Spontaneous Disorder? A Very Short History of British Vocational Education and Training, 1563-1973

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ABSTRACT A distinctive feature of the British approach until the 1960s was that vocational education and training (VET) should be provided by employers. This is conventionally contrasted with the much more formal state coordinated approach of Germany. The question posed is whether the British style was the 'spontaneous order' that results because markets use information efficiently about the supply of and demand for skills. Alternatively, was it 'spontaneous disorder' in which the absence of standards and coordination led to under-investment in VET and economic decline relative to those countries with strong leadership in education and training? There is considerable evidence in the twentieth century that Britain suffered from shortcomings in the availability of highly trained labour. The most credible explanation is the organisation and operation of the VET system; the perceived self-interests of undereducated employers and restrictive unions during booms and slumps provided inadequate conditions for efficient employer-led education and training.

Vocational education and training (VET) contrasts with liberal education. In economic terminology, liberal education is consumption, worthwhile for its own sake; the student becomes better off, not because of access to employment or higher wages permitted by the education, but because of direct benefits conferred. On the other hand, VET is unambiguously concerned with investment in human capital, in preparation for work. It is a means to an end. In principle, VET may be undertaken at any level in industry – management, foreman, craftsman or shop-floor (Gospel, 1991). VET is broader than 'technical education', being concerned with the supply of professional services – medicine, law, religion, accountancy, among others. However, to keep the scope of the article manageable, industry (rather than services or agriculture) will be the principal focus of the present discussion.

Over the centuries, economic growth created wider ranges of employment opportunities while technological change destroyed the value of some skills and enhanced the demand for others. In response to this turbulence, the British approach to vocational education and training has been decentralised and market driven. In particular, the essential principle was that VET should be provided by the employers who would be using the skills created, rather than by the state through formal education institutions. The heterogeneity of provision therefore creates a challenge for measurement; there are no obvious standardised units, such as years of schooling (by which investment in human capital more generally is often measured).

This style of VET reflected the gradual nature of industrialisation in Britain and the broadly laissez-faire stance of economic policy until the First World War. It could be interpreted as a form of 'spontaneous order' in the supply of VET, undistorted by government planning. At all levels of British industry there was a reliance upon education and training 'on the job'. The British style has often been contrasted with the German more formal and centralised system and assigned a role in the 'decline of industrial Britain' debate. For many admirers of the German model British VET seemed an ineffective 'spontaneous disorder'.

Advocates of 'spontaneous order' maintain that social institutions or systems of rules are most effective when they 'evolve spontaneously', as have common law and markets. Although not designed or intended by any one group they serve human purposes more effectively than deliberately contrived or centrally planned institutions (Hayek, 1967, ch. 6; Barry, 1995, p. 21). The doctrine is an approach to social problem solving analogous with the way in which genetic diversity encourages evolutionary fitness (North, 1990, p. 81). 'Spontaneous order' in VET summarises the position that, left to themselves, employers, trade unions and workers will reach arrangements that suitably balance their interests and supply VET in the right qualities and quantities – or at least better than the next best alternative approach. Government may be the instrument of their interests but should not take an independent position. The contrary principle, 'spontaneous disorder', is that if government does not take a firm line, instead of merely 'holding the ring', chaos will result. The weak will be exploited by the strong, there will be a lack of standards, an absence of coordination, all leading to under-investment in human capital and economic decline relative to those countries benefiting from strong leadership.

At least from the 'second industrial revolution' (say around 1870), when science-based technologies in electrical engineering and chemistry became more important and foreign competition intensified, questions began to be asked about Britain's approach to the new circumstances (for instance, the Royal Commission on the Depression in Industry and Trade, 1886). Could 'on the job' training be considered satisfactory in times of rapidly changing technology? Technological change may require the use of abstract knowledge by both workforce and management. In addition, how much practical training, rather than mere time-serving, was actually supplied 'on the job'?

The impact or effectiveness of VET might be measured by the proportion of 'skilled' labour in the workforce. But this would beg the question of how skilled they were, as well as how they acquired their skills. Another approach, common to assessing the value of investment in education more generally, is to consider the higher wages available to those with VET as attributable to the VET itself. In a competitive labour market, these higher wages should reflect the greater contribution to the output of the economy consequent upon the investment in VET.

The Market for VET

To understand the effectiveness for industry of the British approach to vocational education and training, it may be helpful to distinguish between the supply and the demand sides of the market. The supply of education and training might have been either autonomous or responsive to industrial demand/needs. If supply did respond, how rapidly did it do so? How closely did VET track the changing needs of industry? More fundamental is the question of whether the supply *should* have been more autonomous. If business really knew what education and training was needed, then a purely passive or fully responsive education supply would be effective. Otherwise some leadership by government or the educational sector itself may have been necessary for full effectiveness.

VET concerned British policy makers both because of their interest in national efficiency and their responsibilities for controlling and developing young people. Why should government intervention be supposed to improve national efficiency? Market enthusiasts might contend that workers and employers left to their own devices would choose the optimum level of training according to the returns earned in the form of wages and profits. Workers could pay for necessary training with lower initial wages or by direct purchase or by other contractual forms, if their future earnings were sufficiently enhanced as a consequence.

The conventional response is that nowadays there is evidence of market failure in the higher rates of return that are generated by investment in training than in comparable outlays elsewhere (Ritzen & Stern, 1991).[1] As part of the analysis of market failure a distinction has been drawn between general and specific training. The point of the categorisation is to determine who has an incentive to pay for investment in skill or VET.[2] The employer has a motive to pay for firm-specific skill investment as long as labour turnover is not too high. Workers with greater skills raise the firm's productivity and profits in the same way as do better machines. But unlike machinery, employees can change firms of their own volition. Since the worker can take general skills with him or her when moving jobs, it should be in the employee's interest to invest in them and so raise their wages. However, an incentive is not the same as the power to take action.

Four general sources of, or reasons for, market failure can be suggested.[3] They are:

1. *Risk*. Investment in any particular form of training might generate 'high' or 'low' returns on the available information. If workers are risk averse they will undertake less training than if returns are certain. Although investment by firms in specific training is also risky, a firm can pool risks over a number of different workers. So the weakness of investment will be on the side of workers rather than employers.
2. *Liquidity constraints* might prevent a worker paying for otherwise profitable training. Nobody will lend to the employee to allow payment for the training now in the expectation of being paid back from the higher wages. The effect is likely to be strongest on those born into the poorest families, unable to invest in their children's careers.
3. *Complementarity between general and specific training*. Returns to general training are likely to be higher when combined with specific training and, conversely, returns to specific training are probably greater in conjunction with general. Employers will not invest enough in specific training if workers do not have the right general educational background. Equally, workers will invest insufficiently in general training if they think that inadequate specific training will follow. Without labour turnover workers and employers could negotiate contracts whereby employers paid a part of the general training costs. But if workers may leave before employers recoup the cost of their training then employers will be loath to pay for the investment. Labour turnover reduces the payoff to general and to specific training when there is complementarity.
4. *Transaction costs in signalling to other employers the outcome of general training*. If employers do not recognise each other's general training, in effect it is transformed into specific. Without, say, national or industry-level accreditation which enforces recognition, there is less than the full possible social return from the investment. A worker changing firms would not be paid as much as the training warranted.

A caveat to all market failure analysis including this one is that to be relevant for policy, the impact must be quantitatively significant and proposed correctional intervention must be both effective and less expensive than the failure to be rectified.

