The History of Education Institutions in Developed Countries has Lessons for the Reform of the System of Higher Education in Africa

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Abstract

Universities in African countries are widely considered to be a colonial relic that is in desperate need of reform. This article argues that useful lessons for such a reform may be drawn from the developed countries' own education policy debates and history, especially as those relate to development. In that history, innovation-oriented industrial employers that advocate adjustment and institutional change at universities often clash with the vested interests of the educated elite and its desire to buttress its privileged social position with restrictions on entry into various professions and occupations. Any reform proposals should be cognisant of 'hidden' prestige projects masked in the rhetoric of the public good. It is also argued that in developed countries, schools and intermediate technical institutions were historically more important than the universities at early stages of development and continued as useful complements to the stock of the technically educated in later stages of development. It is therefore suggested that the proper basis for university reform in Africa is to ask first whether the range and quality of educational institutions is appropriate to the current state of private sector activity. Such an enquiry may find, for example, that improving technical schooling should be a priority in any educational reform of a country that is in an early stage of industrial development.

1 Responsiveness of higher education to practical needs: Lessons from the British debate

In the 1980s in Britain two books by historians were published that supported the thesis that there had been a form of 'institutional failure' in British higher education. Corelli Barnett argued that British technical education was generally inferior to the German and especially that Oxford University had failed at the turn of the nineteenth century to lead in the provision of engineering and science degrees as they became useful to industry [1]. As the title of Norman Wiener's book 'English Culture and the Decline of the Industrial Spirit' suggests, Wiener proposed that English culture in general lost interest in industrial issues and specifically that the universities turned away from practical education [2]. If universities were able to do this in the developed countries, it might support those who argue that the colonial legacy of universities in anglophone Africa is a poor one.

However, the subsequent debate over the historical role of the universities in Britain provides a different picture. According to the historian Michael Sanderson the common belief in the 1980s was that British universities were not only 'out of touch with industry but actual breeding grounds of anti-business snobbery... overemphasizing the arts and denigrating science and technology' but he believed that this was '...nonsense. It was true of Oxford at the end of the 19th century but it was not true of the civics [the British civic universities such as Sheffield, Leeds and Birmingham Universities]and has certainly not been true of universities in contemporary times' [3: 103].

The mistake is to think that the most prestigious universities should perform all the functions that a modern university system provides for the private sector. The 'civic' universities that Sanderson refers to in the quote above were founded by successful British entrepreneurs in such industrial cities as Liverpool, Sheffield and Birmingham from the turn of the 19th century. Unlike Oxford and Cambridge their role was not to educate the national governing class, but to provide new forms of vocational education for their communities. Sanderson comments on those that prospered that, 'The conclusion was clear. Those civic universities located in industrial regions flourished because they gained the support of the business classes and were conducive to their needs for locally relevant human capital. Those that did not, did not' [3: 93]. Given the source of their funding, the research instituted by these universities was also directed to very practical ends; Sanderson argues that between 1880 and 1914 and before the widespread institution of corporate R&D departments, the civic universities were crucial providers of research of great practical significance to local industry [3:99].

The 'bottom-up' source of funding for the English civic universities in this period is a significant feature: after-World War II, the British state took over the funding of these universities through the tool of the University Grants Committee (UGC). This is how it became possible that the output gap evident in the 1900-1910 period in terms of number of qualified graduate scientists and engineers between Britain and Germany (see below for an analysis) could be reversed so that by 1964, 'Britain had a larger stock of science graduates than any other Western European country and employs a larger proportion of them in industry.... British industry, far from being short of scientists is more richly endowed with them than is any country except the USA....' [4:55]. The subsequent performance of the British manufacturing industry should cast doubt on popular beliefs that 'more' scientists are always useful or necessary for development; Britain probably came to educate too many by the mid-1960s. Generous state-funding has the danger that it will pro-

This article is a development of material from a chapter in my book on the management of development, Howells, J. (2005) [19]. The Management of Technology and Innovation: Technology and the Shaping of the Market Economy. London and New York, Sage.

mote the over-supply of educated professionals who will consequently experience falling salaries and poor career prospects – as the scholar Terence Kealey[1] - argues has been the experience of British scientists during the post-WW II period [5]. If the policy problem is understood to be how to keep educational institutions responsive to actual demand for education and research it will always be dangerous for the state to fully substitute for private sources of funding for higher educational institutions.

