Sabine Clarke

State, University and Business Collaboration in the Search for New Industrial Uses for Sugar after 1940 - DRAFT

Introduction

This paper examines the role given to scientific research into finding new uses for cane sugar in Britain's development plans for the West Indies after 1940. Rising unemployment, poverty and discontent amongst West Indian populations was linked by a number of investigators in the late 1930's to the low price of cane sugar on the world market. For a number of Colonial Office staff it seemed clear that economic growth, and the improvement of the social conditions in the Caribbean, could not rely upon increasing production of an export commodity that was already in surplus. In discussions at the Economics Department of the Colonial Office in 1940 it was suggested that the issue of the oversupply of sugar as a foodstuff could be resolved by diverting this product to industrial uses. A fantastic opportunity appeared to exist to turn sugar and its by-products into alcohol for transport, or provide important chemical intermediates and starting materials for the emerging synthetics industries that manufactured drugs and plastics. British scientists with experience of working with Britain's largest chemical company, Imperial Chemical Industries (ICI), endorsed this idea and the result was the creation of a programme of research into the chemistry of carbohydrates. Whilst science had sounded the death knell for a number of traditional colonial exports such as natural indigo, it was now hoped that the Colonies could move forward by taking advantage of a future demand for the novelties that science was increasingly producing in the field of synthetic goods.

The search for new uses for West Indian sugar was incorporated into wider Colonial Office ambitions in the 1940's for colonial industrialisation. As researchers at British universities identified new compounds and chemical processes it was thought that business would take the opportunity to exploit these discoveries. Attempts were made to facilitate this process through the

publication of papers and patents, liaison between the state-funded Colonial Products Research Council that oversaw research and British firms, and the creation of a research association in partnership with sugar manufacturers in the West Indies. Sugar research was intended to provide the means for British intervention to transform the economic life of the islands. Whilst in the long run these plans were not successful in producing the changes anticipated in the early 1940's, this paper shows the need to re-examine that claim by historians that the Colonial Office purposely obstructed industrialisation and economic diversification in Britain's Caribbean colonies in the post war period.[1] This paper will consider the factors that led to the belief that research organised by government into new products for sugar could be a spur to colonial development whilst considering some of the broader and longer term impacts of this episode of state, business and university collaboration.

Sugar and Development in the British West Indies

Historians of British imperialism have asserted that British approaches to economic development for the colonies did not encompass the need for economic diversification and industrialisation because of attachment to the idea of complementary economies. This model restricted the colonies to the role of exporters of primary products whilst providing markets for manufactured goods from Britain.[2] In addition to the claim that this was an enduring and central tenet of British policy, many discussions of the British Caribbean after 1940 make reference to the report of the Moyne Commission.[3] The Moyne Commission was appointed in 1938 to make a comprehensive investigation of economic and social conditions in the British colonies of the region after widespread riots in the 1930s.

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[1] See for example Havinden and Meredith, *Colonialism and Development*, ch. 13, pp. 299-318; Michelle Harrison, *King Sugar: Jamaica, the Caribbean and the World Sugar Economy*, (Nottingham, Russell Press, 2001), p.53.

[2] Havinden and Meredith, *Colonialism and Development*, ch. 13, pp. 299-318.

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[4]The final report was both deeply pessimistic about the long term future of the sugar industry whilst also stating that there was little scope for industrial development in the British West Indies.

This paper asks for a reconsideration of the claim that the Moyne Report dictated the nature of economic policy for the British West Indies after the Second World War. Rather than dismissing the possibility of industrial development in the British Caribbean, officials at the Colonial Office after 1940 conceived a new and radical vision of economic diversification in which the establishment of new industries that used sugar as a raw material would bring prosperity to the British colonies of the region. The success of this policy was predicated on the idea that the British state would provide funds for research by university scientists into new uses for sugar and that a new laboratory in Trinidad would be established in collaboration with West Indian sugar manufacturers. Questions emerge about the reasons for this emphasis on industrial development in the British West Indies after 1940 and the factors that led to the belief that this process could be facilitated by scientific research into non-food uses of sugar. Specifically, why did Colonial Office officials give a central role to scientific research in their plans after 1940 and how exactly did they perceive that state-sponsored research would led to the establishment of new industry?

New policies for economic development in the Caribbean in this period emerged in a context in which there was a wider shift in policy and funding that placed emphasis on planned development, metropolitan intervention and scientific research. This shift was prompted by the perceived failure of previous development initiatives in the colonies. A growing belief amongst officials of the need for reform was given greater impetus by events during the second half of the 1930s, particularly the riots in the British West Indies that had drawn attention to the very poor conditions under which many people in the British colonies lived.

