawthorn Leslie is examined next.

6.2 Rowell's cost engineering

Rowell's cost engineering data and information are gathered in his personal, hand-written memorandum book and pocket notebooks. The one memorandum book surviving in the archive is neatly written, well presented and contains very full coverage of matters of business importance to Rowell. With regard to the notebooks,

the legibility of the text is variable; some analyses are clearly written and presented while others are less so. The memorandum book covers the period from August 1897 to August 1899 and the notebooks are dated in the period 1901 – 1915, although there are gaps for 1908, 1910 -11 and 1913. Sometimes pages are numbered and at other times they remain un-numbered. The surviving archive of Rowell's notebooks is thus incomplete and it is possible that the memorandum book archive is also incomplete. The surviving documentation is analysed in two sub-sections. The first deals with cost management and the second considers cost estimation, pricing and tendering. This form of analysis is in line with Rowell's view of his priorities and the appropriate measures of his performance. When re-negotiating his personal contract with Hawthorn Leslie in 1895, Rowell argued that his bonuses 'should be governed by the accuracy of my estimates and the economy of my work' (Clarke, no date, p.51).

6.2.1 Cost management

Using his own experience together with data from within Hawthorn Leslie and knowledge derived from personal contacts within shipbuilding, Rowell could understand and analyse cost structures in ways that were different to the formal contract accounting and costing system. Downturns in demand for ships, such as that which led to the Amalgamation Movement of the 1880s (Appendix A) caused a downward pressure on wage rates. However, increases in demand and an increasingly politicised workforce (Appendix A) caused an upward pressure on wage rates. For example, in 1899 (DS.HL/1/13, pp. 24-27), Rowell was able to attribute increased labour costs to the widespread,

> abuse of the piece rate and even of the time rate system. Inducements are held out to men to leave their employment in numerous ways, such as . . . counting 70 or 80 rivets to the 100 and thus evading the agreed piece rates. Time and a quarter is also said to be paid for ordinary work as well as piece rates for time work. Abuses like these once established can never be completely got rid of, and explain fully the recent disproportionate increases in labour costs in certain yards.

Rowell made particular use of his industry contacts during a time of crisis in 1900-1902 when there was an ongoing debate within Hawthorn Leslie of a proposal to sell off the shipyard. This debate, which was driven by Hawthorn Leslie's accounting numbers and was based on the Directors' perception of the shipyard's lack of profitability, resulted in an investigation by a Special Committee consisting of the firm's auditors and its Finance Committee (McLean, 2006). However, in order to gain further insights into the shipyard's position, in December 1901 Rowell visited the River Clyde and engaged in frank exchanges of detailed information with other shipbuilders (DS.HL/5/2/1). Table 1 indicates that, despite Pollard and Robertson's (1979, p.149) views on the unwillingness of shipbuilders to share information with one another, Rowell was able to obtain much knowledge from the Clyde shipbuilders on normally highly confidential matters such as actual and estimated ship construction costs and product mix decisions (Table 1), together with cost estimating methods, labour cost analysis,

TABLE 1

piecework systems, overhead costing methods, cost recording systems and product mix decisions. This gathering of knowledge underpinned Rowell's stance in the debate on the proposed sale of the shipyard. Although the Special Committee was not able to provide any explanation of the apparent under-performance of the shipyard, Rowell was able to state firmly (DS.HL/5/2/1) that 'Visit confirms my view that our labour is present cause of our not paying'. Armed with insights derived from his visits to River Clyde shipyards, Rowell addressed his Board of Directors and argued successfully against the proposal to sell off the Hawthorn Leslie shipyard.

As part of the information exchange with River Clyde shipbuilders, Rowell noted the disparity between engineers' ship cost calculations and the 'accountants basis' (DS.HL/5/2/1), thus confirming the differing approaches of the two professions to this key managerial area. This visit also gave Rowell insight into shipyard fraud and embezzlement, its impact on ship costs and the counter-measures to be taken by engineers rather than accountants. He noted (DS.HL/5/2/1),

Recent case at Rumages (Shipyard) – their foremen check paysheets for

> piece(work) before pay is made up - & clerk altered figures afterwards - instance on which he was caught . . 117 rivets passed as covered and he put a '1' in front making 1,117 rivets & took the money for the 1,000 from the paytin – Ward (of Denny & Co) thinks excess (cost) for riveting on (Hawthorn Leslie Ship Number) 380 may be due to this & recommends analyse quantity of rivets put in by foremen & paid for and check from ship or plans. (Now, at Denny & Co) Foremen fix no piece rates – Jackson (the shipyard manager) fixes all new rates and checks all repeat ones & all new ones are presented to office to Ward.

The visits to River Clyde shipbuilders in December 1901, undertaken in a time of crisis, represent the only extensive and detailed instances of information exchange with other shipbuilders recorded in Rowell's documentation during the period 1897-1915. In that sense, these visits are exceptional. However the visits may also be regarded as particular instances of Rowell's practice of gathering and analysing cost management data relating to his operational responsibilities from sources both within and, particularly, from outside Hawthorn Leslie throughout this period.

