

CONCLUSION

Science and industrial development: lessons from Britain's imperial past

For many places seeking to raise living standards after 1945, economic development came to mean industrialisation. By the 1950s, economists such as Raul Prebisch, Hans Singer and Paul Baran were advancing models of industrial development that promoted the necessity of restricting imports to allow new domestic industries to flourish. The 1950s also saw the rise of modernisation theory in which industrial revolution was central to the process of emerging as a modern state. This book has been concerned with development visions that were circulating before economists such as Prebisch and W. W. Rostow published their ideas. It has aimed to revise the usual story in which Britain resisted economic diversification in its Caribbean colonies and instead has shown that a number of visions of Caribbean industrialisation were proposed after 1942 that can be described as types of industrialisation-by-invitation, in a stronger or weaker form. These ideas, promoted by the British government, Arthur Lewis and the Caribbean Commission, differed so that no unified theory of development can be said to have informed plans for the Caribbean between 1940 and 1960. This account has explored the variety in proposals to encourage economic diversification that were expounded. The aim has been to demonstrate how different economic and political priorities worked to produce contrasting visions of industrial development, and explain in particular the emphasis on scientific research by the Colonial Office in London.

Amongst the various paths to industrialisation that were promoted to Caribbean legislatures after 1940, the least complete and coherent programme of economic diversification was that promoted by Britain. Officials in London favoured limited incentives from colonial governments for business and, in general, wished for minimal

disturbance to market forces. Britain would not assume large financial risk in the process of establishing new business across the British Caribbean and it advised colonial governments to act similarly. In addition, officials did not believe that it was the job of planners appointed to an official body to determine the nature of new industry. The role of metropolitan government was to provide the money needed for the development of infrastructure as the necessary context for industrial development, and the provision of useful information. This included economic and business advice and also the funding of scientific research with the goal of opening up new opportunities for manufacturers to exploit tropical products.

The Colonial Office solution to the issue of how to facilitate industrial development in the British Caribbean was unique in giving a role to scientific research. Funds from the CDW Acts were used to sponsor laboratory investigations into cane sugar, with the aim of generating power alcohols, plastics and drugs that could be commercially produced. This was an ambitious plan in which the transformation of sugar into an industrial raw material would supposedly allow the British West Indies to escape the trap of being producers of low-value foodstuffs in oversupply. It was also a vision that confirmed the liberal values of the Economics Department of the Colonial Office. The Colonial Office committed funds for the scientific study of cane sugar on the basis that firms would take up the production of sugar-based compounds if the right sort of information was made available to them. This was a carefully delimited type of state intervention; government would assume responsibility for generating knowledge, but how that information was utilised was left up to business. This was an intervention intended to stimulate the creation of new industry in the Caribbean or encourage firms in the UK to take up new products that supposedly did not disturb the natural play of market forces. Decisions about the development of new products based on discoveries in state-funded laboratories resided with business. Firms would also provide the finance necessary to undertake this task. While officials were happy to support state-funded scientific research, they rejected the suggestion of a Caribbean development bank or regional development corporation with planning functions. For officials at the Colonial Office, the limited form of state intervention represented by scientific research was a relatively inexpensive and politically acceptable mode of state action to stimulate industrial development.

Sugar research was part of a wider commitment to funding scientific research in order to provide knowledge for colonial development after 1940. It is a commonplace claim in much scholarship on science and development to assert that the high profile given to scientists and