Apprenticeship

The apprenticeship system can be represented as a way of financing VET by a long-term contract, particularly to avoid the second source of market failure above. Apprenticeship allows an initially very low-productivity worker first to be paid more than they are worth to the employer in terms of extra output. Subsequently, as the training given takes effect, productivity rises above the wage so that the employer recoups the 'investment' or 'loan' to the worker (see Figure 1). Data for the beginning of the twentieth century show apprentices' wages rising by about 20% in every year of the contract (Elbaum, 1991). Then at the end of their indenture, wages doubled or tripled. In Figure 1 the course of wages is observable and consistent with the facts but productivity cannot so easily be measured. The wage jump could be interpreted as a sign of apprentice exploitation by barriers to entry to their trade; they could be paid less than they were worth because employment was restricted, not to repay the costs of their training.

The Elbaum story is that apprenticeship survived because it performed an economic function – an example of 'spontaneous order' (rather than, say, a simple barrier to entry). But this is not necessarily 'Panglossian economics'; it is possible at the same time to recognise that there could have been better ways of training or incorporating new technology into production. In the USA greater labour mobility and opportunities meant enforcement of the apprenticeship contract was problematic. Employers could never be reasonably certain that they would recover their investment in the early phase of an apprenticeship. They therefore abandoned apprenticeships, instead adopting technologies suitable for unskilled labour or 'poaching' skilled labour from other countries. Public education was developed in response to the perceived 'youth problem' left by the absence of US apprenticeship.

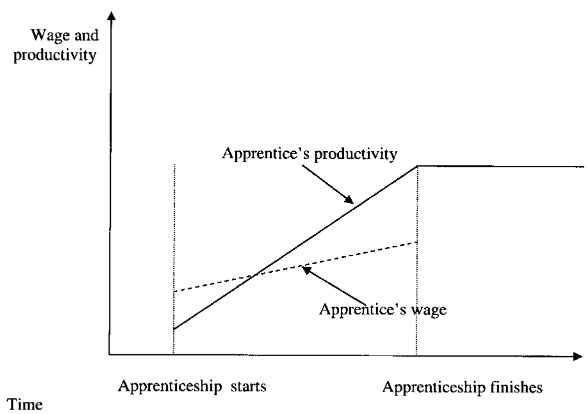

Figure 1. A theory of VET by apprenticeship.

Pre-Industrial Revolution Apprenticeship

Non-vocational education would have been an oddity in the Middle Ages. Traditionally, British universities were intended to train the clergy for posts in the Church, though some graduates might also find employment in the civil administration. The less exalted trades typically obtained trained manpower through formal or informal apprenticeship – by 'on the job' training.

The clearest starting date for a history of British vocational education and training is the Elizabethan 1563 Statute of Artificers.[4] Guild control of industrial training was replaced with statutory apprenticeship (though still monitored and enforced by guilds). Seven-year terms were required before a trade or craft could be exercised (reduced to four years in 1768) and a master was to have no more than three apprentices (Lane, 1996, pp. 3-5). The arrangement was an instrument of social control in the face of the disorders created by a market economy and the undirected energy of young males. Apprentices and servants typically lived with the master under the same roof. Restrictions on apprentices included prohibitions on hunting in 1692 and in 1757 on playing specified games of hazard especially in public houses.

In 1709 the premium that a master could charge for an apprentice was taxed (one quarter of a million apprentices were recorded in 1710-1762 but there was much under-registration). Higher premiums were paid if the apprentice was in some way handicapped. The highest premium paid, to Levant merchants in London, was £200 in the 1660s and 1670s (Lane, 1996, p. 19). The greater the pay-off from the accreditation or the knowledge acquired, the greater the premium that could be charged. Russian apprentices to English masters paid £30-£120 compared with £4-£40 for native apprentices in 1716-18. Premiums also were higher the more expensive the materials with which the apprenticed worked and was likely to damage through error.

Wages were paid in kind – food, lodging and clothing. When apprentice productivity was low, these costs would not be covered, and the premium provided an offset. ' For the first two years an apprentice cost more than he was worth' (Landes, 1998, p. 224). With industrial progress the productivity curve might be expected to shift upwards and a premium becomes less necessary. A wage progression could then be introduced, whereas at low productivity this could be below subsistence.

The Privy Council recorded in 1669 that the 1563 Apprentice Law had 'been by most of the judges looked upon as inconvenient to trade and inventions' (Clapham, 1966, p. 259). More than a century later these views were elaborated by Adam Smith, who regarded apprenticeships as a restrictive practice reinforced by statute, intended to limit output and keep up prices. 'In Sheffield no master cutler can have more than one apprentice at a time by a bye-law of the corporation' (Smith, 1904, I133). If parents and tradesmen wished to agree training contracts then statutory enforcement was unnecessary. Apprenticeship demoralised young people by separating their effort from their reward. A seven-year contract was needless to learn even a complicated trade like clock or watch making. A few weeks at the outside would suffice, Smith maintained.[5] Although it was true that a great deal of practice was required in order to build up skill, this was better achieved if the novice paid for his own mistakes with wasted material. He would receive his financial reward when he produced a good product (assuming, as Smith does, that there was no financing constraint).

The customer was not protected by apprenticeship because poor quality was most often a matter of fraud. Certification of quality was a far better quality guarantee – as with the sterling mark on silver plate and stamps on linen and woollen cloth.

In his condemnation of apprenticeship Smith was driven by indignation about statutory enforcement. He did not concede that learning a trade could be more than just a technological training matter which in any case could benefit from sustained advice on how to rectify mistakes and improve practice. The self-employed craftsman could teach an elite apprentice how to judge and buy raw materials, to keep accounts and to cultivate contacts with clients, customers and suppliers as well (Lane, 1996, pp. 242-243). But by the eighteenth century, the spread of wage labour meant that such relationships would be a minority and Smith's charges would have general force (Dunlop, 1912, p. 224).[6]

Guilds or corporations, originally composed of small craftsmen, were ineffective in a world of large rich employers. Wealthy masters were unwilling to be restrained by guilds and were too powerful to be controlled. 'What told against the guilds told against apprenticeship.' Sir Frederick Eden in 1790 disputed Smith's contention that corporations enforced apprenticeship (Dunlop, 1912, p. 238). They were just irrelevant. A 1701 complaint to the Commons maintained that fewer than half of the 3500 wool weavers in the Taunton area had served apprenticeships. This was a trade that clearly fitted into Smith's world-view. More macabre evidence for the pervasiveness of apprenticeship in the first half of the eighteenth century is that 40% of those hanged at Tyburn had been apprentices (a high proportion were butchers). London however was very different from England and Wales as a whole, where apprenticeship never bound the great majority of manual workers (Clapham, 1966, p. 260).

For this majority the principal official economic concern was that they should not become a claim upon the local taxpayer under the terms of the 1601 Poor Law Act. On occasion this might stimulate local authorities to invest in training. The Poor Law authorities in Hitchin, Hertfordshire in 1618 paid for their charges to receive training in wool work and later in flax. These overseers also apprenticed the poorest children for whom they were responsible into what was often a disguised form of servitude. Houses of Correction could be places of industrial training but, as the name suggests, this was rarely their principal function. In 1695 a Quaker published a proposal for a 'College of Industry' to provide training but no action was taken and state policy did not begin seriously to address VET for most of the population for some centuries (Clapham, 1966, pp. 299-301).

The date of publication of Smith's condemnation of apprenticeship (1776) approximately marks the complete breakdown of the Elizabethan system – in wool, knitting, watch making and calico, but elsewhere apprenticeship continued, often in modified form. The poet John Keats was apprenticed to a surgeon in Edmonton in 1811. Three years later he abandoned his apprenticeship to work as a dresser or junior surgeon at Guy's and St Thomas Hospitals. Apprenticeship persisted often under a different name (such as 'articled clerk') where professions were able to take over the regulatory functions of the medieval guilds. This was so where the technology allowed the 'master craftsman' mode of production to continue and where foreign competition was unlikely to erode nationally established monopolistic practices. Manufacturing industry was not so protected and for this reason, with industrialisation abroad, the arrangements for VET in the sector were more prone to be scrutinised critically by the later nineteenth century than was VET for professional services.