The efficient organisation of supplies underpinned the success of British shipbuilding (Pollard and Robertson, 1979, p. 89). Rowell paid particular attention to analysing the comparative costs of engines and boilers to be purchased from various suppliers, including Hawthorn Leslie's own Engine Works (DS.HL/5/2/3) and (DS.HL/5/2/11), indicating that the shipyard was not simply a captive market for the Engine Works. On a ship-by-ship basis he compared engine cost quotations from the Engine Works and 'outside' suppliers (DS.HL/5/2/8) and used his knowledge of Hawthorn Leslie's Engine Works costs to compare engine costs with 'charges' (i.e overhead costs) at one-half and one-third of their normal levels (DS.HL/5/27). When considering steel, timber and other supplies, Rowell analysed not only stocks in hand (DS.HL/5/2/11; DS.HL/5/2/9), contract quantities and prices (DS.HL/5/2/4; DS.HL/5/2/7; DS.HL/5/2/9; DS.HL/5/2/15)), but also brought into play his knowledge of the industry and imposed his own standards. For example, Rowell noted (Rowell, 1996, p. 22) the counter-measures he took when the Steel Company of Scotland tried to deceive him: 'The Steel Company of Scotland, where castings were made, had a very dishonest testing room and trained the lads to call out false figures when measuring

test pieces, and showed resentment when I took all my own observations (in order to thwart the company's attempts to deceive me)'.

In conjunction with his organisation of supplies, Rowell prepared information to help him in the planning and control of shipyard activities. He employed planned and actual ship construction work schedules and time lines, noting: starting dates; dates at various stages of the construction process; completion dates; and dates of sea trials (DS.HL/5/2/4; DS.HL/5/2/6; DS.HL/5/2/7). On a ship-by-ship basis, he noted delivery dates and material and labour costs 'spent' and 'to spend' during the construction process (DS.HL/5/2/9) and month-by-month costs incurred (DS.HL/5/2/15). Furthermore, he presented detailed analyses of estimated cost, price and profit for later comparison with actual results (DS.HL/5/2/9) and constructed schedules of total cost and cost per ton of steel and various labour categories (DS.HL/5/2/7). Rowell did not take cost calculation methods as a matter of course but took a great interest in methods of overhead costing, paying great attention to the overhead 'charges' to be included in ships' costs. He discussed the calculation of 'charges' as a percentage of labour cost + material cost and noted Denny & Co's method of calculating a 'charges' percentage (DS.HL/5/2/8). Rowell was particularly concerned with 'charges' during downturns in the industry and showed some flexibility in amounts included in ships' costs. In 1904, he noted that there were 179 shipbuilding berths on the River Tyne and that only 77 were occupied (DS.HL/5/2/6). On repair work, he noted that applying 'charges' at the rate of 50% on direct labour does not cover us . . unless very busy –If slack as now we require 56%.' (DS.HL/5/2/7) and compared the 'charges' element in the cost-plus pricing methods allowable by the Admiralty and others (DS.HL/5/2/12).

Similarly, Rowell also used comparative, external data when analysing and examining the wages of shipyard workers. In 1905-06 (DS.HL/5/2/9), he gathered data from five firms on the wage rates of fitters, a particular group of tradesmen, and recorded that the 'standard rate', including an 'advance due', varied between 36/- and 38/6 per week although this could be increased by allowances for factors such as 'dirty money'. Furthermore, he listed and compared 'average wages' of workers in Hawthorn Leslie's three departments for 1913 and 1914 (DS.HL/5/2/15). Rowell recorded (DS.HL/5/2/10) the ratio of apprentice boilermakers to tradesmen in nine

different shipbuilding areas of Great Britain. Although not stated explicitly in his notebook, Rowell's concern was probably the perceived cost advantage of employing a high proportion of apprentices rather than with their training *per se*. As comparators with Hawthorn Leslie costs, Rowell obtained detailed analyses of other shipbuilders' labour and engine costs (DS.HL/5/2/7) and their estimated material and labour costs on ships tendered for (DS.HL/5/2/6).

Although ship operating costs were crucial to customers, there is little evidence in Rowell's documentation that he devoted a great deal of effort to the preparation of costings dealing explicitly with this matter, his calculations of the ship coal consumption costs of Hawthorn Leslie ships (DS.HL/5/2/3) and (DS.HL/5/2/12) being rather isolated examples. It is possible that the lack of ship operating cost data may be explained by the fact that such matters were dealt with in technical documentation no longer extant. Similarly, Rowell's notebooks contain very little reference to capital expenditure and shipyard operating costs. However, he did compile (DS.HL/5/2/10) an analysis of 'Capital Expenditure 1906-7' for all three of Hawthorn Leslie's departments: the Shipyard, Engine Works and Locomotive Works. Furthermore, he prepared cost statements dealing with alternative proposals for the 'electrification' of the shipyard (DS.HL/5/2//3) and noted electricity costs per unit consumed (DS.HL/5/2/9). Rowell prepared analyses of work in progress and capital expenditure proposals in technical rather than in financial terms and this may explain the lack of relevant financial data in his notebooks.