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Britain found itself subject to mounting international and domestic criticism of its management of its colonies and a sense of crisis was compounded by the outbreak of war which created a pressing need to take constructive action to alleviate social and economic distress if colonial peoples were to remain loyal to Britain.[5]

In 1940 officials at the Colonial Office were debating the findings of the Moyne Commission and considering their plans for the British West Indian colonies in light of the recently passed Colonial Development and Welfare Act. This Act had made provision in 1940 for new development grants to be spent on schemes of economic and social improvement in the colonies. It also provided a Research Fund which was increased to £1 million pounds pa in 1945; a substantial new fund in relation to existing civil research allocations in Britain and one which promoted the Colonial Office to second largest sponsor of scientific research after the Department of Scientific and Industrial Research. Importantly, the passing of the 1940 CD and W Act had the effect of creating a reinvigorated sense of purpose at the Colonial Office when it came to planning schemes of economic and social improvement.

In discussion of economic development plans for the British Caribbean the newly appointed Comptroller for Development and Welfare in the West Indies, Sir Frank Stockdale, and the Finance Adviser at the Colonial Office, Sydney Caine, raised their concerns about the long term future of the sugar industry. Cane sugar had reached its lowest ever price on the world market in 1934 and crucially it was the low price of this commodity that was considered to have led to the extreme deprivation endured by many workers in the West Indies, large numbers of whom had been moved to violent protest during the 1930s. The issue was said to be one of oversupply – the world market for sugar as a foodstuff had reached saturation point. In the words of Stockdale in 1940

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> we think of present, of sugar only as a foodstuff but the field of consumption will have to be extended, if the post war situation is not to find us with no alternative but restriction, increased unemployment, distress and misery in the West Indian colonies.

Caine and Stockdale raised the prospect of diverting sugar from the British West Indies to new uses as a fuel and as a raw material for industry. The suggestion that sugar surpluses might be dealt with by the large-scale production of power alcohols was made in the context of a high degree of international interest in using agricultural produce in this way and Stockdale referred to the power alcohol blend, Discol, as the type of fuel that he had in mind.[6] Discol was a mix of alcohol and petrol that had been marketed in Britain during the 1930's by Cleveland Discol, the British subsidiary of Standard Oil of the United States.[7] A number of European governments had initiated power alcohol programmes during the 1930's. In some countries, such as France, laws had been passed making the use of alcohol blends compulsory (the alcohol in France originating from the grape harvest). The object of this type of legislation, along with subsidies offered to power alcohol producers, was to reduce the dependence of European nations on imported petroleum, and in the case of France, to protect a domestic alcohol industry that was considered essential in case France was ever at war again.[8] In America, the chemist William Jay Hale had advocated the production of power alcohols during the Great Depression to address the problem of agricultural surpluses. Hale christened the use of farm products in the chemical industry as *chemurgy*.[9] At the Colonial Office there had been interest in

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[6] PRO CO 852/280/8.
[7]Hal Bernton, William Korarik, Scott Sklar (eds), *The Forbidden Fuel: Power Alcohol in the Twentieth Century*, pp. 21-23.

[8] Hal Bernton, William Korarik, Scott Sklar, (eds), *The Forbidden Fuel: Power Alcohol in the Twentieth Century*, p. 27.
[9]Robert Bud, *The Uses Of Life: A History of Biotechnology*, (Cambridge University Press, 1993), pp. 48-49; Hal Bernton, William Korarik, Scott Sklar, (eds), *The Forbidden Fuel: Power Alcohol in the Twentieth Century*, p. 14-15.

the production of power alcohols since the end of the First World War, with correspondence relating to fuels from colonial agricultural products grown in Sierra Leone, Tanganyika, and Nigeria continuing into the early 1940's.[10] The outbreak of war led agricultural experts in African colonies to attempt to develop local fuels to replace imported petrol using products such as coconut and cotton seed.[11] The Colonial Office had also recently received a number of reports and letters prepared by the Zionist and future president of Israel, Chaim Weizmann, on the subject of power alcohols and other fermentation products.[12] Weizmann was a keen advocate of chemurgic schemes for using surplus agricultural products or agricultural waste and he proposed producing a high-octane motor fuel made from agricultural materials.[13] Weizmann had personally lobbied the Secretary of State for the Colonies, Thomas Lloyd, in 1940, to consider his proposals for power alcohol in light of his claims that Britain would be facing an acute shortage of aviation fuel as the war progressed.[14]