technological solutions after 1945 resulted from an unquestioning faith in the superior nature of American and European science and technology, possibly fuelled by Allied success in the war and the emergence of technological wonder weapons such as penicillin, DDT and the atom bomb. In contrast to such claims, Britain's enthusiasm for investment in research as an activity essential for successful and effective colonial development cannot be reduced to some ill-defined enthusiasm for science in the 'atomic age'. The expansion of research in the Colonial Empire is better understood as one step in the more general rise of state-funded research over the first half of the twentieth century in Britain. Officials at the Colonial Office were not the first to formulate a relationship between scientific research and economic growth. The idea that the state should assume some responsibility for the production of knowledge relevant to issues of national importance – agriculture, health, industry and military matters – underpinned the creation and extension of government departments and laboratories that dealt with work in the civil and military spheres at home. It led to the formation of the research councils, beginning with the DSIR in 1916 and then continuing with the creation of the MRC in 1920 and ARC in 1933. It was the research council system that provided the model for colonial research after 1940. In the case of research into tropical products by the CPRC, the methods and rhetoric employed by the DSIR were of most importance. The CPRC, the DSIR and also the Development Commission and Empire Marketing Board offered something significant to politicians and officials concerned with economic policy, apart from the promise of useful facts. The creation of these agencies was facilitated by their political utility as these bodies provided a method of stimulating economic growth and development that was could be promoted as useful and effective, a demonstration of the willingness of government to take action, without being overly contentious or divisive. A commitment to funding scientific research was not associated with any party political or ideological position in the way that other more controversial types of government action to encourage economic and social change, such as the use of tariffs, subsidies or state-run companies and development banks, could be. In the vision of colonial development that emerged after 1940, scientific research could be invoked both for its compatibility with laissez-faire economics and also as the first stage of planning. The fact that scientific research could be associated with such a range of latent functions helps explain how agreement could be forged on the need for government to support this activity. Scientific research was a method of state intervention in economic matters around which political consensus could be reached. Research is not so much apolitical, but rather an activity with such

a range of meanings and implications that it is flexible enough to be compatible with many political positions or requirements.

If the commitment of state funds to scientific research through the DSIR or CPRC had political expediency then this was because of the way that activity was characterised. Both bodies used the expression 'fundamental research' to describe the work they sponsored and this was often defined as enquiries into underlying phenomena or basic chemical reactions. The general nature of this work was important as it indicated that public money would advance a field to the benefit of a particular sector of industry and was not going to be spent on problems that were so practical they were close to the everyday problems of production, or so specific they concerned only individual manufacturers. It was important to avoid any accusation that state agencies allocated money that merely ended up lining the pockets of businessmen or favoured one firm over another. The meanings afforded to fundamental research between the First World War and the 1940s shaped a conception of state science that had a distinctly liberal character. The key value that was embodied in the state-funded research council system was freedom – for individual scientists to be free to choose their own research problems without direction, and also as the value underpinning the vision of how the results of research would benefit the nation or colony, namely that the responsibility of eminent research organisations was to ensure that scientific knowledge was freely available but not to engage in the process of uptake or application themselves. This was not the only vision of the relationship between scientific research and national needs that was available. We can compare the research council formulation of the place of scientific research in the progress of nation and empire with that of J. D. Bernal, for example, where 'planning' replaced 'freedom' as the cornerstone of the system. However, whilst the ideas of Bernal and other scientists on the Left have attracted much historical attention, the reality was that they were not significant in shaping the system of state-funded scientific research that emerged in Britain during the first half of the twentieth century. The research council model as promoted by individuals such as Edward Mellanby, W. W. C. Topley and A. V. Hill triumphed. The dominance of one particular vision of the way in which scientific research should be funded and organised, at a moment when government sought to find politically acceptable ways of increasing the capacity of the state to stimulate and manage change, was the particular accomplishment of those who worked in and defended the research council system, rather than something that was natural or inevitable. Important to the rise of the liberal ideology of research were claims about the supposed true nature of scientific research, often called

fundamental research, by a group of scientists in Britain that sought to balance a desire to bring science and the state into a much closer relationship with the preservation of the professional freedoms and status of scientists.