6.2.2 Cost estimation, pricing and tendering

Rowell was assiduous in cultivating connections not only with shipbuilders but, particularly, also with shipowners. His memorandum book and his notebooks are replete with information derived from contacts at home and from his business trips to France, Germany, Italy, North Africa, Greece, Turkey, Russia and Canada (DS.HL/5/1; DS.HL/5/2/1; DS.HL/5/2/3; DS.HL/5/2/4; DS.HL/5/2/12). In the process of cost estimation, pricing and tendering, Rowell drew on this externally sourced information and also on Hawthorn Leslie's formal costing system. This system incorporated Cost Books (DS.HL/4/10) containing memorandum historic cost records for each ship built. On a ship-by ship basis, each record includes: a calculation of total

cost, analysed by expense heading; analyses of materials and labour costs per ton; detailed analyses of labour costs by trade and by mode of payment, whether time-work or piece-work. A study of Rowell's documentation indicates that he used the formal costing system as a database but re-worked, adapted, extended or ignored these data in preparing cost estimates when tendering for new contracts.

However, in the period up to 1914, the price of ships was influenced more by demand side factors, such as freight-rates, than by supply side cost structures (Pollard and Robertson, 1979). In addition to his knowledge of Hawthorn Leslie's pricing, Rowell gathered pricing and other market-based information both from shipbuilders and shipowners. All of his documentation indicates the importance that Rowell placed on the tendering process. He obtained detailed data on competitors' ship design, specification, construction cost, operating cost and tender price and compared these with data on Hawthorn Leslie ships (e.g. DS.HL/5/2/11). Table 2 is a summary of the many cost engineering entries in Rowell's memorandum book for 1897 – 1899 (DS.HL/5/1). This table indicates that Rowell's prime emphasis in cost engineering lay in the field of cost estimation, pricing and tendering. As noted by Table 2, the vast bulk of his analyses dealt with the estimation of ships' costs and the subsequent careful consideration of tender details and contract prices. The final item in Table 2 is a summary of the entries in page 210 of the memorandum book and deals with the 'Comparison of tender prices of various shipbuilders for the building of the same ships'. The full detail of this item is presented in Table 3.

INSERT TABLE 2

INSERT TABLE 3

Table 3 records data communicated to Rowell by a shipowner, A.L. Alliman, in November 1899. These data list tender prices submitted to Alliman by fourteen different shipbuilders, including Hawthorn Leslie, for five different types of ship. Rowell was able to use these data to compare Hawthorn Leslie's tender prices with those of other shipbuilders over a range of ships. Thus in the pricing decision, Rowell's cost data were much enhanced by an understanding of the market place and of shipowners' requirements and competitors' costs and prices.

In Hawthorn Leslie, some invitations from shipowners to tender for the construction of a new ship were dealt with as a matter of organisational routine: same day responses were supplied on pre-printed forms, the tender price being written into the appropriate space on the form (DS.HL/4/1). However, other invitations to tender were dealt with in detail by Rowell; often the shipowner would supply only the barest of details as to his requirements and Rowell would then determine the physical dimensions and technical capabilities of the ship before building up a cost estimate and determining a tender price (Figure 1).

INSERT FIGURE 1

At times, this entire process would go through several iterations as Rowell sought to come to a pricing decision. As Pollard and Robertson (1979, p.103) comment, 'The decision to be made by the builder might be a very delicate one. He had to balance the divergent claims of quality and cheapness, speed and safety, reliability and innovation. He had to bear in mind the tenders of other builders, which induced him to lower his standards and prices, but also his future reputation, which induced him to raise them. With these and a number of other considerations in mind, such as the delivery date, the tender would finally be made.'

Rowell expended enormous effort in preparing cost estimates as part of the tendering process. They are the major focus of the memorandum book and all of the notebooks. As indicated above, it appears that his response to an important or technically challenging invitation to tender was to determine himself the physical and technical specification of the ship as required to meet the owner's operational requirements, prepare a cost estimate and then base a tender price on that estimate and his knowledge of the market. It is apparent that, to Rowell, this response was obvious, natural and necessary. However, the historian may wonder what it actually accomplished and what purpose it actually served. From Table 3 and other instances (e.g. DS.HL/5/2/15) it may be noted that, at times, there were huge variations in the prices quoted by different shipbuilders for the same ship. Also, for example, it may be seen in Table 4 that Rowell has noted beside his price quotation that the 'order was placed for a good deal less' with another shipbuilder. Such differences between shipbuilders' price quotations may be explained by differences in cost, cost estimation

methods and market assessments and also by the fact that shipbuilders would make a particularly high bid when, in fact, they did not really wish to be awarded the contract. Nevertheless, on other occasions shipbuilders' price quotations were grouped rather more closely. It is probable that, even if flawed, the process of cost estimation and the application of market intelligence provided Rowell with a means of dealing with the uncertainty and complexity of the competitive bidding process, although his success rate cannot be ascertained from the available data.

Pollard and Robertson (1979, p.93) note that close links between shipowners and shipbuilders were a great strength of the British shipbuilding industry as they provided an element of continuity in orders and some standardisation in design. Rowell's contacts with shipowners were crucial to the success of the Hawthorn Leslie shipyard. Between 1899 and 1914, Hawthorn Leslie constructed 102 ships totalling 408,000 tons. Of these, five commercial shipping lines contracted for 38 ships totalling 220,000 tons (Clarke, n.d., p.67) while the British Admiralty contracted for 27 ships totalling c. 16,500 tons (ibid, p.112). Thus 58 per cent of Hawthorn Leslie's tonnage was constructed for only six major customers.