Did apprenticeship as the principal source of VET exercise the harmful effects that Adam Smith claimed? The skill differential from the fifteenth century to the 1890s, including Smith's period, in the building industry remained unchanged (Phelps Brown & Hopkins, 1955). This suggests the supply and productivity of carpenters relative to labourers was regulated broadly to maintain the percentage differential. Wages were in fact 'sticky', they supported a customary lifestyle and would not change in response to 'short-term' excess demand or supply. But if these disequilibria persisted ultimately there would have been irresistible pressure to change.[7] As long as, and because, there was no big or rapid technology change that shifted the demand for labour suddenly, relative supplies of skilled and unskilled men never altered sufficiently to put irresistible pressure on wage differentials. Apprenticeship arrangements controlled the supply of carpenters so as not to disrupt relative wages. Apprenticeship terms and conditions, as well as numbers taken on, may be assumed to have adjusted to maintain the traditional differential[8] – not necessarily in the interests of would-be apprentices or of buyers of building services. After the Great Fire of London in 1666 carpenters petitioned against permitting 'foreigners' to do their much expanded work, or if they were permitted, they should not be allowed to take apprentices (Clapham, 1966, p. 260).

The accelerated pace of industrial change and the impact on VET was marked by an act of 1802 regulating hours of work of 'factory apprentices' and specifying the teaching of reading, writing and arithmetic. Since Poor Law authorities paid premiums for their orphan charges to be indentured to factory owners, the system became tainted as a form of juvenile slavery. The requirement of serving an apprenticeship before practising a trade was legally abolished in 1814. Long before then, the institution had lost its former general function. Thereafter apprenticeship survived in particular trades, not because of statutory support, but because of the agreement of the contracting parties, in accordance with 'spontaneous order'.

VET in the Industrial Revolution and After

Modern technical education is often thought to have begun in England, entirely independently of government, with the first Mechanics Institute in London in 1823 (Committee on Industry and Trade, 1927). Professor John Anderson of the University of Glasgow lectured on practical physics to an audience including a number of working men in 1760. At the end of the eighteenth century, George Birkbeck gave special lectures at the 'Andersonian Institution' in Glasgow on Natural Philosophy for 'mechanics' and was amazed at their popularity (Curtis, 1967, pp. 471-472). When he moved to London, his successor Dr Ure continued the lectures. Birkbeck was a member of a committee that founded the Mechanics Institute eventually to become Birkbeck College of the University of London. By 1860 there were 750 such institutes, of which 300 with about 20,000 students were in Lancashire and Yorkshire – the classic Industrial Revolution regions (Committee on Industry and Trade, 1927).

Mechanics Institutes were originally intended to teach artisans the principles underlying their trade through evening classes. The institutes were not solely concerned with technical education and generally became less occupied with it as the years passed. Partly this stemmed from the weakness of students' basic education necessary to understand technical education (market failure 3 above) (Wrigley, 1986, pp. 164-166). The other driver was students' thirst for general education. In some cases institutes eventually merged with local literary and philosophical societies.

The Society of Arts began to set exams for artisans in 1855. During the first century of its existence the Society aimed to encourage manufactures and the arts by the award of medals.[9] For example in 1757 the Society conferred awards for spinning in workhouses and for carpet manufacture. In response to severe deforestation over the previous century, and in order to boost the availability of timber for shipbuilding and industry, the Society began to offer prizes for tree planting and subsequently for the domestic cultivation of opium. In 1851 it held the Great Exhibition in Hyde Park.

The year after the Great Exhibition, and in response to the international comparisons made there, the Government established the Department of Practical Art to reform the schools of industrial design. A science division was added the following year. This Department made funds available for technical education, for example giving grants to existing navigation and trade schools. From 1859 the Department covered the teacher costs of science classes – aimed at 'the industrial classes' at the lowest cost to the Government and on the premise that the Government was not to be involved further.[10] By 1864 23 subjects were recognised for support. As the Board of Education in 1899, the former Department of Science and Art recognised 25 subjects. By then £200,000 a year was being spent and students in classes exceeded 170,000 (Roderick & Stephens, 1972). These classes could not cover trade training for fear of antagonising trade unions and employers (Argles, 1964, pp. 21-22). They therefore restricted themselves to abstract teaching and so reinforced the view that technical education had little to offer industry.

The Revised Code of 1862 shunned practical work for ordinary elementary schools. 'Top-up' classes of Science and Art Dept provided science and technical instruction in pseudo-secondary school (Sanderson, 1994). For the elite, science classes began to appear in public schools. Rugby was the first school to take up science and was highly praised when the Devonshire Commission investigated scientific education in schools in 1871.

Reacting to the Devonshire Commission's survey of technological advances in foreign countries,[11] the City Livery Companies (survivors of the medieval guilds) appointed a committee in 1877 to specify a national scheme of technical instruction (Curtis, 1967, p. 495). They established a national system of exams in which there were 151 passes in 1879, rising to 14,750 by 1914. Their City and Guilds of London Institute (1878), which founded Finsbury Technical College, offered payments to teachers. City and Guilds classes were reckoned to be more practical than those of the Science and Art Department.[12] The Institute established a large Central Technical College at South Kensington in 1884 (eventually Imperial College).

The Royal Commission on Technical Instruction 1884 provided the impetus to the Technical Instruction Act 1889, which empowered local authorities to raise a penny rate in aid of technical education. By a political accident in 1890 a 6d (penny) a gallon tax on spirits was handed to local authorities for technical instruction or rate reduction. Eventually, 160 colleges were financed by this 'whisky money'. These colleges in turn gave rise to 37 'junior technical schools' by 1913. Junior technical schools began in 1905 (in imitation of the French *écoles primaires supérieures* started in the 1830s) (Sanderson, 1994).[13] A constraint on the expansion of numbers of technical schools was that they were expensive – by comparison with grammar schools – and suitable teachers were scarce.

The distinctive characteristic of technical education in England at the beginning of the twentieth century remained evening classes. Sidney Pollard (1989, p. 194) observed that those who made an effort to attend them, will have valued them, been selective and worked hard. But Michael Sanderson (1994, p. 6) believes that too often evening classes were a waste of time and money.[14] Teachers liked the top-up income and employers did not want to lose labour during working hours, but students were too exhausted after a long day's work to take much in. Yet he also concludes that (Sanderson, 1999, p. 161) the system of technical education evolved through 1870-1914 into a satisfactory, even impressive, one. Colleges sprang up in industrial provincial towns.[15] Funded by local industrialists, their curricula and research were determined by national and regional industrial needs, their students came from industrial backgrounds and up to one half went on to careers in industry. The London polytechnics beginning with Regent Street in 1882, and numbering 11 by 1898, provided artisans and clerks with classes in technical education as well as sports. The problem for Sanderson was the inadequate use made of the system. Some compulsory day release would have been desirable, he judges.

The variety of private sector provision of VET is illustrated by the 14 railway companies that ran their own technical classes. Mather and Platt in Manchester went so far as to attach a school to their works. To ensure relevance of the teaching, drawings of work in progress through the shops were made in the school. Alfred Marshall at Bristol around 1880 introduced a sandwich degree with six winter months of the year in college, and the summer months spent as articled pupils in large workshops. But Marshall observed that the cooperation of heads of large firms was needed and by implication this was not always forthcoming (Marshall, 1920, p. 174, fn. 3). The trade cycle could disrupt training, especially if a company was forced to close. Instead of certification, there was the reputation of the firm to sell the apprenticeship, yet reputations take much time to build up and may become out of date.