Scientific research in Britain's tropical colonies, then, was not a thing apart but was shaped by the values and beliefs that had informed the metropolitan research system as it developed and which many scientists saw as having an important role in defending their interests, professional status and identity. The DSIR, MRC and ARC provided a model, and a defence, of particular arrangements for research in which the freedom for researchers to choose research problems for themselves was of paramount importance. The creation of the Research Department at the Colonial Office effectively created another research council to sit alongside the DSIR, MRC and ARC. In practice, this created a strange situation in which the Colonial Office mimicked the work of the research councils while still being a government department. This anomalous situation proved to be unsustainable in the long term, and by the 1950s, officials at the Colonial Office asserted that the priority in colonial research was for scientific research to meet colonial needs, rather than the preservation of the freedom for scientific researchers to determine their own research agenda.

Scientific research was funded for Britain's colonies on the basis that it might stimulate industrial development, amongst other things, and this study has considered the ensuing relationship between research and colonial development. The result has been to raise some questions about seemingly straightforward assertions about the role of state-funded scientific research as a motor for development and economic growth. One relates to the issue of the mechanisms or processes that allow knowledge to move from the laboratory and be translated into social and economic benefits. The fact that the Colonial Office and its scientific advisors did not much attend to the ways in which scientific discovery might be turned into commercial products can be explained by the use of the research system that operated in Britain as a model. The DSIR, MRC and ARC were concerned with projects of general fundamental research and it was said they left the development of any findings that arose through that work to other people. While research councils such as the MRC might have appeared to be only concerned with freely publicising the results of the work it sponsored, in fact researchers sponsored by the MRC were embedded in wider networks of pre-clinical and clinical researchers, government and business in Britain. These relationships were not necessarily formally defined but had developed over time in an ad hoc way through contacts that occurred at universities, clinics, London clubs, the numerous

government committees that existed, and scientific societies. In the field of chemistry, research groups such as that headed by Norman Haworth at Birmingham University had a long history of acting as consultants to firms such as ICI and Glaxo. Students left the Chemistry Department at Birmingham and joined industry, or formed their own companies, and it seems highly likely that the most important way in which university–business contacts were deepened and maintained was through this employment of students who facilitated the exchange of knowledge and techniques between their old teachers and the firms they worked for. In Britain’s colonies, scientists could become part of networks, but useful contacts that would facilitate the transfer of knowledge at the level of the individual colony did not necessarily have the time and opportunity to develop in the late colonial period.

Fundamental research into the chemistry of sugar was done on the basis that the results of scientific research would be of interest to businessmen. It became clear, however, that sugar manufacturers that operated in the Caribbean did not possess the necessary chemical and commercial skills to capitalise on the results presented to them. The sugar technologists who worked for firms such as Caroni in Trinidad focused their efforts on improving the efficiency and quality of technical processes in the sugar factory, rather than engaging in synthetic chemistry. This would seem to mirror the point that has been made in a recent study of the relationship between academic research and economic development in low- and middle-income countries. A report by UNESCO shows that university science has limited wider impact if there is a gap between this research and the technological and scientific know-how held in the private sector.¹ In other words, successful commercialisation requires a wider context in which a skilled workforce is employed by firms outside of the academy that can make use of university research findings, otherwise research may come to very little. That wider context was absent in the case of the research undertaken into sugar in Trinidad in the late colonial period. Although the sugar research scheme sponsored by the CPRC appears to have been a failure, it is worth remembering, however, that the findings of Wiggins and his team were subsequently taken up in countries such as Mauritius, where sugar was an important commodity, and have continued to inform research in the field of carbohydrate chemistry and the search for alternatives to petrol and new uses for sugar cane.²

Historical accounts that ask the question ‘Why did development fail in the past?’ have produced conclusions that run the gamut from the claim that scientists were not adequately consulted and so development failed because of insufficient research (see Havinden and Meredith on the Groundnut Scheme and the projects of the CDC),³

through to the idea that scientific experts were given too central a role and so development failed because it dealt in overly simplified representations of nature and society. The contribution from this study is that the wider effects of scientific research are dependent upon other economic and institutional factors, such as human and financial capital, government assistance, markets and so on, to the extent that policies that focus on science are often missing the point. Tweaking science policy or increasing funding for science in African universities, for example, is not going to have the decisive effects that policy makers often claim. Scientific research can be important only if, and when, other conditions are in place.