Often, Hawthorn Leslie did have to engage in a bidding process with other shipbuilders when competing for contracts from these customers. However there are instances (e.g. DS.HL/5/2/4) when the Hawthorn Leslie bid was the highest price and the firm still gained the contract, perhaps indicating the strength of the relationship between builder and owner. At times a customer required a series of ships of the same design, and then Rowell prepared a detailed cost estimate of the first ship before making rule-of-thumb reductions in the cost estimates of further ships. He then calculated an average estimated cost per ship and used this as a basis for determining an average ship price to be quoted in the tender (e.g. DS.HL/5/2/9). In order to remain competitive during downturns in the market, Rowell would base his estimated 'charges' on one-half and at times one-third of the normal rate in an effort to quote competitive prices (DS.HL/5/2/4).

Moreover, as part of the process of building and maintaining good relationships with shipowners, Rowell played a role in helping them to decide how they would finance the purchase of ships. He noted the use of bills of exchange for payment by

instalments (DS.HL/5/2/4) and financing by the issue of debentures (e.g. DS.HL/5/2/2). Additionally, he documented how a shipowner had awarded a contract to a competitor shipbuilder, requiring the builder to take part-ownership of the ship in return for 'all earnings over 5% net until he is paid off & of course (the builder) gets interest on the unpaid balance @ 1% over bank rate' (DS.HL/5/2/4).

Furthermore, Rowell also documented some of the realities of commercial life that were not recorded openly in either the contract accounting system or the costing system. For example, the 'commissions' paid to the representatives of foreign governments during the process of tendering for warships and the fact that an influential overseas figure 'goes to England twice a year & likes being entertained', together with the knowledge that one particular superintending engineer is a 'man who would be entertained & the other a poor one who would like something' (DS.HL/5/2/5). However, obtaining a contract was simply part of the shipbuilder's relationship with the owner. Owners often changed their requirements during the construction process and, because the craft control of the construction process built adaptability and flexibility into the system, British shipbuilders could deal with these changes more easily than their overseas competitors who relied upon capital intensive construction methods (McLean, 1996, p.125). Rowell dealt with these changes in his cost estimation and pricing by calculating the impact of the 'extras' required by them (e.g. DS.HL/5/2/3; DS.HL/5/2/4; DS.HL/5/2/7; DS.HL/5/2/9; DS.HL/5/2/12).

The constant gathering of market intelligence is a feature that runs throughout all of Rowell's documentation. He monitored the costs and prices of other shipbuilders (DS.HL/5/2/12; DS.HL/5/1/15) and, based on his knowledge of the market, he pursued business and prepared cost estimates and price quotations in diverse areas of business including the Canadian Great Lakes (DS.HL/5/2/3), the New Zealand and Australian sheep trade (DS.HL/5/2/2; DS.HL/5/2/10), Finnish icebreakers (DS.HL/5/2/10) and Turkish warships (DS.HL/5/2/15).

Rowell paid particular attention to the gathering of market intelligence on Admiralty work. Such work was prestigious and profitable and Rowell took pains to gather data to help him in the pursuit of this business. He compared other shipbuilders' quotes for battleships and noted that they would be able to cover all 'charges' and make high

profits (DS.HL/5/2/6). Furthermore, he recorded data from a Parliamentary report on the performance of destroyers of different shipbuilders and compared these with data on Hawthorn Leslie-built destroyers. In his search for market intelligence, he prepared an analysis from the 'Globe' newspaper and noted the tonnage and cost of warships, excluding submarines and torpedo boats, constructed over a five year period in Great Britain, Russia, Germany, France and the United States (DS.HL/5/2/8). However, while gathering market-based information, Rowell did not neglect to collect relevant data from within Hawthorn Leslie and noted sea trials data on Hawthorn Leslie warships for the Admiralty (DS.HL/5/2/8)

In analysing Hawthorn Leslie's position in the competitive market for the building of British warships, Rowell observed that the 'Government is committed to the country to build 33 knotters & if we object they will approach others' (DS.HL/5/2/8). In pursuit of warship business, he recorded details of other shipbuilders' estimated costs of alternative designs of destroyers (DS.HL/5/2/12). In relation to Admiralty work, as with all other business, Rowell took care to keep in touch with developments in the market place in order to facilitate his own journey through the tendering process. For example, he kept abreast of changing markets for warships (DS.HL5/2/8) and noted prices quoted by other shipbuilders (DS.HL/5/2/15). In one instance he recorded that HMS Invincible was under construction at Armstrong's shipyard in Newcastle (DS.HL/5/2/10), Armstrong's having submitted a tender price of £483,508 against Fairfield's £438,495 and Clydebank's £435,754. Rowell noted that the ship delivered 41,000 Indicated Horse Power (IHP) which equalled 'about £10 - £12 per IHP' and given that the Admiralty wished to obtain tenders for new Dreadnoughts of 23,000 IHP he calculated that an approximate price would be £270,000. Rowell sought not only to build new ships for the Admiralty, but also sought repair work for which he placed cost-plus bids (e.g. DS.HL/5/2/12).