Paul Robertson (1984) noted that successful late nineteenth-century industries include shipbuilding with no technical education. The industry ignored what was available and believed none was needed. Craft apprenticeship in this industry was 'more important as a trade union device for controlling entry' (Jeremy, 1998, p. 396). Michael Sanderson (1999) contends that the metal mining industry received good educational support but there was not enough of it. On the other hand, Sidney Pollard (1989, p. 176) maintained that an average of only four students a year in mining, metallurgy or the geological survey from the College of Mines entered British industry between 1853 and 1871. Extending the period to 1895, only 20% of graduates did so, mostly going into mining and brewing (where there was a regulatory requirement). In cotton there was no education available or requested. Sanderson concludes that any failure in VET was in the period 1870-1890 rather than in the two decades before the First World War. Yet a neglect of formal VET may be reflected in the insufficient flexibility shown by these industries when economic conditions changed after the First World War.[16]

Despite the decline of Elizabethan apprenticeship described by Dunlop for the previous century, '*Apprenticeship* was the single most important source of skill 1870-1914' (More, 1980, p. 41) – though it was for supervisory and technical staff not ordinary manual workers (More, 1980, p. 215). 'Behind the decline of apprenticeship 1870-1914 lay mechanisation and an unwillingness to lose independence for 4-6 years when the craft might be obsolete in an era of rapid technological change' (Sanderson, 1994). In engineering apprenticeship was remarkably persistent. Of 226 engineering firms in 1917, 43 maintained a pupillage system and 62 took on secondary school boys for an apprenticeship that involved part-time study (Pollard, 1989, p. 201). Unskilled boys earned more than apprenticeships but skilled craftsmen earned twice as much as unskilled labourers. Internal rates of return to a person investing in an apprenticeship were 21 % or 27% depending on whether the alternative was unskilled work or semi-skilled (Elbaum, 1991).

These returns would look favourable for many industrial investments at the end of the nineteenth century; rentiers were content with yields of 3%. They are therefore evidence of human capital market failure or monopolisation, despite the institutional arrangement of apprenticeship that, in principle, might have avoided it. The high rates of return signal under-investment and a source of lower national income and economic growth than necessary. This was an opportunity for intervention to encourage VET.

Apprenticeships did not persist simply because unions wanted them, according to Elbaum (1991), since unions could not normally impose a closed shop. In engineering and building, firms hired as many apprentices as they chose. Smaller firms 'trained' many more than were needed for their own purposes – apparently a form of 'dilution'. But the lack of consensus behind the institution is shown by the engineering union's persistent, if ineffective, attempts to exert control. In 1845 the union in Manchester aimed to limit apprentices to 'the standard regulation of the trade namely one boy to four men' and later more generally, it 'remained a keystone of the general wages policy of the Society'. However, in Sunderland between 1883 and 1885 the union's strike to limit apprentices was defeated (Jefferys, 1945, pp. 24, 34, 102-103).

The Cambridge economist Alfred Marshall (1920) wanted to revive 'the apprenticeship system in a modified form so the apprentice is taught in the workshop all the subdivisions of one great division of trade supplemented by theoretical knowledge of all branches of the trade acquired in a technical school'. He describes the 'premium apprenticeship' that typically involved a payment of £50-£600 for young men who were destined for leading positions in industry (Pollard, 1989, pp. 200-201; Jeremy, 1998, p. 396).

By restricting VET to apprenticeship at the intermediate stage and ignoring basic training, Steve Broadberry (forthcoming) has constructed a new measure of British vocational skills. This allows him to conclude that, relative to the USA and Germany, before 1950 there is no evidence of a British shortfall. He estimates the proportion of apprentices in 1906, 1925 and 1950 in industry in Britain and compares them to proportions in Germany and the USA. The US pattern is for a small number of intermediate qualifications – apprenticeship – but more higher-level qualifications. Germany has more apprentices in industry but overall, when weighted by wages, Britain appears to have a high level of vocational skills in services and is not pulled down by a low productivity agricultural sector as is Germany. However, inevitably Broadberry is unable to measure fully VET stocks.[17]

The long decline of apprenticeship and the scant provision of education in some quarters was perceived to create a training vacuum for the majority of the young population. An Edwardian memorial from the Associated British Chambers of Commerce to Winston Churchill drew attention to the mass of unskilled workers in Britain who received no training at all. Selling newspapers was a typical 'dead-end', low-paid occupation that the Association contrasted with provision in Germany (Sheldrake & Vickerstaff, 1987, p. 6). Of boys leaving London elementary schools in 1899, 42% became errand boys and two-thirds in the following decade went into unskilled jobs (Sanderson, 1994). The gap between the school-leaving age of 12-14 and apprenticeship at 16 encouraged moves into 'dead-end' jobs. The 'youth problem' was not alleviated by the Education Act 1902, when the science and art schools became real technical schools, with a wider curriculum. In the planned German system matters were very different. Georg Kerschensteiner, Director of Education in

Munich in the first decade of the twentieth century, arranged for 20,000 children to be taught 56 trades free of charge in seven specially equipped schools.[18] Germany had virtually no 'dead-end' problem.

Echoing Adam Smith more than a century earlier, Marshall maintained that public exhibitions, trade associations, congresses and journals were the great agencies of technical education for adults (Marshall, 1920, p. 175, fn. 1). 'Compared with the German educational system the British was indeed chaotic' (Pollard, 1989, p. 194). The German system was an all-embracing net which swept in everyone who might profit from formal or technical education. It was geared much more closely to later occupational needs with a system of widely understood leaving certificates. But it was wasteful and rigid, with a government-dictated curriculum. Some Germans maintained there was nothing in Germany in the first decade of the twentieth century to match Cambridge in physics, Sheffield or Birmingham in metallurgy and Leeds and Manchester in textile chemistry and dyeing. The switch to war technology shows the speed of response and flexibility of British industry, in dyestuffs, optical glass, and aircraft frame dope (Pollard, 1989, p. 197). Large British manufacturers thought they could always buy in scientific expertise if they wanted it; they did not need in-house investment.

There is no doubt that there were many commissions, investigations and initiatives in British VET during the later nineteenth century and early twentieth century (the Newcastle Commission 1861 on primary education, the 1864 Clarendon Commission on the fee paying 'public' schools, the 1868 Taunton Commission on the endowed/grammar schools, Samuelson's Select Committee on Scientific Instruction 1867-68, the 1871-76 Devonshire Commission, the 1881-84 Royal Commission on Technical Instruction, the Royal Commission on the Depression in Industry and Trade 1886, the Technical Instructions Act of 1889, the 1902 Education Act …). Moreover, Britain showed continuing inventiveness in new technology in which VET institutions played a part. The Honourable Charles Parsons went on to an apprenticeship in Armstrong's after graduating from Cambridge and before his path breaking steam turbine work. Joseph Swan demonstrated the first electric light bulb at a meeting of the Newcastle Literary and Philosophical Society in 1879. Professor William Ayrton of Finsbury Technical College was such an international authority that he played a major role in transferring electrical technology to Japan.

However, the question remains whether, at any date, sufficient activity of the appropriate quality for the economy as a whole was undertaken. The impression given jointly by the rates of returns to apprenticeship, by Table I and the 'dead-end problem' outlined above, is that VET was excessively scarce. Table I indicates that most of the population aged between 14 and 21 were untouched by any formal tuition. There were sufficient evening classes for approximately each school leaver to take one, but in practice a few would take several and in any case many of the classes offered were not VET.