It is highly unlikely that issues to do with the take-up of scientific results were the major factor that limited the industrial development of the British Caribbean. No amount of scientific research could overcome the problems of attracting investment for new industry to the region, the expense of shipping both between the British colonies and further afield, or the identification of adequate markets. While scientific research into finding new products and processes could play a part in facilitating industrial development, it could not be the motor. In order for scientific research to be important in economic development, certain preconditions needed to be met, such as the existence of industrial expertise, capital, services and incentives or support for new business. The policies of the Colonial Office were only marginally concerned with providing the wider context in which scientific research might have an impact. In contrast, the most fully worked-out visions of industrial development that were created for the Caribbean were much more transformative, seeking to create a wider set of conditions that would allow industry to flourish, including incentives for private investors through tax relief, trading estates, subsidies, cheap factories and credit. While the architects of these alternatives did not reject the need for scientific research useful to business, they did not make provision for it. The vision of industrial development promoted by W. Arthur Lewis, and representatives from Puerto Rico, was focused instead on the crucial role of foreign capital.

The most comprehensive plans for industrialisation, those of Lewis and Teodoro Moscoso of Puerto Rico, gave a bigger role to government in creating key industries, providing loans to businessmen and building factories. Additionally, officials on the American Section of the Caribbean Commission saw benefit in the idea of coordinated industrial development that involved some rationalisation of manufacturing across the Caribbean region, and trade agreements for the mutual support of the industrial activities that occurred in different territories. While the provision of advice was considered essential,

and officials of the American Section wished to see an advisory body created to help plan and coordinate industrial development for the whole Caribbean, US representatives did not make plans to support scientific research in the way that the Colonial Office did.

Clearly, there were ideological differences between Arthur Shenfield and Sydney Caine at the Colonial Office on the one hand, and individuals such as Lewis and members of the American Section of the Caribbean Commission, on the other, in their expectations of the role of the state in economic affairs. These beliefs about the role of government in economic development were often contained in references to the speed and scale of change that was said to be appropriate or desirable. The fundamental differences between officials in London and those who favoured greater intervention for development was most apparent when the Colonial Office spoke of the need for gradual change, often naturally occurring, while others such as Lewis and officials from Puerto Rico claimed that what the Caribbean needed was a 'sudden jump' or rapid economic and social transformation. While Britain saw virtue in caution, US officials desired action and supported the more assertive approach voiced by representatives on the Caribbean Commission from Puerto Rico.

This investigation of the variety that existed in visions of industrialisation after 1940 leads us to a more fine-grained and nuanced understanding of the factors that shaped development thinking in the post-war period. It shows the limits of some of the broad descriptions of the nature of development that are used by scholars. The paths to industrial development that were promoted after 1940 cannot be explained merely by reference to the emergence of an orthodox development model. Ideas about development that were expressed during the 1940s and early 1950s were derived from various ideological, political and economic beliefs, practices or requirements. In this case, deeper consideration of political and economic pressures and ideals, beyond just a reference to the emerging tensions of the Cold War, can help us understand the particularities of the visions of industrialisation that were promoted.

Differences in British and American priorities when it came to developing the Caribbean were related to the different function of development for those nations. US encouragement of industrial development in the Caribbean region was intended to bring prosperity to a region of strategic importance to America and also to further the wider aim of reducing barriers to trade around the world, including the opening-up of the colonies of the European powers to American firms. American officials wished to demonstrate the enlightened nature of US policies, and to do this it was imperative that they distinguish

their actions from those of the European colonial powers. Such differentiation could be achieved by emphasising US commitment to the provision of political freedom for colonised peoples, amongst other things. While the Colonial Office worked to limit the powers of the Caribbean Commission, this body was a major instrument for the exercise of American power in the region. The US Section needed the Commission to be active and interventionist if it was to be proof that the US was serious in its commitment to improving the conditions that existed in poor nations in the post-war world, and if America was to shape that world in ways it considered to be politically and economically desirable.