6.2.3 Rowell's inter-organisational relationships and cost engineering

Rowell's inter-organisational relationships were fundamental to his cost management and his cost estimation, pricing and tendering. These relationships posed management control and cost engineering problems beyond those encountered within Hawthorn Leslie itself. Three approaches to the control of such inter-organisational relationships

have been identified: outcome controls, behaviour controls and social controls (Kraus and Lind, 2007).

Outcome controls measure the results of inter-organisational relationships and determine appropriate evaluations and rewards, often on the basis of accounting measures (Dekker, 2004). However, Rowell's cost engineering system did not operate in this formal and structured manner but relied instead on behavioural and social controls. Behaviour controls specify how parties within an inter-organisational relationship should act and then evaluate whether or not the specified behaviour has been adhered to. Thus, as noted above in relation to Rowell's cost management, Rowell and other shipbuilders were parties to the setting of 'agreed piece rates'. Then, Rowell monitored the actual practice of other shipbuilders and found 'abuse of the piece rate and even of the time rate system' (DS.HL/1/13, pp. 24-27). On the basis of this information, Rowell was then able to 'explain fully the recent disproportionate increases in labour costs in certain yards' (DS.HL/1/13, pp. 24-27).

Such behavioural feedback had implications for the use of social controls, that is 'the values, norms and culture that influence the behaviour of people in companies' (Kraus and Lind, 2007, p. 280). Trust is fundamental to social control. In an inter-organisational relationship, trust may be viewed as the expectation that all parties will behave in a predictable and acceptable manner (Sako, 1992). The greater the level of trust, the less need there is for the more formal and expensive outcome and behaviour controls. However, where agreements are abused or flouted then, of course, trust is diminished. At this point, firms must consider the intensity of their inter-organisational relationships and determine which should be close and which should be more distant. The intensity of the relationship determines the amount of information to be divulged (Kraus and Lind, 2007). Thus Rowell engaged in very free and frank information with River Clyde shipbuilders but was more guarded in his dealings with shipbuilders in the North East of England. Similarly, Rowell developed relationships of trust with the five commercial shipping lines which became his major clients and engaged in freer information exchange with them than with other clients.

7. Conclusions

Operating in a context of industrial, organisational and environmental change, the British shipbuilding industry of the late nineteenth-early twentieth centuries was

successful in its management of complexity, uncertainty and risk. During this period, Great Britain became the world's leading shipbuilding nation (Jones, 1957) and Hawthorn Leslie became one of the country's 'important shipbuilders' (Pollard and Robertson, 1979, p.51).

Hawthorn Leslie Shipbuilders employed separate formal systems of contract accounting, costing and reporting for directors. These systems measured and reported the profit performance of the shipyard, enabled the operation of a managerial bonus scheme together with the enforcement of managerial accountability on a contract-by-contract basis, and provided ships' historic cost data. Additionally, Herbert Rowell had access to shipbuilders' general cost engineering arrangements and systems which provided information for operational planning and control. Nevertheless, overall, there was an apparent shortfall in the information required to manage Hawthorn Leslie Shipbuilders during this period of rapid organisational and technological change in a cyclical and very competitive market place. In fact, this apparent information gap was filled by Rowell's informal and personal cost engineering system. In this system, Rowell gathered data from external sources and used these together with internal data to develop sets of information for cost management and for cost estimation, pricing and tendering. Thus, in Hawthorn Leslie Shipbuilders engineers and accountants were not 'fighting for turf' (Boyns and Edwards, 2007, p.980) in a war of the professions; rather, cost engineering and costing served very different functions and developed in two separate spheres and on two different trajectories. Hawthorn Leslie Shipbuilders offers further opportunities as a research site for the study of costing and cost engineering, particularly in the field of labour cost management and behavioural accounting.

Through to the twenty-first century, cost engineering has continued to develop along its own professional route, focusing on cost estimation, cost control and profitability, often in relation to large-scale capital projects. National professional bodies, such as the UK's Association of Cost Engineers and the American Association of Cost Engineers, together with the International Cost Engineering Council and university cost engineering programmes (e.g. Cranfield University, 2010) have been key elements in the development of the profession. Cost engineering has been neglected in

studies of costing within the accounting literature and it is recommended that future research should seek to remedy this neglect.

Note 1

J.F. Clarke is the author of a history of Hawthorn Leslie entitled '*Power on Land and Sea'*. This book was published by Hawthorn Engineers Ltd but, unfortunately, no publication date is available.