Stockdale, Caine and Gerald Clauson (Head of the Economics Division) agreed that the next stage in their plans to find new uses for sugar, as a source of alcohol for industry and transport, was some research into the matter. This was a view which was endorsed, perhaps unsurprisingly, by the scientists consulted on this point by the Colonial Office, namely the Fuel Research Board of the Department of Scientific and Industrial Research and Sir Norman Haworth, a leading figure in the field of carbohydrate research. The most obvious source of money for these projects was the Research Fund resulting from the 1940 Colonial Development and Welfare Act.[15] The idea that finding industrial uses for

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[10] PRO CO 852/482/13.
[11] PRO CO 852/482/13.
[12] PRO CO 852/482/.
[13] PRO CO 852/482/11. Weizmann had come to Britain in 1904, where he worked in the Chemistry Department of the University of Manchester. Weizmann had developed a method of producing acetone from maize during World War I that had been used in the production of artillery shells.
[14]PRO CO 852/482/13.

[15] PRO CO 852/280/8.

sugar could furnish a solution to the problems of the British West Indies was given further impetus with the discovery that the chemical firm ICI was considering the possibility of basing their new synthetic manufacturing processes on molasses as a raw material, rather than oil or coal.

Research Into Sugar and West Indian Industrialisation

A belief that the future of the West Indian sugar industry could be assured if research was undertaken by the state into new uses for sugar can be seen as resulting from a context in which there was both a strongly technocratic turn in colonial policy with the passing of the 1940 CD and W Act and the creation of new research fund. In addition to a privileged role for scientific research as a means for effective development planning there also existed at this point a high degree of interest by governments and business in the possibility of using molasses as a raw material for fuel and industry. As discussions about the best approach to resolving West Indian problems continued in the early 1940s state-funded scientific research provided a solution to the issue of the most appropriate method of government intervention in order to facilitate the process of colonial industrialisation.

Officials at the Colonial Office decided to create a Colonial Products Research Council in 1943 to allocate funds to university scientists for research into commercial products from a range of tropical commodities. A programme of research into sugar was begun at the University of Birmingham under Norman Haworth and Leslie Wiggins. This research consisted of the elucidation of the chemical reactions of sucrose, followed by a survey of the resulting derivatives to establish if they possessed any useful properties, particularly analgesic, chemotherapeutic or plasticising effects. The number of compounds generated by this approach could be substantial. The CPRC related in their annual report of 1945-1946 that Wiggins and his team had produced more than 100 new substances that year.[16] By the following year the researchers at Birmingham

[16]*Colonial Research, 1945-1946,* Col. No. 208.

were being assisted in the laborious task of screening these compounds to find useful substances by the Department of Pharmacology at the University of Oxford and by a researcher at the Physiology Department, Birmingham.[17]

The first report of the CPRC made a bold statement of how the research sponsored by the Colonial Office could work to transform the lives of the people of the West Indian colonies. Once processes for industrial uses for sugar had been determined, new factories producing these goods would be established in the Caribbean and in this way the economies of the West Indies would be transformed as they gradually became exporters of secondary products. In their first report the CPRC commented that whilst it aimed to secure better prices for existing colonial products,

> it must always bear in mind the fact that the low standard of living for Colonial peoples is, at any rate in part, due to the fact that they are almost without exception primary producers and therefore do not enjoy the higher standards which can, generally speaking, be attained only by industrial activity. It must therefore be constantly alive to the possibility of developing techniques whereby Colonial peoples may not only produce primary products but also convert them into secondary products of greater value, both for internal consumption and for export. [18]

One question that concerned officials at the Colonial Office committed to industrialisation in the British West Indies was the appropriate role of the state in facilitating this process. A number of proposals involving tariff protection or government factories were made by officials and advisers including the St Lucian economist W. Arthur Lewis. The approach that was finally endorsed by the Colonial Office, however, was distinctly laissez-faire. The Colonial Office would

[17] *Colonial Research, 1946-1947*, Cmd 7151.
[18] *Colonial Research , 1943-1944,* Cmd 6529.

provide funds for scientific research to find new products and then it was up to business to undertake commercial exploitation. In order to achieve this objective, the Director of Research of the CPRC, John Simonsen would communicate with British companies such as ICI, Boots and Glaxo directly about new discoveries. It was also decided that a new laboratory should be established in Trinidad to undertake research into sugar and its by-products and this laboratory would be a joint venture between the Colonial Office and the British West Indies Sugar Association, an organisation comprised of representatives of the manufacturing associations from each West Indian colony and headed by R.L.M. Kirkwood of Tate and Lyle. In 1946 the CPRC managed to secure an agreement with British sugar manufacturers based in the West Indies for the creation of an industrial research association, similar to those that operated under the Department of Scientific and Industrial Research.[19] In Britain the DSIR oversaw a number of research associations in which companies with common interests would collectively fund and supervise research work. This research work, often carried out in laboratories run by the research association, was financed jointly by the industry represented in the association and government. The object of the association was to undertake fundamental research into general principles of potential use to all firms involved, leaving the individual firm to work out problems that directly related to their own manufactures. In this way the DSIR was able to avoid the suggestion that state funds for scientific research were being used to further the interests of one individual company over another.[20]