The Colonial Office managed to resist most of the recommendations for a new Caribbean industrial policy that were made by the US Section of the Caribbean Commission during the 1940s and early 1950s. American ambitions for coordinated industrialisation, for trade agreements between territories, or for new regional agencies to fund and plan development, were all frustrated by opposition from Britain. For the Colonial Office, it was the CDW Acts, not the Caribbean Commission, that were intended to be an important demonstration of the altruism of British imperial rule. The CDW Acts would show colonial peoples, domestic audiences and critical foreign powers that British imperialism was not primarily concerned with exploitation but would bring social and economic benefits to the people that inhabited Britain's colonial possessions. The creation of laboratories for scientific research in the colonies had particular symbolic value after 1940 as concrete representations of Britain's commitment to modernising its possessions. National research laboratories could be presented as indicators of incipient modernity and the move towards an independent status. They brought to a colony the capacity both to be self-sufficient in knowledge and also to contribute to the international project of scientific advance.

The 1940 CDW Act was inspired by the experiences of the Great Depression that exposed both the fundamental weakness of colonial economies and the limited capacity of colonial governments to address those weaknesses. The recognition of the problems produced by the narrow base of primary products that underpinned colonial economies, and the growing problem of unemployment in some places, produced a turn towards industrial development. Historians have spoken of the way that the Colonial Office appointed expert metropolitan bodies, embraced planning and dispatched large numbers of new specialists to the Colonial Empire as part of an assertive, interventionist approach to colonial development during the early 1940s.

In practice, the Colonial Office approach to encouraging industrial development was decidedly more *laissez-faire* than that favoured

by officials from Puerto Rico, some members of the US Department of State, Eric Williams and Arthur Lewis. The rather piecemeal and limited nature of British recommendations for the industrial development of the British Caribbean is likely to have contributed to their invisibility in the existing historical record. The principles that determined British attitudes towards industrial development for the Caribbean were very different from those discernible in British approaches to developing African agriculture. The work of Christophe Bonneuil, Dorothy Hodgson and others has focused on the sort of 'total' development scheme that colonial officers attempted to impose on African communities from the interwar period onwards. In projects such as the Gezira cotton-growing scheme in Sudan the aim was the complete restructuring of village life and work to turn subsistence farmers into efficient producers of cash crops. These projects could be very large and aimed to completely transform the lives of the African communities involved so that individuals became part of regimented and disciplined systems of production. In African colonies, then, the state could assume substantial responsibilities in the name of development, and employ methods that were highly interventionist, coercive and disruptive. Two related questions emerge therefore – why were there such differences in approach to industrial development in the Caribbean between the Colonial Office and others, and why did the Colonial Office policies encompass such different conceptions of the role of the state in development when it came to industry and agriculture for Africa and the Caribbean?

The encouragement of large-scale agricultural production was a basic tenet of colonial policy, and agricultural development and the expansion of mining in Britain's colonies were effectively synonymous with economic development from the time of Joseph Chamberlain's tenure as Secretary of State for the Colonies in the 1890s. Colonial production of primary products was the basis of the notion of complementary economies in which Britain's tropical possessions provided the raw materials needed in Britain for consumption and manufacturing, and in doing so generated demand for the purchase of industrial goods from the metropolis. For officials, and the public more widely, agricultural development in Britain's possessions was an undeniable good; it was good for colonial producers and it was good for British workers and industrialists. This model of imperial economic relations did not readily accommodate the emergence of colonial industry. After 1940, economic diversification in the colonies was presented as an opportunity for British firms, but in reality industrial development was always in tension with the expectations of British manufacturers and labour. New colonial industry would most likely serve local markets,