Appendix A: Hawthorn Leslie in context

Timeline

1817 R. & W. Hawthorn engineering partnership formed

1853 A. Leslie's shipyard opened

1869 Opening of the Suez Canal, reducing voyage time between Europe and Australia, New Zealand and the East

1876 Queen Victoria declared as Empress of India

1880 – 1889 The Amalgamation Movement in shipbuilding, marine engineering and shipowning

1880 Education Act. School attendance compulsory for children aged 5 – 10

1880 - 1881 First Boer War

1883 Extension of Married Women's Property Act of 1870

1884 – 1885 European Partition of West Africa

1884 Fabian Society formed

1884 Third Reform Act extends male franchise

1886 Formation of R. & W. Hawthorn Leslie & Co Ltd

1888 Wilhelm II becomes Emperor of Germany

1892 Keir Hardie elected as MP

1893 Independent Labour Party formed

1897 Merger of women's suffrage groups to form National Union of Women's Suffrage Societies

1899 – 1902 Second Boer War

1900 Arms race between Great Britain and Germany begins

1900 Boxer Rebellion in China

1902 Anglo Japanese Treaty

1904 Entente Cordiale between France and Great Britain

1904 John Fisher appointed as First Lord of the Admiralty; begins process of reform and warship construction

1904 – 1905 Japan victorious in Russo-Japanese War

1906 First dreadnought battleship

1907 Triple Entente between France, Great Britain and Russia

1908 State pension introduced for people aged over 70

1911 National Insurance Act provides benefits for workers in times of sickness

1911 Parliament Act limits power of House of Lords

1912 Sinking of the 'Titanic'

1914 Outbreak of World War 1

Monarchs

Queen Victoria, 1837 – 1901

King Edward VII, 1901 – 1910

King George V, 1910 – 1936

Main political leaders

W.E. Gladstone, Liberal, Prime Minister: 1868 – 1874, 1880 – 1886, 1892 – 1894

B. Disraeli, Conservative, Prime Minister: 1874 – 1880

Lord Salisbury, Conservative, Prime Minister: 1885, 1886 – 1892, 1895 – 1902

W. Asquith, Liberal, Prime Minister: 1908 – 1916.

Table 1: Information obtained by Rowell during visits to River Clyde shipbuilders

Wages	Christie's ship		Hawthorn Leslie ship 'Kingstonian'		
			Weight 3,804 tons includes 60t too little for rivets		If 3,864tons
Platers & A.I.S.	(£)7,514	(£)2. 0. 2(per ton)	£7,533	1.19. 8	1.19. 1
Rivetters	6,656	1. 15. 6	6,646	1.14.10	1.14. 4
Caulkers	1,892	10. 1	2,098	11. 0	10.10
Drillers	1,670	8.11	1,847	9. 9	9. 7
	17,732	4. 14. 8	18,124	4.15. 3	4.13.10
15% off as our wt.	heavier	1.11 1/2			
		4. 13. 8 1/2			

Christie considers their cost a very bad one & attributes it to demoralisation by . . . heavy inspection. also to time vessel took to build, 14 months, but says this latter was a cause of them doing so badly on her. Result of last few years inflation in his opinion shows that on a rising market & under such exceptional labour conditions the right thing to do is to build moderate sized, plain vessels with as little special work as possible so as to get it rapidly out, & see how things are going as many times in the year as possible . . . .

They have built a series of similar boats about 2,600 tons . . their average cost of the lab(our) on our basis is about (£) 3-10-0 for five built in normal times & the average of 3 built in 1900-1 is 15% above what it should have been on accountants basis i.e. 30% up instead of 15%.

Source: transcribed and extracted from DS.HL/5/2/1

Table 2: Analysis of Rowell's memorandum book, 1897-1899:
cost estimation, pricing and tendering

DS.HL/5/1	Memorandum Book
Page no.	Description of entry
	(Note: HL = Hawthorn Leslie)
9	Comparisons of estimates of various shipbuilders for icebreakers
10	HL ship cost estimate
19	HL screw trawler cost estimate, labour, materials and overheads
20	HL ship cost estimate
21	Specification, cost and payment terms of ship built by Palmer for Elder Dempster
63	Updating of costs of HL 'Canadian' ships under construction as basis for re-negotiation of contract price
67-68	HL torpedo boats cost estimate
75	Comparison of tender prices and construction time estimates, HL, Palmer and Edwards
84	Cost estimate and price quotation for Wm. Johnston & Co., Liverpool
86	Comparison of HL and Palmer estimated prices for building same ship for Wm. Johnston & Co., Liverpool
94	Comparison of estimated prices for building same ship by HL, Scott of Greenock, Philipson of N. Ireland, Swan Hunter
107	Details of Palmer's quote for the ship 'Viper' built for Parsons and Palmer's negotiations with Parsons regarding price
109	Detailed specification and cost of ship built by Palmer
110-119, 125-128, 133-139	Negotiations with shipowner on ship specification, cost and price of ship to be built by HL
156	HL ship cost estimate
183	Comparison of estimated prices of various shipbuilders for building the same ship
190	Comparison of HL and Denny ship specifications and price estimates for

	a contract won by Denny
193	HL ship cost estimate for new ship: based on historic cost for previous similar ship, adjusted for changed specification
210	Comparison of tender prices of various shipbuilders for the building of the same ships