Additional evidence of under-provision of VET is the British comparative disadvantage in high-wage, high-skill sectors in 1880, 1910 and through to the interwar period (Crafts & Thomas, 1986). In each of five years between 1880 and 1935, exports tended to be higher in industries with lower skills, as measured by wages. Although supply of VET matched demand, there was arguably a deficiency of demand for VET to offset British comparative disadvantage in skill-intensive activities. While every exporter must have a comparative disadvantage in some factors, as a wealthy early industrialiser, Britain's pattern of development should almost certainly have emphasised skills. That the market did not signal skill shortages then must have been a consequence of various market failures, of which in addition to those giving rise to high returns to apprenticeship, management failings in recognising and adopting the appropriate technologies should be considered.

	Graduates in science and technology from civic universities	City and Guilds passes	Students in technical college evening classes	Day students in engineering classes in four college	Students in full-time post-secondary technical courses at technical colleges	Apprentices
1870	19	-	-	114		
1879	-	151	-	-		
1880	55	515	-	119		
1890	166	3,507	-	193		
1893	-	-	120,000	-		
1900	378	8,114	475,000	376		
1910-1914 (various years)	1231 (431 technology)	14,105	708,000	613	1,199 (engineers 584)	343,000 (1906)

Table I. Measures of vocational education and training 1870-1914. Source: More, 1980; Sanderson, 1999.

Typically untrained in theoretical and technical skills themselves, management was in general unlikely to have a full appreciation of the value of such knowledge in their employees.[19] Higher technological education for engineers struggled for acceptance against the conservatism of the Institution of Mechanical Engineers until the eve of the First World War (Guagnini, 1993). Other political pressures established by British history pushed in the same direction. Trade union concerns about the price of skilled labour would hardly incline them favourably towards state efforts that would benefit the employer and lower the wages of their members. The tradition of small and parsimonious government, coupled with laissez-faire economics, was reinforced by the religious societies' views of general education and their part in it. Only the accident of whisky money provided for what state-financed technical education there was. The few state-aided 'Industrial Schools' were in fact juvenile open prisons.[20]

Aside from any industrial need, there remain questions of social control and personal development of young people that the USA addressed by expanding higher education more energetically than Britain. It is hardly reasonable to maintain there was a deficiency of VET purely on these grounds, independently of industrial demand. A more credible solution was liberal education, although later experience in the twentieth century suggested compulsion could discourage motivation to learn. Government did eventually plug the gaps in the provision of elementary education by religious societies through the creation of School Boards in 1870 and by making such education compulsory after 1880.

VET from the First World War

The Government was able to expand VET when it chose. War production required a massive government training effort, pioneered by Christopher Addison at the Ministry of Munitions. By 1918 there were 100 equipped technical schools and nearly a dozen large instructional factories able to accommodate 400-800 learners each. Government could do this because the task of war production, and therefore of the new training institutions, was simple compared with that of the peacetime economy. Even so, more might have been done after the war, if only for able-bodied ex-servicemen, had it not been for union hostility and the post-war budget cuts (Sheldrake & Vickerstaff, 1987). Then the Ministry of Labour took over responsibility for training but only covered disabled ex-servicemen. Trade union pressure in the face of unemployment restricted even this scheme. Also depressed economic activity discouraged employers from taking on 'improverships'.

By 1925-26 it was estimated that only one-third of the under-21s in the engineering industry were apprenticed, with a further 11% learners (Jefferys, 1945, p. 205). Unemployment continued to take its toll so that, by 1938, of 1300 firms a mere 16% employed indentured apprentices. The use of the apprenticeship contract to supply cheap labour rather than training is illustrated by the 1921 strike over paying apprentices by results (Jefferys, 1945, p. 221).

More (1980) estimated the number of male apprenticeships in the mid-1920s was 368,000 – by way of comparison the number of boys leaving public elementary schools in England and Wales in 1924-25 was 364,000. The predominant length of apprenticeship was about five years so at the most one in five male school leavers found their way into apprenticeships. The official view was that there were probably seven non-apprentices to every apprentice among youths aged 14 to 21 (Committee on Industry and Trade, 1927, p. 146).

The same survey of training also expressed muted concern about a number of sectors. In mechanical engineering 'appreciation of training frequently depends on the amount and kind of training the managers have had themselves'. In iron and steel, while there was an excess demand for metallurgists, less training was insisted on for operatives 'than is altogether good for the industry' (Committee on Industry and Trade, 1927, pp. 191, 201). In coal mining, miners were 'likely to be under-educated even from the viewpoint of safety' – shift working rendered attendance at evening classes impossible (Committee on Industry and Trade, 1927, p. 204).

If VET between the world wars was deficient and there were increasing skill shortages then this could have been reflected in changes in relative remuneration. Two occupations in which Britain was castigated for being weak were chemistry and electrical engineering. Comparing such figures as are available with those for solicitors and general medical practitioners suggests a faster rate of increase for the salaries of the second two occupations than for the first two in the interwar years. Over the First World War period (1913-14 to 1922-24) in the 'old' professions average salaries rose by over 90% whereas chemists' salaries increased by only 77% and engineers achieved merely 60%. By 1935-37 engineers' salaries had fallen while those of the 'old' professions were up 45% for medical practitioners and 12% for solicitors. Entry barriers and foreign competition apparently controlled salary movements. Those trained in the new trades were not earning substantial economic rents because of training supply shortages (Foreman-Peck, 1994).

Nonetheless, there were ways in which a 'shortage' could be revealed without the type of relative price movement considered above. There might be very high rates of return to investment in skills at the existing wage structure, because of market failure or monopolisation. Moreover, if top management have effectively no technical training then they may be unable to recognise opportunities for investment and employment of technologically advanced skills. In international perspective, the educational backgrounds of British top management are consistent with this possibility (Cassis, 1997). In 1907, 37% had university backgrounds compared with 57% of their equivalents in Germany and 72% in France. Of British managers of the largest businesses, 18% experienced apprenticeship training compared with 31% of comparable managers in Germany and 7% in France. The ordering of these figures across countries remained unchanged over subsequent decades, although there was a tendency for the university-educated proportion to rise and the apprenticeship proportion to fall.

Alternatively or additionally supervisory or shop-floor grades with the right levels of training might be impossible to recruit, rendering unprofitable or uncompetitive various lines of activity (Prais's [1995] explanation for the last two decades of the twentieth century). In 1936 one in four school leavers attended an evening class but of these only a small minority studied a technical subject (Foreman-Peck & Hannah, 1999, p. 32).

Unemployment soon displaced other policy concerns and wartime VET experience was utilised as a solution with the Unemployed Training Schemes. These had a capacity of 6500 places on six-month courses. But since graduates needed to find jobs in industry, widespread unemployment ensured that only about half the places were taken up until the mid-1930s. Other supposed training initiatives in effect invoked the New Poor Law (1834) principle of 'less eligibility' to ensure that unemployment claimants were genuinely seeking work. Instructional centres put on 12-week residential camps usually undertaking forestry work (Sheldrake & Vickerstaff, 1987).

In 1937 the engineers' union managed to extend their control over numbers of apprentices to negotiating over their wages and conditions as well. Around 32,000 apprentices went on strike. The agreement reached was for a wage that was a fixed proportion of that of the adult workers (Jefferys, 1945, pp. 244-245).[21] The union judged that the decay of apprenticeship between the wars was due to 'exploitation' (Jefferys, 1945, p. 263). But the consequences of the fixed proportion wage for the viability of the apprenticeship model of training should be apparent from Figure 1 above.

Technical education of the workforce between the world wars deteriorated or at least did not improve. Absolute numbers of skilled workers changed little between 1911 and 1951 (Matthews et al, 1982, p. 109). From 1911 to 1931 the ratio of skilled to total manual workers fell – the combined impact of war and unemployment not offset by special government schemes. Official anxiety about the small number of apprentices and a shortage of skilled labour crystallised in 1927 with the 'interrupted apprenticeship scheme' (Sheldrake & Vickerstaff, 1987). Ex-servicemen participants were paid what they would have received had training not been interrupted while they were apprenticed; about 100,000 passed through the scheme.