2 The Significance of dedicated Elite Technical Education Institutions is less than it first Appears.

An element of Barnett's critique of British higher technical education was that there was no English equivalent to the dedicated German engineering schools, the Technische Hochschule and it is tempting to believe that the high quality and higher numbers of graduates from these institutions represent a better form of practical education than that provided by the English civic universities of the same period. Edgerton quotes figures for graduating engineers in the period 1900-1910 as 1000 per year in Germany compared to 400 per year in Britain. However when adjusted for the 40% greater German population in this period it is not quite as impressive [4: 53]. As for research, Pollard gives figures for 1914 of 250 teachers and 400 students in research bearing on industry in Britain against 673 teachers and 3000 students in Germany [6: 195]. Here is another quantitative advantage in favour of Germany, but Pollard notes that the German dye industry with its exceptional demand for industrial research chemists accounts for almost all of the difference. The British 'failure' then was restricted to this 'missed opportunity' earlier in the nineteenth century when the dye industry in Germany was establishing itself and benefiting from German universities' early preparedness to introduce chemistry departments and doctoral programmes in chemistry. This they did largely because of the prestige chemistry attracted as a result of the spectacular practical applications demonstrated by the German chemist Leibig [6:158].

Apparent clear quantitative evidence in favour of German institutions' superior ability to produce higher numbers of qualified scientists and engineers (hereafter QSEs) and the existence of distinctive German institutions (the Technische Hochschule), once adjusted for population and special cases (the dye industry and its special demand for university-educated chemists) suggest that British and German institutional supply of higher technical manpower was more similar than it first appeared in that both supplied appropriate numbers of QSEs for experienced industrial demand. The general case that British universities 'failed' to supply QSEs in either numbers or quality given prevailing industrial demand cannot be sustained; indeed, Sanderson and others join Barnett in suggesting that if there was a problem it was with the large number of British employers who failed to experiment with the employment of QSEs. Divall has a particularly convincing institutional explanation in 'pupillage' for a degree of British employer tardiness in demanding the institution of universities. The best employers were paid to train the sons of wealthy middle class families to become engineers and this source of income was valued by them and according to Divall, blunted their motivation to organise an external standard source of higher technical training in the form of universities [7].

France provides another example of a distinctive institutional arrangement that one might be tempted to think highly significant in its effect on industrial practice in the two elite Napoleon-era higher technical institutions, the Ecole Superieure and Ecole Centrale. With their restrictive academic merit basis for student recruitment and their position at the top of the French academic status hierarchy, they appear to represent today the realisation in another country of the one-time ambitions of the nineteenth century German 'academic engineer' interest (see next section). However, as these institutions proved insufficient to meet mid-nineteenth century industrial demands for a more practical type of engineer, the French state responded with the founding of the Ecole National Superieure des Arts et Metiers (ENSAM). Then after the Second World War the state founded the 'petites écoles' in an effort to increase the supply of engineers and help modernise French industry [8: 136]. So the critic might be right that these institutions had a narrow curriculum and were over-concerned with educating an elite, but for our purpose this would be besides the point as other institutions did the job of supplying sufficient number and range of technical labour to meet industry needs, as happened in Prussia/Germany. France Britain and Germany illustrate different historical patterns in technical education institutional innovation, but in all three countries what appear as outstanding differences in institutional provision are less outstanding on closer inspection. The full set of technical institutions in each country arguably fills the obvious gaps with respect to gross industrial demand for technical expertise, whether in terms of practicality or number, or 'level' of engineers. The reason is that each state was willing to respond to clear industrial demands for new forms of technical education provision.

There is arguably a policy problem in the period before an employer interest has developed sufficient strength to articulate its technical education needs. Relevant here are the Anglo-German historian Pollard's rather caustic observations on the state of Prussian, then German universities as they developed from the early nineteenth century, when 'the position of Germany appears to have been not unlike that of the less developed countries today: a shortage of technicians coincided with an over-supply of highly educated Arts graduates crowding round the high-prestige, highly paid traditional State jobs'[6: 146]. At the secondary level of education the German Kaiser admired the English public school system and copied such schools' typical classics curriculum into the German Gymnasium school, so that it became a 'training ground for the learned and the elite, and it did indeed survive into the modern era as a fortress of privilege and exclusiveness.' [6: 149]. Those engaged in commerce established 'Realschulen' in despair at the hopeless curricula of the Gymnasien [6: 150] and this type of school also survives today. In schooling as in higher technical education then, the distinct German institutions of today were founded in despair of reforming the inherited classic curriculum and elite-oriented institutions.

If it is accepted that the German story of development is not about spectacular out-production of qualitatively superior technical personnel from somehow superior higher education institutions, then the more interesting German story is how a practical engineering curriculum was instituted and developed *despite* the constant temptation to design 'technical' education on the model of the liberal arts education which fitted students for the higher prestige government posts.