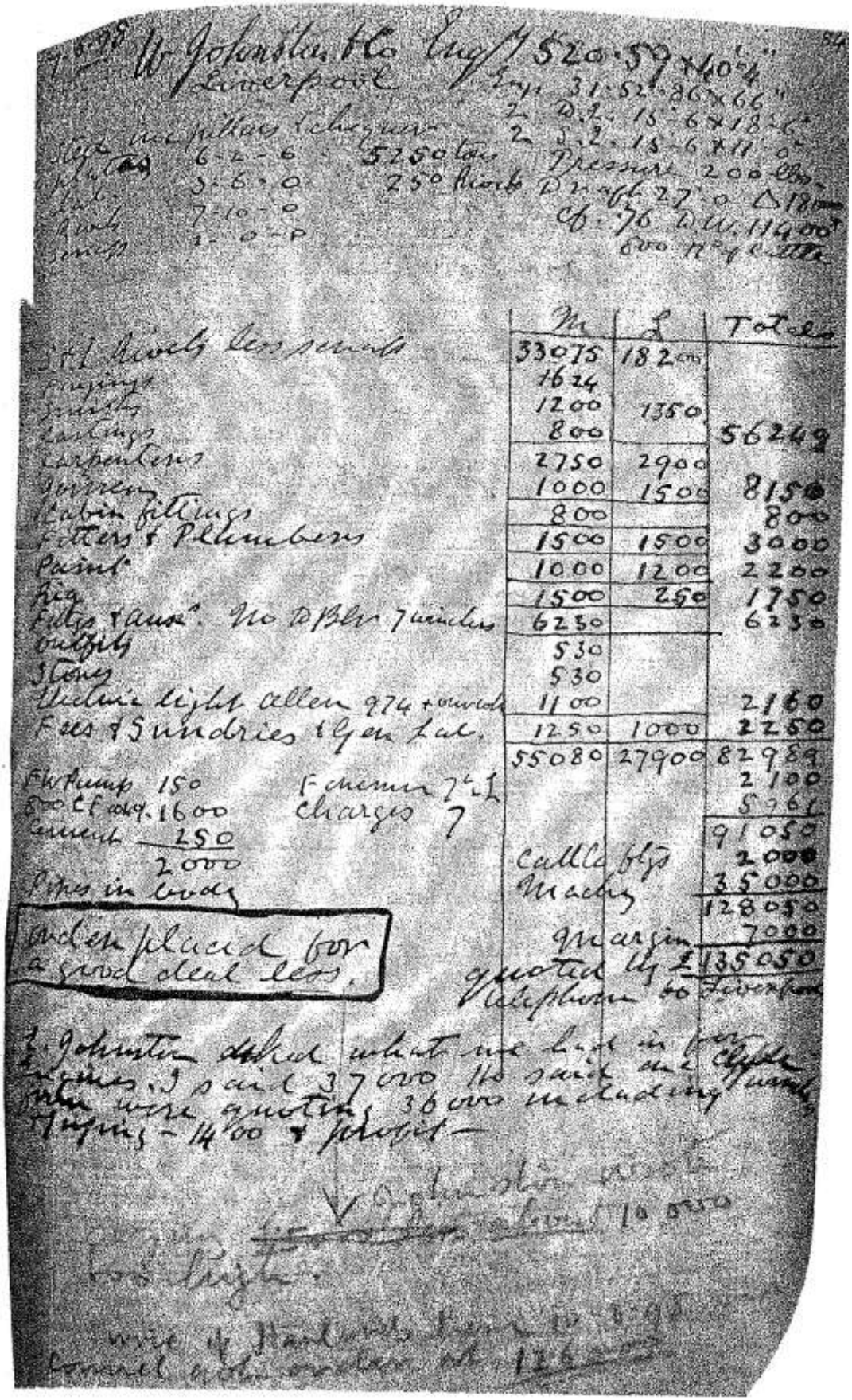
Source: transcribed and extracted from DS.HL/5/1

Table 3: Comparative tender prices: information received from A.L.Alliman, shipowner, 25 November 1899

Shipbuilder	Ship Type A	Ship Type B	Ship Type C	Ship Type D
Richardson	£65,250	£42,700	£43,500	£43,500
Dobson	70,000	46,500	48,200	48,000
Armstrong	75,000	55,000	-	-
Howaldswerke	74,500	46,000	48,900	49,900
London&Glasgow	76,000	46,200	49,500	49,200
Denny	77,000	-	-	-
Hawthorn Leslie	80,300	49,500	58,100	-
Greenoak	81,300	53,800	-	-
Earles	88,500	52,500	58,000	55,350
Clydebank	93,000	58,500	61,800	63,350
Palmers	96,000	54,000	58,500	68,900
Swan Hunter	-	53,000	-	-
Fairfield	-	60,800	-	68,900
Burmeister&Wain	-	-	53,890	55,500

Source: transcribed and extracted from DS.HL/5/1, p. 210

Figure 1: Cost estimate and price quotation



Source: DS.HL/I/5/1

References

Boyce, G. (1995). Accounting for Managerial Decision Making in British Shipping. *Accounting, Business and Financial History*, 5 (3), 360-378.

Boyns, T. and Edwards, J.R. (2007). The Development of Cost and Management Accounting in Britain. In C.S. Chapman, A.G. Hopwood, M.D. Shield (Eds) *Handbook of Management Accounting Research*, Volume 2 (pp. 969-1034). London: Elsevier.