Plans for a West Indian Sugar Technology Research Association were not well received by the British West Indies Sugar Association who informed the Colonial Office that they felt unable to make a financial contribution because of the uncertainty facing the industry in the longer term.[21] The association went on to

[19] *Colonial Research, 1944-45*, Cmd 6663. .
[20] S. Clarke "Pure science with a practical aim: the meanings of fundamental research in Britain, c. 1915-1950", *Isis,* (2010), pp. 285-311.
[21] PRO CO 899/1.

tell Stockdale that they feared that if they were seen to make a contribution to research then their workers would ask for higher wages.[22] In its reply the Colonial Office explained that the CPRC wished to encourage the location of processing activities in the colonies themselves and felt it was important that a technological institute, with a pilot plant, was established in the West Indies. The BWISA were further told that the sugar industry needed to increase and diversify the uses to which its products were put.[23] In the end, the BWISA agreed to a cess of 4d per ton for research (approximately £10,000 a year) with another £10,000 coming from the Colonial Development and Welfare Research Fund.[24]

In March 1951 a new sugar technological laboratory funded by the BWISA and the CPRC was opened at the Imperial College of Tropical Agriculture in Trinidad. The Francis Watts Laboratories had sufficient money for up to 26 staff and funds for the introduction of new machinery for an Experimental Sugar Factory at the ICTA. The role of the laboratory was explained by Lord Hankey, the chair of the CPRC at its inauguration,

> I have no doubt we shall, in due course, see as the outcome of the work of this laboratory new industries in the West Indies utilising sugar as their raw material. We shall, I believe, obtain also a much deeper insight of the nature of sugar cane juice of which, in spite of its long usage, we are still far too ignorant. Based upon fundamental research and upon its application, and given reasonably stable political and economic conditions, we can anticipate an increase to prosperity in the West Indies.[25]

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[22] PRO CO 899/1,
[23] PRO CO 899/1.
[24] PRO CO 899/2.

[25] *Colonial Research, 1950-1951*, Cmd 8303,.

Simonsen added,

> I think that it would be appropriate if I were to add a few words on what I regard as the main functions of this new laboratory. The success of the Industrial Research Associations in Great Britain have in large measure been due to the recognition by the industries which they serve that it is no part of their functions to replace the ordinary works laboratory. Whilst always willing to advise it is not for them to undertake the investigation of the day to day *ad hoc* problems which arise in the works. The Association's laboratory will only investigate major problems of interest to the whole industry**.** I will venture to suggest that this new laboratory will have two main functions, (a) to carry out fundamental research on the utilisation of sugar and the by-products of the sugar industry, and (b) when desirable to carry out such investigations through the pilot plant stage. If these investigations show that the manufacture is likely to be economic and that a market for the product can be found then it will be for the Sugar Industry itself to undertake large scale production. If the Industry recognises this responsibility then this new experiment has an assured future.[26]

The Outcomes of Sugar Research for the British West Indies

Despite the publicity that surrounded the opening of the new laboratory in Trinidad and the Colonial Office view that the institute was firm proof of Britain's commitment to modernising its colonies, the contribution of the sugar research programme to economic development in the West Indies was decidedly modest. Two compounds that were considered by the CPRC most likely to have a

[26] Address by John Simonsen on the opening of the Sugar Technological Laboratory, Imperial College of Tropical Agriculture, Trinidad, 17th March 1951, from the *Colonial Products Research Council, 8th annual report, 1950-1951*. (My emphasis.)

commercial future were sodium levulinate and dextran. The first was found to be an effective anti-freeze, with several advantages over ethylene glycol. The CPRC stated in their report for 1947-1948 that several firms had applied to work the patent for this compound, but it is not clear what became of this interest.[27] In 1955 it was reported to the CPRC that the firm Argus Chemical Corporation (New York) had offered to pay Wiggins' team in the Trinidad for the information necessary to start commercial production of levulinic acid. The intention was to use this sugar derivative in the production of plastics, to be manufactured either on the Virgin Islands or in Trinidad.[28] This particular scheme was subsequently abandoned on the basis that it was not sufficiently commercially attractive.[29] The compound dextran, for which scientists at Birmingham developed a new synthetic process, appears to have faired better and was commercially produced as a blood plasma substitute.[30] After successful clinical trials in Britain and the USA dextran was marketed under the name Intradex.[31]