3 Technical Education for Social Prestige or for Practical Utility – Lessons from German History

Since the universities would not teach engineering, by the mid-19th century, German engineers were educated in technical schools 'separate but unequal' to the universities in prestige whether their careers lay in industry or state service [9: 79]. An essential problem of early technical education policy is illustrated when both Pollard and Gispen comment that German industry being technologically backward at this time, an industrial engineering career had relatively low prestige as did engineers in general. Raising its prestige in order to attract better students would seem to be a good idea, but the danger of misdirected reform effort is illustrated by Gispen's story of how Grashof (head of the VDI, the German professional engineering organisation) in 1864 made an effort to raise the status of engineers to the level of the established professions and civil servants *through imitation of the curricula* associated with these high-status professions. Grashof's 'vision' of engineering reform through the new, high prestige institution of the technische Hochschule is worth citing from Gispen's work;

'Workshops and laboratories were to be dismantled as much as possible because they were unworthy of the pure science that engineering education was to become. On the other hand, the technische Hochschule would incorporate generally cultivating disciplines such as languages, history, literature, economics and aesthetics in its curriculum, because "familiarity with them guarantees a higher cultivation of the mind, which corresponds to that social rank for which the higher technical institute is to give the final preparation" [9: 79].

German governments enacted it wherever the technische Hochschulen were established, but as German industry continued to develop and grow, by 1880 the result was a rising level of industry criticism of the impractical technische Hochschule graduate, unable to adapt to industrial life and tending to irrelevant speculative work [9]. The VDI began a successful campaign for the (re)-introduction of a compulsory year of workshop training in the technische Hoschschule (Gispen 1989). The detail of what became a trend towards a more industrially-useful engineering education is significant; the widespread adoption of laboratories for empirical research and training, the diffusion of compulsory drafting and design courses and the fascinating 'anti-mathematician' movement, a deliberate attempt to expel complex techniques such as calculus wherever it was possible to use simpler graphical methods [9]. The dramatic transformation of the curriculum is demonstrated by the change in laboratory and drafting hours in the Berlin Technische Hochschule: it rose from 35% of instruction time in 1881-82 to over 70% in 1898-9 [9]. Many of the liberal arts subjects were lost.

Yet as a result of the successful changes in support of the formation of useful engineers, the 'elite' status of the technische Hochschule graduate now depended only on the high academic standards for entry, the four-year fixed period of instruction and the restricted number of students admitted. These restrictions on supply enabled the rise of a fascinating private educational challenge to the intended 'engineering elite', in the form of 'graduates' from a new kind of non-academic engineering school. These private forerunners of today's Fachhochschulen were initially founded to meet strong demand from employers and workers and were widely understood to be necessary to supplement the meagre numbers graduating from Technische Hochschule. Even the VDI supported the rise of the non-academic engineers, because in their ideal world the graduates of such schools would be subordinate to the graduates of the Technische Hochschulen and would release the elite from the burden of the more routine and tedious forms of technical work. Unfortunately for the would-be elite, by the First World War, 'the opposite happened' as employers promoted the upstart workplace and private school-educated technical employees over the technische Hochschule graduates [9: 160]. Employers argued that the individual abilities of non-academic engineers were underestimated by the academics.

The professional engineering 'status' crisis of unstructured competition between the different technical schools and colleges led the government to create a 'Committee on Technical Education', which rationalised and standardised the competing and overlapping institutions on a national scale [9: 211]. Within this committee the academic engineering elite sought to buttress its status and privileges through devices such as legal restrictions on the forms of employment allowed to those promoted from the shop floor. However the large employers dominated the committee and they defended the non-academic engineering schools and consolidated the workplace-based route into engineering and management to parallel the 'graduate' route represented by the technische Hochschulen.

The German 'dual system' is widely admired, but Wolf reports that the attempts by other developed countries including the US and South Korea to copy it have failed [10: 158]. It may be surmised that, although today it is the regulated order of the German technical qualifications that seem most impressive, in Gispen's account that order was only the prompted-formalisation of the preceding period of excessive supply and unchecked competition between different technical qualifications. It was from that chaotic period that the employers gained confidence in the effective utility of the Fachhochschule-enabled route to engineering status for the shop-floor skilled workers. The difficulty of imitation today of Germany's 'ordered' system may be explained by the absence elsewhere of the unique historical cir-

cumstances of high demand combined with multiple sources of supply of engineering skills that preceded the formalisation of the German workplace-based route to engineering status.