	City and Guilds Institute			
	Craft Certificate	Technician Certificate	Ordinary National Certificate	Higher National Certificate
1929	-	-	1.2	0.5
1938	-	-	3.3	1.1
1951	18.6	9.0	11.0	5.6
1964	47.7	37.9	23.0	12.8
1973	183.2	131.0	21.6	15.1

Table II. Number of workers acquiring technical qualifications 1929-73 (thousands).
Source: Matthews et al, 1982, table to note 24, p. 634.

A government initiative in 1921 introduced the Ordinary and Higher National Certificate qualifications but numbers of workers with technical qualifications remained few compared with those in the great boom after 1945 (Table II). A similar tale of underachievement is the rise of the technical schools. By 1918, 61 had been established (Sanderson, 1994). Pupils increased by a factor of three to over 30,000 between 1919-20 and 1937-38. Yet by the last date technical school students accounted for only 2.6% of boys and 1.4% of girls of school age. Years of schooling of the labour force continued to rise. Formal education added 0.2% to the quality of the labour force every year on average between 1856 and 1893 and 0.4% between 1873-1937. Technical education was estimated to have improved the quality of the labour force by 0.1% a year between 1856 and

1937[22] (Table III) (Matthews et al, 1982). Was this a lot, a little or close to the ideal? As a proportion of the growth rate per head over the period it was about one-tenth. Formal education was estimated to have contributed three times as much. A doubling of the technical education effect, another 0.1% on the growth rate over the years 1856 to 1937, would have raised income per head in 1937 by 15% or 20%.

Consistent with a shortfall in VET, a very large 'human capital' effect explains differences in relative US-British productivity among industries in the mid/later 1930s (Broadberry & Crafts, 1992). American industrial productivity was massively higher than that in Britain and the USA made minimal use of apprentices. A 1% rise in relative US/British human capital across industries was associated with roughly a 1% higher relative productivity.[23] If Britain had invested more human capital in any particular industry the productivity lag behind the USA would have been reduced. Steve Broadberry (1997) contends that this result stems from the USA adopting mass production techniques in contrast to the 'craft production' of British industry. Mass production did not need the skills supposedly imparted by apprenticeship but only required unskilled labour. The greater US human capital was in the managerial and supervisory levels and in research. Yet for human capital to have such a strong aggregate effect it is likely to have been rather more pervasive. Greater human capital more plausibly allowed larger throughput processes and more productive technologies in the USA.

	Formal education (%)	University education (%)	Technical education (%)
1856-1873	0.2	0	0.1
1873-1937	0.4	0	0.1
1937-1964	0.4	<0.05	0.2
1964-1973	0.3	<0.05	0.2

Table III. The contribution of education to improvement in labour quality 1856-1973 (annual percentage growth rates). Source: Matthews et al, 1982, p. 111.

With rearmament and another world war the Government once more temporarily became proactive in VET to ensure a shortage of skilled labour did not hamper the war effort. Sixteen General Training Centres established by 1939 expanded under the pressures of war to 35 by the end of 1940, training 30,000 people. By 1941, 75,000 workers were trained in single machine/job skills, but labour shortages meant that only three-quarters of the available training places were filled. Between 1940 and 1945 almost 300,000 workers completed engineering courses. Training was generally poor or low grade and those trained were usually squeezed out of their jobs at the end of the war according to Sheldrake & Vickerstaff (1987) – though the aggregate statistics suggest a more optimistic conclusion.

Vested interests played a part in the success and failure of training initiatives. Ernest Bevin, then Minister of Labour, secured trade union cooperation during the war on condition of 'business as usual' and full employment afterwards. Consequently, the immediate post-war training agenda concerned only youth issues and demobilisation. Follow-up pamphlets to the Butler Education Act (1944) suggested Local Education Authorities should consider extending technical school provision. But there was no requirement to do so in the Act and expansion was very limited. The few technical schools were eventually swallowed up by the new 'comprehensive' schools (Sanderson, 1994).

By 1953, 70 industries formally had adopted nationally agreed training schemes but local implementation and knowledge of schemes were weak. Trade unions maintained defensive controls over conditions of entry to apprenticeship (Sheldrake & Vickerstaff, 1987, p. 28). As far as the apprenticeships themselves were concerned there was a concentration on the form (for example duration) rather than content (what should be learned). There was still no standard system of qualification other than time-serving (to which Adam Smith's condemnation continued to apply).

Indirect evidence continued to suggest inadequacies of VET in manufacturing industry. The contribution of human capital to the US/British labour productivity gap was even greater in 1950 than it had been in the 1930s (Broadberry & Crafts, 1996). In 1910 the USA had employed almost twice as many engineers as a percentage of the labour force and in 1950, after Britain's wartime expansion of engineering, the USA still utilised one and a half as many (Peck, 1968, p. 452). If Britain's concentration upon apprentices and non-professional technicians instead of professional engineers by comparison with the USA was simply a rational response to skill scarcities, relative wages of the two types of skilled labour would have been radically different in the two economies, but they were not. US experience suggests that more professional engineers and fewer non-professional technicians would have raised productivity.

Even though the school-leaving age had been raised (to 15) in 1947, the small numbers completing British secondary school education in the 1950s limited the opportunities to implement this option. In 1961, 12% of 17-year-olds attended school full time compared with 75% for the USA in 1960. Complementarities between secondary schooling and VET then contributed to an undersupply of professional engineers and skilled personnel. As a consequence, in the mid-1950s Britain employed the lowest proportion of technically qualified staff in the metals, food and electrical industries among seven Organization for Economic Cooperation and Development countries surveyed (Peck, 1968, p. 459). This position was exacerbated by basic research and aviation probably accounting for one-quarter of the deployment of Britain's technical manpower. Britain produced more science and technology graduates than Germany (or France or Italy) (Edgerton, 1996, p. 54). However, more relevant for VET, this is not true of 'technology-only' graduates. In 1954-55, 55% more graduated in France and 22% more in West Germany.

Britain appeared to supply more science graduates than ideal, who then substituted at lower wages for engineers in industry (Peck, 1968).

The incoming Labour Government attempted to adopt a coordinating role with the Industrial Training Act of 1964. This established a Central Training Council of six employers and six trade unions and made provision for an Industrial Training Board (ITB) to manage a levy/grant system that in principle addressed at least one possible market failure – employers' 'free-riding' on others' investment in training. By 1966 13 ITBs covered 7.5 million workers – and were causing complaints about the administrative burdens on small firms. Training numbers in manufacturing increased by 15% between 1965 and 1969, and they increased faster in ITB industries.

Nonetheless, the 1968 Donovan Commission remained critical of deep-rooted restrictive practices governing training. Similarly, the Ministry of Labour maintained that both sides of industry were short-termist. The Institute of Personnel Management observed that in apprenticeship training there was a continuing conflict between standardisation and flexibility. There was inadequate liaison with further education. Typically, the quality of training was poor with, for example, little systematic feedback, and the period of apprenticeship lasted too long (Singer & Macdonald, 1970).

Aggregate data suggest that in historical perspective this pessimism was not wholly justified, though in absolute terms it probably was. The great post-war boom saw a break in trend with numbers of skilled manual workers increasing between 1951 and 1961. But the proportion of skilled to total manual workers fell at an accelerating rate over the two decades after 1951. By 1971 the ratio of skilled to total manual workers was at about the level achieved 40 years earlier.