and in doing so it threatened to reduce demand for British products across the Colonial Empire. After 1945, the Colonial Office had to deal with the hostile reaction of British manufacturers to the news that special concessions were being made in some colonies for pioneer industries. A certain ambivalence towards the encouragement of colonial manufacturing on the part of officials, because of the possibility of complaints by British firms, is likely to have contributed to the conservative attitude of Colonial Office. More than this, however, industry was not considered essential for the colonies in the same way as agriculture, and therefore the issue of both the short- and long-term financial burden to government that might arise from the encouragement of colonial industry was a greater check on intervention. Colonial industry was desirable for the benefit it might bring in diversifying the base of colonial economies and relieving unemployment, but not at any cost. It would never displace the central place of agricultural production that was considered the natural and most suitable activity for Britain's tropical possessions. Sydney Caine was an advocate of industrialisation in the Caribbean but he did not believe that manufacturing would replace sugar production as the principal economic activity of Britain's West Indian territories. The Colonial Office attempted to rework and modernise the meanings of cane sugar through a search for new uses for this commodity as an industrial raw material in a vision of industrial development that aimed to prop up the ailing sugar industry rather than replace it. The point is that the sort of thoroughgoing, state-centred initiatives that were considered appropriate for the transformation of African farming practices were not needed in the case of industrial development, as industry was not considered central to the economic life of the colonies.

The Colonial Office ambition to foster some degree of industry in the colonies that was first expressed in 1943 was also frustrated in practice during the course of the 1940s as new demands were placed upon the Colonial Empire in line with changing domestic needs. Agricultural development schemes that were focused on increasing the production of cash crops for export were compatible with both the ambitions of the CDW Acts and also the requirement to improve the supply of foodstuffs and the dollar revenue available to Britain after 1947. While the currency controls and regulations on imports that were introduced to deal with Britain's economic crisis became a spur to increasing agricultural production, they were not compatible with the requirements of industrial development. Colonies such as Trinidad found their plans to attract new business frustrated by restrictions on imports of machinery from the US. Controls in place to conserve dollars and strengthen the sterling area made it hard for the colonies

to make progress with industrial development, and officials in London did nothing to address the difficulties that faced colonial governments when it came to implementing their plans for industrialisation.

Altogether, the Colonial Office focus on industrialisation in the early 1940s was not quite the break with the past in practice that officials sometimes claimed. More generally, in fact, the new interventionist, active and constructive approach to development that historians have said was represented by the 1940 CDW Act did not amount to a turn towards detailed economic planning and the widespread assumption of new state functions. When Sydney Caine or Charles Carstairs spoke of the need for greater metropolitan initiative and clearer strategies for development by colonial governments, they were making an argument for the assumption of greater responsibility by the imperial and colonial state than had previously been assumed in colonial policy. Considering that in the past the primary task of colonial governments had been to balance the books – to spend little and collect taxes – this was not necessarily a grand vision of comprehensive economic planning. The challenge after 1945 was to reconcile an attachment to laissez-faire economics with a commitment to greater government-initiated change, in order to improve conditions in the British colonies and restore Britain's reputation as a colonial power. One way in which officials could resolve the potential tension between these imperatives is demonstrated by the role given to scientific research in Britain's programme for industrial development in the British Caribbean.

Notes

- 1 UNESCO, *Higher Education in Asia: Expanding Out, Expanding Up. The Rise of Graduate Education and University Research* (Montreal, Canada: UNESCO Institute for Statistics, 2014), ch. 3.
- 2 M. Patarau, *By-Products of the Cane Sugar Industry* (Amsterdam: Elsevier, 1989).
- 3 Havinden and Meredith, *Colonialism and Development*, Conclusion.