There are many other examples of prestige or status issues threatening to limit the effectiveness of higher technical workers in the work place. The British institution of pupillage has been mentioned above. In the Finniston proposals for engineering reform in early 1980s Britain, there was a proposal to limit access to certain engineering occupations to accredited engineers – but as in the German story, employers blocked it [11] [12]. A more ambiguous example is Divall's history of British higher engineering education in which he describes how a consensus formed between university engineering academics and a small group of enthusiastic employers in the 1940s to change engineering curricula in the direction of 'engineering science': the theoretical analysis of the physical aspects of engineering [7: 94]. Divall shows that the new theoretical curriculum became dominant in British universities post-WWII and through the 1970s [13]. Many British civic universities dropped 'practical' activities such as workshop training. Divall points out that the change suited academic engineers' desire to pursue research in order to establish parity of prestige with respect to other university academics. It also suited the R&D intensive employers in aeronautical engineering and electrical goods who had promoted the change – their engineers would work within R&D. What it did not do was to enable graduate engineers to be quickly and effectively deployed in the production environment in the private sector when this was arguably the greater need of British industry in the post-WWII period, as British production dropped behind world class standards.

4 Chartered professional bodies as limitation of the flexibility of higher technical education curricula

Some time ago Child et al. argued that there is a general tendency in Britain for those engaged in specialised work functions to aspire towards status-seeking 'professional' objectives at the expense of practical attainment within the firm [14]. A recent comparative study of engineer and architect education between Britain and Germany described what might be understood as one of the roots of this syndrome: British higher education and training is generally under the control of professions granted a charter by the institution of the Privy Council [15]. English patents were once granted by the Privy Council [16] and a charter may similarly be regarded as the award of the exclusive right to a single body, in this case to determine the content of education and training for professional accreditation.

University curricula must meet the demands of the professional bodies if graduating students are also to gain professional accreditation. For Clarke and Hermann the monopoly of the charter contributes to a destructive fragmentation of higher technical education and a destructive perpetuation of the divide between higher and lower technical education, for they find 'seemingly uncrossable institutional divides, in particular between professionals and operatives' in the technical qualifications of the British construction industry when compared to its German counterpart [15: 128]. Technical qualifications seem to reinforce a class divide between those who work on the shopfloor of construction and those who obtain a professionally-accredited higher education. In their words,

> '...the exclusive privileges granted through the charters have created deep divisions and fragmentation in built environment professions. There are altogether seven main chartered bodies – the RIBA [Royal Institute of British Architects], the Institution of Civil Engineers (ICE) , the Institution of Structural Engineers (IstructE), the Royal Institute of Chartered Surveyors (RICS), the Chartered Institute of Building (CIOB), the Chartered Institute of Building Service Engineers (CIBSE) and the Royal Town Planning Institute (RTPI) and a myriad of other professional organizations' [15: 135].

In contrast there are only two significant German construction industry professions, architects and engineers [15: 143]. The multiple British chartered professional bodies with their jealously guarded exclusive rights over fragments of technical knowledge limit the universities' ability to adapt teaching curricula to practice, whether to pioneer best practice, to remove obsolescent practice or to reduce duplication between curricula. The broader significance of this example is that it may be a mistake to assume that reform should be directed at universities alone. Universities' relations to professional institutions matters and may have to be considered in any reform proposal.

Conclusions

If we return to consider the original question, given the diversity amongst university-level education, unless one thought that the goal of the colonial power was a benevolent wish to educate indigenous talent to enable self-directed and therefore ultimately independent development, one ought to be surprised if the colonial universities had managed to contribute towards this objective. A better question to ask is whether the range and number of HE institutions match the range of purposes and demand for higher educated labour that society and economy have. There may be a role for a few universities specialising in the liberal education of a governing elite, but where are the civic and technical universities to provide the technical education of a developer-class of entrepreneurs and how do they relate to the schooling system?

There is no space here to review the many disastrous state-initiated technology development 'missions' in developed countries that share many of the organisational characteristics of the top-down 'development' projects in African countries [17]. As Aerni argues, it is the failure of many well-funded projects to meet effective social and economic needs that is most persuasive in favouring an entrepreneurial and 'bottom-up' approach to development. This after all, is how developed countries achieved development; their large firms were once initiated by entrepreneurs in an earlier stage of their history as economic powers and it has long been shown that continuing entrepre-

neurial activity is an essential feature of a developed economy (for example in [18].