Matthews et al (1982) contend that the numbers and proportion of apprentices increased over the war period. Given the expansion of engineering and other export industries while foreign competition was muted, this is not unexpected. The proportion of male school leavers aged 15 to 17 entering apprenticeships was about 35%.[24] Before the war a figure nearer 20% was likely. Relative to Germany the apprenticeship position looked less buoyant. Apprentices accounted for some 3% of British manufacturing employment in the 1960s, whereas in Germany the figure was 5% (Broadberry, 1997). This may well have contributed to the labour productivity gap between German and British manufacturing that by 1968 reached some 20 or 30%. More (1980) estimated that young trainees in manufacturing peaked in 1964 (240,000 apprentices and 149,000 other trainees, just 13% more than the total of apprentices for 1906).

Leaving aside apprenticeship, the quality of the labour force after 1945 increased markedly when measured by qualifications (Table II). Workers acquiring City and Guilds technician certificates increased by a factor of 14 between 1951 and 1973, and those gaining craft certificates increased 10 times. The upshot was perhaps a doubling of the contribution of technical education to the growth in labour quality to 0.2% in the period 1937-1973. The impact of formal education showed some tendency to decelerate on the other hand, from a growth of 0.4% per annum between 1937 and 1964 to 0.3% over the following decade.

German workers held more qualifications: according to 1978 data, 60% of German workers possessed vocational qualifications against half that percentage among British employees even on generous definitions (Prais, 1981). Some maintain this is merely German 'credentialism': an obsession with qualifications for their own sake (Locke, 1985), but the association with higher productivity suggests otherwise.

The oil price shocks ended the post-war boom and the British economy passed through an especially difficult decade. By 1979 sectors employing higher proportions of workers with professional and technical competence, and with higher earnings, tended to export more (Smith et al, 1982).[25] This was the reverse of the relationship found for the early twentieth century. Although reversal appeared to indicate an improvement in investment in human capital in the post-1945 period, there was now a rising tide of skill-intensive imports. Both the research and development and skill intensity of British imports increased faster than those of exports (Katrak, 1982). Again, since there was little relative price evidence of skill shortages, the inference must be, not that VET supply was becoming more inadequate for what was demanded but that market failure persisted and perhaps also that management failed to recognise the VET that should have been undertaken.

Postscript

A measure of the effectiveness of VET, British labour productivity, declined relative to the USA, France, Germany and Japan, from 1870 (Table IV). During the great boom after 1945, and more so in the 1980s and 1990s, Britain caught up the USA somewhat but failed to recover the 1913 relative position. Because for much of the post-1945 period comparisons were made only with West Germany, the lower productivity of Germany as a whole throughout the period may appear surprising. When manufacturing industry productivity alone is compared the results are very different. The US-British ratio remained around two and the German-British relationship oscillated around parity (Broadberry, 1997, ch. 2). International trade in comparable goods probably ensured that these ratios were broadly maintained, while changes in efficiency were reflected in the size of the sector. Gross domestic product (GDP), with the higher proportion of non-traded or non-competing goods, is therefore a better index of national performance.

Investment in human capital, either the quantity or the quality, is an obvious possible contributor to the slippage in GDP productivity (Broadberry, 1997, ch. 6). From the later 1970s the Government therefore entered the direct provision of VET for younger people.[26] By 1980 German manufacturing was apparently 40% more productive than British, with some 7% employed as apprentices. The British proportion was a little over 2%, falling to 1% at the end of the 1980s.

	1870	1913	1950	1973	1998
Britain	113	84	63	67	79
France	61	56	46	76	98
Germany	69	59	32	62	77
Japan	20	21	16	49	65

Table IV. Relative labour productivity: levels of GDP per hour worked 1870-1998 (US = 100) (source: Maddison, 2001, E9).

Prais (1981, 1995) and other researchers at the National Institute for Economic and Social Research established a link between the low qualifications of British workers in particular sectors and their low productivity. Prais also identified shortcomings in the state secondary and primary education systems in contrast to continental Europe (especially Switzerland). This kind of study has been very rare in its attempt to establish a line of causation between education/training and industrial performance. Comparison of hotel productivity in Britain and Germany found that in both countries the operative level (housemaids) held no qualifications. The big difference was at the supervisory level, the housekeeper. In Britain none had a qualification whereas in Germany a substantial proportion held a certificate. The practical difference this made was that in Germany supervisory staff used PCs for stock control and time planning for instance, whereas in Britain they did not. Consequently, British management were obliged to undertake these tasks, and were therefore left less or no time for the more strategic management issues of arranging block bookings and such like. Hence productivity was much lower in Britain. Similar behaviour and productivity was observed in other industries such as biscuit manufacture.

Statistical analysis reached similar conclusions. Prais's (1981) cross-section regressions demonstrated that intermediate qualifications were the most significant education variables in predicting performance of an industry by country. A corollary was that, comparing industries, as skill intensity rose, any British labour productivity advantage declined (Davies & Caves, 1987).

While these years in some respects, such as the decline of apprenticeship almost to extinction, may differ from earlier periods, the shortfall in human capital formation seems to be part and parcel of a bigger picture of British VET history. With the pervasion of market forces and international competition from the later nineteenth century if not earlier, market failures in this field became serious but were not remedied by state action.

Conclusion

Although it may not be true, the view underpinning the British style of VET is entirely plausible; that users of VET, employers, are in the best position to know the most appropriate content and methods of communication of VET. What is not so obvious is that employers will also provide the best possible coordination between themselves and employees in the provision of VET. No employer will 'free-ride' on another's efforts to provide general VET for instance; there will be no 'market failures', such as under-investment in firm-specific VET because of inadequate general VET. Often employers are successful because they are lucky and risk takers. But luck does not usually persist when the environment changes. Under- or inappropriately educated and trained employers must not, as it seems they will, tend to favour workforces like themselves.

It is not enough to note that for more than a century the Germans operated a coherent and all-embracing VET system and to conclude that because the British did not, their arrangements must have been inadequate. Additional evidence is needed of clear British (or German) shortcomings in supply or consequent deficiencies in economic performance. Here lies the challenge of an analytical history of VET. Any long-run study of British VET is hampered by the difficulty of measuring how much VET was undertaken. The next problem is establishing how effective was that VET. Then there remains the task of explaining why the particular supply configurations were adopted.

A weakness of the British style of market-driven VET was the dependence on stable output and employment conditions for effectiveness. With deep and long cycles of boom and slump the system was likely to break down because of the difficulty of long-term planning. Judging by the aggregate data, this seems to have occurred in the years between the world wars and perhaps after the oil shocks of the 1970s. By contrast the great post-war boom after 1945 appears to have been associated with a massive expansion of VET – certainly as measured by City and Guilds qualifications.

There was no shortage of initiatives in VET. The question is whether they were the right type and available in sufficient volume. Since Britain slipped relative to its competitors in the later nineteenth and twentieth centuries, under-investment in labour skills is an obvious suspect. Aggregate tests are consistent with a British comparative advantage in less skill-intensive products. Yet continuing prosperity and substantial economic growth in Britain must depend on specialisation in skill-intensive activities. The greatest gap between American and British labour productivity occurred in sectors where skill differences were greatest. This contribution to comparative advantage is clinching evidence for a VET failure. The detailed industry-level research of Prais and collaborators for the 1980s and later provides the closest connections that suggest inadequate supplies and quality of VET. The conclusion here is that the preceding century showed the same shortcoming in manufacturing industry.[27]

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Notes

[1] The only rate of return to education estimate for Britain before the contemporary period appears to be the returns to literacy estimated by Mitch (1984):

	Males (%)	Females (%)
1839-43	9.0-42.5	Under 1-16.5
1869-73	5.0-20.5	Under 1-18.0

All these rate of return estimates depend upon assumptions about what would have happened. Typically, wage differentials of literates over illiterates, or trained over untrained, provide the estimate of the returns on the assumption that if the untrained had been trained they would have received the wages that the trained actually received.