Browne, S.B.C. (1914). *History of the New Firm of R & W Hawthorn (Now R & W Hawthorn Leslie and Co. Ltd), 1870-1885.* Newcastle: R. Robinson & Co. Ltd.

Bruce, C.R. (1911). *Marine Engineering and Costs*. No stated publisher.

Burns, J., Scapens, R.W. (2000). Conceptualising management accounting change: an institutional framework. *Management Accounting Research*, 11 (1), 3-25.

Burton, F.G. (1911). *Engineers' and Shipbuilders' Acc*ounts (second ed.). London: Gee & Co..

Buxton, I.L. (1993). *North East Coast Institution of Engineers and Shipbuilders, Index to Publications 1884-1993.* Newcastle: North East Coast Engineering Trust.

Clarke, J.F. (1984a). *Dictionary of Business Biography* (pp. 957-961). London: Butterworth.

Clarke, J.F. (1984b). *A Century of Service to Engineering and Shipbuilding.* Newcastle: North East Coast Institution of Engineering and Shipbuilding.

Clarke, J.F. (no date). *Power on Land and Sea*. Newcastle: Hawthorn Engineers Ltd..

Cranfield University. (2010). *University Prospectus*.

Dekker, H.C. (2004). Control of inter-organizational relationships: evidence on appropriate concerns and coordination requirements. *Accounting, Organizations and Society*, 29, 27-49.

DS.HL, Hawthorn Leslie Collection held by Tyne Wear Archive Service.

Fleming, A.I.M., McKinstry, S., Wallace, K. (2000). Cost accounting in the shipbuilding, engineering and metals industries of the West of Scotland, 'The Workshop of the Empire', c1900 – 1960. *Accounting and Business Research*, 30 (3), 195-211.

Hopper, T., Cooper, D., Lowe, A., Capps, T. (1986). Financial control and the Labour Process in the National Coal Board. In D. Knights and H. Willmott (eds), *Managing the Labour Process* (pp. 109-141). Aldershot: Gower.

Jones, L. (1957). *Shipbuilding in Britain*. Cardiff: University of Wales Press.

Landes, D.S. (2003). *The Unbound Prometheus, Technological Change and Industrial Development from 1750 to the Present*, (Second Edition). Cambridge: Cambridge University Press.

Kraus, K., Lind, J. (2007). Management control in inter-organisational relationships. In T. Hopper, D. Northcott and R. Scapens (eds), *Issues in Management Accounting*, Third Edition (pp. 269 – 296). London: FT Prentice Hall.

McClelland, K., Reid, A. (1985). Wood, Iron and Steel: Technology, labour and trade union organisation in the shipbuilding industry, 1840 – 1914. In R. Harrison and J. Zeitlin (Eds), *Divisions of Labour* (pp. 151-184). Brighton: The Harvester Press.

McKinstry, S. (1999). Engineering culture and accounting development at Albion Motors, 1900 – c. 1970. *Accounting, Business and Financial History*, 9 (2), 203-223.

McLean, T. (1995). Contract accounting and costing in the Sunderland shipbuilding industry 1818-1917. *Accounting, Business and Financial History*, 5 (1), 109-145.

McLean, T. (1996). Bureaucratic and craft administration of the production process: the formation of accounting and non-accounting control arrangements. *Management Accounting Research*, 7 (1), 119-134 .

McLean, T. (2006). Continuity and change in British cost accounting development the case of Hawthorn Leslie, shipbuilders and engineers, 1886-1914. *British Accounting Review*, 38 (1), 95-121.

McLean, T and Tyson, T. 2006. Standard costs, standard costing and the Introduction of scientific management and new technology into the post-Second World War Sunderland shipbuilding industry. *Accounting, Business & Financial History*, 16 (3), 389-417.

Plumpton, T. (1895). Manufacturing costs as applied to shipbuilding. *The Accountant*, 21, 773-775.

Pollard, S., Robertson, P. (1979). *The British Shipbuilding Industry, 1870-1914*. Cambridge MA: Harvard University Press.

Reid, A. (1991). Employers' Strategies and Craft Production: the British Shipbuilding Industry, 1870-1950. In S. Tolliday and J. Zeitlin (Eds), *The Power to Manage - Employers and Industrial Relations in Comparative Historical Perspective* (pp. 31-45). London: Routledge.

Rowell, E.R. (Ed.). (1996). *In Peace and War, Memoirs of Herbert Rowell and Robin Rowell.* Otley: E.R. Rowell.

Sako, M. (1992). *Prices, Quality and Trust: Interfirm Relations in Britain and Japan*. Cambridge: Cambridge University Press.

Scapens, R.W. (1994). Never mind the gap: towards an institutional perspective on management accounting practice. *Management Accounting Research* 5 (3/4), 301-321.

Slaven, A. (1980). The Shipbuilding Industry. In R. Church (Ed), *The Dynamics of Victorian Business, Problems and Perspectives to the 1870s* (pp. 107-125). London: George Allen and Unwin.

Transactions: Transactions of the North East Coast Institution of Engineers and Shipbuilders.

Yamey, B.S. (1981). Some Reflections on the Writing of a General History of Accounting. *Accounting and Business Research* 12 (2), 127-135.