Pollard [6] judges that at early critical junctures it was the will of the German state to promote effective practical reform that was critical in shifting institutions and curricula in that country. Reform is always difficult to conceive well and carry out, but resort to developed countries' educational histories can indicate some of the practical difficulties in conceiving and executing reform in African universities today.

Endnote

I. Kealey's book is a rare attempt to present the case against state funding of science. Following John Stuart Mill's maxim from 'On Liberty', as such it deserves to be read more widely and carefully than the many tracts promoting the value of state-funded science and state-educated scientists, especially if one wishes to test the robustness of the pro-state support view.

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12: 00 Networking and Lunch

14:00 Finance and Investment in Technology Development
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15:00 Coffee Break and networking

16:00 Entrepreneurship and Technology Commercialization
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17:30 Presentation of Prizes: Dr. Ernst Thomke and Minister, STVT

18:00 Vote of thanks: Professor Oliver Saasa

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The challenge

One of major challenges facing Africa is unemployment and an institutional setting that discourages entrepreneurs in the informal sector to grow and move into the formal sector. As a consequence, many young and talented Africans migrate to Europe, North American and other developed regions of the world in search of employment opportunities. This undermines the development of Africa and presents many challenges for developed countries, some of which respond by erecting ever growing barriers. Efforts to improve health care or eradicate hunger and poverty, among others, are intricately linked to the ability of countries to provide opportunities to their citizens to provide quality products and services and contribute to national revenues

ATDF believes that one way of achieving such a goal is to help individuals turn their ideas, research outputs and concepts into viable enterprises, products and services. This would provide employment, generate revenues and, in the process, empower communities to meet their needs. However, there are two major gaps that hinder individual and teams to turn their ideas into commercially viable products and services in Africa:

1. Financial and support gap: In developed countries, government grants, public incubators and science parks and venture capital firms often fill in this gap.
2. Skills and knowledge gap: In developed countries, technology development and transfer institutions and associations help firms learn, adapt and acquire emerging technologies.

Taken together, aspiring entrepreneurs face a steep learning curve as they have to be profitable within their first 2-3 months or they will not survive. Globally, start-up firms need up to 5 years to become profitable. It explains why many individuals are trapped in the informal sector for a long period of time (accounting for over 70% of the total employment in some African countries). This in turn makes service delivery, quality control and economic planning almost impossible.

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ATDF Entrepreneurship Hub is an independent corporate unit of Africa Technology Development Forum (ATDF) based in Lusaka, Zambia. The primary goal of the Hub is to promote entrepreneurship and innovation, to facilitate development of businesses, products and services as a way of creating wealth and jobs and reducing poverty. ATDF Entrepreneurship Hub offers five main products:

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and start-up firms seeking administrative, technical and financial support are highly encouraged. In exceptional cases, the Hub may invest up to $100,000 or more than 30% of the firm's share capital. Selected individuals, teams and firms will have to be based in Zambia.

2 Entrepreneurship Challenge Award 2007 (up to $5000)!

This investment is designed to help young people (below the age of 40) to refine their business concepts, conduct market research and interact with seasoned entrepreneurs. In addition to the modest funding, selected entrepreneurs will also access technical and commercial services through the ATDF network of entrepreneurs and R&D centres. Successful projects may apply for Entrepreneurship Support Investment.

3 Business incubation and commercialization.

Often, firms and R&D centres may wish to commercialize or spin-off a unit that is no longer considered part of its core business, could become self-sustaining or is loss making. Rather than shutting these units down, The Hub could bring in investment, management, technology and leadership to facilitate their growth and become viable firms.

4 Business Intelligence Support

One of the challenges African firms and institutions face are the limited sources of market, technology, investment and business information. The Hub will collect, synthesise and disseminate emerging trends in the domestic and external markets. It will collect information that helps firms to strategically manage their intellectual assets, seek partnerships, identify emerging markets and regulations.

In addition to a small business and technology relevant library, it will also run a depository of creative, marketable and thoughtful business ideas. Many individuals with brilliant ideas may not be talented business managers, have difficulties in accessing technical and financial institutions or lack the right platform to launch their business. The depository will assist them by serving as a meeting point of potential partners or the sieve for refining and recombination of business ideas.

5 Entrepreneurship Course

The Entrepreneurship course is designed to stimulate entrepreneurial creativity and innovation, facilitate commercialization of research output and encourage development of private and public enterprises to create jobs and reduce poverty. It shall enable entrepreneurs to quickly spot and evaluate business opportunities, solve entrepreneurial challenges and enhance the entrepreneurial drive, networks, resources and skills of candidates to communicate and implement business ventures effectively.