[2] What counts as a general or a specific skill depends on the industrial and locational context (Prais, 1995).

[3] These sources of market failure go some way to addressing Sidney Pollard's (1989, p. 138) concern: 'What is lacking is an adequate theory ... to lay bare why years spent at school or college should improve the economic performance of a nation ... .'

[4] This coercive legislation provided for regulation by Justices of the Peace of wages and employment. Qualified craftsmen might be compelled to work at their craft, women up to the age of 40 could be compelled to take service and men not otherwise employed might be required to work in agriculture (Clapham, 1966, p. 213). Statutory definitions of skilled trades were influenced by whether a guild existed; brickmakers, millers and domestic weavers and spinners were defined as unskilled for instance (Clapham, 1966, pp. 256, 240).

[5] The division of labour in watch and clock making was extreme (Landes, 1998, p. 242). The area between Prescott and Liverpool was dotted with cottages specialised in making individual components – these will not have required lengthy apprenticeships. Within the workshop, where assembly took place, there was plenty of rough menial work for apprentices – stoking fires, beating plates, cleaning metal – which could equally well be undertaken by any unskilled workers. The master craftsman planned, ordered components,

supervised assembly and assured quality. Whether a novice could do this must be doubted, whatever Smith contended.

[6] Although Adam Smith denied that formal apprenticeship was needed for specific training in the eighteenth century, he recognised complementarities between general and specific training or education and the likelihood of market failure in the provision of the first of these. He proposed that general education, including some geometry and mechanics, should be provided, subsidised by the state, to 'the labouring classes' as an offset to the stultifying effect of highly specialised jobs. Geometry and mechanics would often prove useful in almost all trades (Smith, 1904, vol. II, pp. 302-303). In addition prizes could be given to encourage and reward excellence (as did the Society of Arts by the time Smith was writing, see below). More radical, but entirely consistent with Smith's outcome-based approach, was the proposal that before a person could set up in a trade they should pass an exam.

[7] Building workers supplied a product that was not traded across regional or national boundaries. When transport costs – including trade controls, the disruptions of war and banditry – were sufficiently low, workers in other, 'traded goods' industries supplied products the prices of which could be determined by conditions independent of local supply and demand conditions. In such cases skill differentials also could be independent of the 'local' VET system. However, until the nineteenth century it seems unlikely that this effect would have been significant.

[8] If we suppose that for seven years the apprentice forewent 70% of what could be earned as a labourer and then for 30 years earned 50% more, the internal rate of return was 18%. Forgoing only 50% raised the return to 22%.

[9] The Society itself was an imitation of the Dublin Society for improving Husbandry, Manufactures and other Useful Arts, which had been established in 1731.

[10] The middle classes were expected to pay fees to finance their training.

[11] In turn the 1871 Devonshire Commission had been triggered by the poor showing of British design and technology at the 1867 Paris Exhibition.

[12] City and Guilds took over technological exams formerly conducted by the Society of Arts.

[13] The 1902 Education Act repealed the Act of 1889 and technical instruction was included in higher education provided by local authorities and financed by whisky money.

[14] At least for factory employees. Self-employed craftsmen were more willing to try to conquer fatigue because it seemed more clearly in their interests. Personal communication from Michael Sanderson, 2 November 2002, based on an essay on Norwich education.

[15] Owens College was reformed in 1873, Leeds was founded in 1874, Sheffield in 1879, Birmingham in 1880 and Liverpool in 1881. In smaller towns there was Southampton in 1862, Exeter in 1865, Newcastle in 1871, Bristol in 1876, Nottingham in 1881 and Reading in 1893.

[16] Of course difficulties stemmed from the collapse of demand but the rise of the motor ship constructed elsewhere than in Britain suggested nonetheless that there was entrepreneurial failure in shipbuilding (Henning & Trace, 1975). Even when this industry's shortcomings had been amply demonstrated, employers' attitudes did not change. The Government acquired the Jordanvale shipyard in Glasgow during 1942 for training purposes but could not recruit. The industry continued to prefer exclusively 'on the job' training.

[17] It should also be noted that comparisons with other countries do not necessarily identify socially optimum levels of investment.

[18] For Kerschensteiner's philosophy see Winch (2004).

[19] Roderick & Stephens (1972) see British nineteenth-century VET as deficient because 'unfortunately at an early stage it was decided that what Britain lacked was an efficient system for the industrial masses and a science based training for artisans', and the needs of management were supposedly ignored.

[20] There were 36 such residential schools with 2822 children in 1858 (Curtis, 1967, p. 303).

[21] Cf. Matthews et al (1982), who state that in 1935 there were fewer restrictive practices than previously. Admittedly engineering is only one sector but it is a key exhibit of apprenticeship.

[22] Matthews et al (1982) add the caveat that their numbers could be out by 50% or more.

[23] Human capital is measured by earnings. If all labour only possessed general skills then an industry's wage bill per head ('earnings') would reflect the skill composition of the labour force. Wages of employees with general skills are determined by the productivity of the economy as a whole. Differences in average earnings levels between industries would reflect variations in the composition of the labour force. Higher average earnings then were a consequence of a greater proportion of employees with substantial human capital.

By contrast, industry-specific skills in principle will be rewarded by higher wages when associated with higher industry productivity, at least in the short run. How long that period is depends upon entry barriers to those acquiring the skills, and the length of training; in summary upon the relevant components of the VET system. But since changes in industry productivity were not associated with changes in wages in these years, the evidence favours general rather than industry-specific skills.

[24] They observe that the official figures in the *Ministry of Labour Gazette* were probably too high.

[25] Analysis similar to that of Crafts & Thomas (1986) for the late 1940s confirmed that the relation between exports and 'skill' had changed immediately after the end of the war. This might prompt concerns that the negative relationship in 1935 was due to the pattern of trade protection that Britain then faced and that the new configuration stemmed from the excess demand for British goods in a war-damaged world under reconstruction.

[26] Consistent with the market 'working' at one level, earnings and employment benefited from degrees and private sector apprenticeship, but government schemes typically conferred no advantages on people up to 23 years old (Dolton et al, 2001).

[27] No consideration has been given in this article to services, where there are prima facie grounds for expecting less VET market failure than in industry. Under-investment in VET is likely to have stemmed from, among other reasons, lack of family resources. To the extent that the middle classes favoured the professions and other services over industry, their more comfortable financial positions would have allowed families to invest more in their children's VET, reducing the shortfall relative to that in industry.

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APPENDIX

VET Chronology 1563-1964

1563	Statute of Artificers
1754	Society of Arts of London 'for the encouragement of arts manufactures and commerce'
1799	Dr George Birkbeck lectures on Natural Philosophy at University of Glasgow
1802	Factory Act regulating hours of work of 'factory apprentices' and specifying the teaching of reading, writing and arithmetic
1814	Abolition of the requirement of serving an apprenticeship before practising a trade
1823	London and Glasgow Mechanics Institutes founded
1824	Manchester Mechanics Institute
1836	House of Commons votes £1500 for Normal School of Design
1845	Royal College of Chemistry founded
1851	Great Exhibition; government School of Mines and Science founded
1852	Department of Practical Art of the Board of Trade (includes Science from 1853)
1855	Society of Arts introduces exams
1867	Paris Exhibition
1878	London City and Guilds Institute
1883	Finsbury Technical College
1889	Technical Instruction Act
1902	Education Act reorganised science schools to become secondary schools
1905	Board of Education Grants given for junior technical schools
1921	Institute of Mechanical Engineers introduces Ordinary National Certificate and Higher National Certificate
1964	Industrial Training Act