In general, products of potential interest that did arise through the research sponsored by the CPRC were often judged not to have a commercial future, one key issue being the identification of suitable markets for industrial goods exported by the British West Indies. The development of new products by companies in Britain was hampered by restrictions on the supply of raw materials during the 1940's.[32] One of the ironies of the work of the CPRC in attempting to alleviate the problems of the oversupply of sugar on the world market was that before 1952 it was difficult to secure sufficient quantities of sugar for pilot plant manufacturing because it was subject to rationing. In addition, by 1951 ICI had settled on the use of oil as a starting material for its synthetic products and had opened its own cracking plant at Wilton using petroleum supplied by the Anglo-Iranian Oil

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[27] *Colonial Research, 1947-1948*, Cmd 7493.
[28] PRO CO 899/5.
[29] PRO CO 899/6.

[30] *Colonial Research, 1947-1948*, Cmd 7493.
[31] *Colonial Research, 1949-1950,* Cmd 8063.

[32] PRO CO 899/1.

Company.[33] Hopes that British sugar producers in the West Indies would diversify their interests also seems to have been misplaced. The reports of the BWISA between 1943 and 1955 show that their saw their future prosperity lying with increases in the volume of sugar production, and the negotiation of a guaranteed price for sugar exports.[34] Funds for sugar research from Britain ended as independence became increasingly imminent in the West Indian colonies and in 1961 the Sugar Technology Laboratory in Trinidad was closed.

A number of Caribbean politicians and intellectuals made their own criticism of British economic development plans in the post-war period. For W. Arthur Lewis and Eric Williams (who would be the first prime minister of Trinidad at independence), both of whom were engaged with formulating industrialisation policies through their involvement with the Anglo-American Caribbean Commission, British plans were just too laissez-faire. Lewis, Williams and others favoured a model of industrial development in which government had a far greater role and the priority in many plans in the first instance was on import-substitution industries. Trinidad, Jamaica and Barbados all adopted initiatives for new industry that were modelled to some degree on the Puerto Rico industrialisation plan initiated in the 1940s and often referred to as "Operation Bootstrap". The Colonial Office in London and British experts dispatched to the Caribbean were progressively more marginalised as local legislatures, increasingly comprised of elected representatives, privileged the regional context when seeking inspiration and advice on industrial development rather than the imperial.

Conclusion

The search for new industrial uses for sugar became part of a plan for economic diversification in the British West Indies after 1940. The factors that prompted this project included a sense of imperial crisis which was particularly acute in the

[33] W.J. Reader, *Imperial Chemical Industries. A History. The First Quarter Century, 1926-1952*, (OUP, 1975), p. 401.
[34] See for example, *BWISA (Incorporated) Handbook for 1954*, (Cambridge: W. Heffer and Sons Ltd).

case of the Caribbean. Social conditions had been found to be extremely poor in this region and there was real danger of continuing revolt against British rule. The result was a new Colonial Development and Welfare Act which provided free grants for planned development projects and a research fund of unprecedented magnitude.

Economists and scientists at the Colonial Office conceived a scheme to alleviate economic distress in the British West Indies through diverting sugar to industrial uses in the context of a new ethos which favoured assertive action in the field of development and scientific research as a means of assuring the efficacy of British intervention. The provision of a new research fund enabled officials to fund scientific research into new uses for sugar at British universities and a laboratory built for this purpose in Trinidad. It was believed that state-sponsored research would stimulate industrial development as it would furnish business with the information necessary to begin production of new sugar derived goods.

In practice, however, new products rarely reached the market with the exception of a blood plasma substitute named dextran. There were a number of reasons for this including in the context of the Caribbean the little interest shown by sugar manufacturers comprising the British West Indies Sugar Association in diversifying their interests. Two main issues were key in this case; one was the problem of finding markets of sufficient size to make manufacturing in the colonies viable and the other was the uncertainty facing the sugar industry as it became clear the British West Indies would soon be achieving independence. We should be careful, however, of using the word ‘failure’ to describe British research into new uses for sugar in the late colonial period. Whilst this work did not fulfil the goals of economic development outlined in the early 1940s the research itself had longer term and wider implications. The notion that sugar cane could be a source of fuels and industrial goods continued to be of interest to scientists, government and business during the course of the twentieth century, as exemplified by the Brazilian alcohol programme initiated in the 1970s. The author of one textbook on carbohydrate chemistry published in Mauritius credited

the work of the Colonial Products Research Council as laying the foundations of the field.