1920.

NEW ZEALAND.

# BRITISH EMPIRE STATISTICAL CONFERENCE

(REPORT OF GOVERNMENT STATISTICIAN ON).

*Presented to both Houses of the General Assembly by Command of His Excellency.*

The Hon. the Minister of Internal Affairs. Wellington, 2nd November, 1920.

I submit herewith the report of the Government Statistician on the British Empire Statistical Conference.

J. Hislop, Under-Secretary.

New Zealand Government Offices, 415 Strand, London W.C. 2,
26th April, 1920.

Now that the Imperial Statistical Conference has completed its sittings, I beg to submit a report of the work done at the Conference, and of the inquiries so far made during my visit.

2. I left Wellington on the 21st November, 1919, and joined the Blue Funnel liner "Ascanius" at Sydney on the 29th idem. The four days in Sydney were almost entirely taken up in getting our passports vised, for which fresh photographs were required. During the five days' stay in Melbourne I visited the Statistical Offices of the Victorian Government and the Commonwealth, and discussed statistical matters with the officials. The Commonwealth officers were engaged in preparatory work for the 1921 census, for the compilation work of which an installation of Hollerith machines has been arranged for.

3. On reaching Durban it was found that owing to the dockers' strike at Cape Town there was a congestion of shipping in port awaiting coal, with the result that my boat was delayed a week beyond schedule time. I was met at the boat by Mr. Carruthers, of the Union Government Statistical Office, from Pretoria, with whom I had a most interesting time. The statistics for the Union of South Africa are largely centralized in the Statistical Office at Pretoria. I was interested to learn that the Statistician there was assisted in his work by a Statistical Council consisting of both official and non-official members. Hollerith tabulating-machines are also largely used there, and found both economical and expeditious. They are used in the Statistical Office at Pretoria for the tabulation of the statistics of agriculture, vitals, law and crime, schools, &c., and these machines are also largely used in the Railway Department of the Union.

4. A separate branch of the Statistical Office is situated at Cape Town, which is the principal port of the Union for the compilation of the Customs or trade statistics. The Statistical Chief of that office, who is also a member of the Statistical Council, met me at Cape Town, and told me that Hollerith machines were used entirely for the tabulation, with the greatest satisfaction. He told me that although they were at first adverse to the adoption of the machine, they would not now revert to the former practice on any account, the machines performed the work so much more expeditiously and accurately, and with so much less worry to those responsible; also, much greater detail was obtainable for publication with practically little or no extra work. He was very emphatic as to the advantages of machine tabulation for Customs work. The Customs entries from all other ports of the Union were forwarded daily to the Central Office at Cape Town, where the whole of the statistics were prepared. I arranged for an explanatory memorandum of the method adopted for utilizing the machines on this work, with a full set of the various cards and forms, &c., to be forwarded to my office at Wellington.

5. Apart from the extensive use made of the Hollerith tabulating-machines, the feature of the South African statistics which impressed me as most desirable of adoption for New Zealand was their card system of obtaining statistics of migration (emigration or immigration). The position of New Zealand as an island makes the collection of migration statistics a comparatively simple one, and there is no reason why they should not be full and accurate. I have always considered our statistics of migration good, and so far as the totals of the arrivals and departures are concerned, the count of population at each census has proved them to be, on the whole, reliable and accurate; but as to the information obtained in regard to those arriving or departing, which would enable us to analyse the character and sources or destination of our immigration or emigration, our methods leave much to be desired. The matter has given me some concern, and how the methods could be best improved has been several times discussed by the Office during the past few years. Complete and accurate statistics of migration for our Dominion are of the greatest importance not only to New Zealand but to the Empire. You will remember that the Dominions Royal Commission laid great stress on the importance of migration within the Empire, and as New Zealand derives a considerable proportion of its increasing population from migration it is obvious that we should have full information as to the people we are absorbing into the country each year, and also as to those we are losing. I consider the card system in use in South

Africa eminently suitable for providing all the particulars required with the minimum of trouble and friction to all concerned. The Conference devoted some time to the discussion of migration statistics, and this is the system which is recommended in Resolutions Nos. 74 and 75 of the report. I arranged with the Statistician in South Africa to send me a complete set of their forms, and I strongly recommend the adoption of the individual card system in New Zealand from January, 1921. The mode of operation could be discussed with our Immigration Officers on my return.

6. I reached Liverpool on the afternoon of the 26th January, and caught the 5.25 train for London the same day, reaching there about 10 p.m. Next morning I called at the High Commissioner's Office and found that the Conference had already sat four days. I immediately reported at the meeting then sitting, and ascertained that no subject had actually been disposed of. The previous sittings had been all taken up in preliminary discussions as to the ground to be covered by the Conference, formation of and allocation of work to sub-committees, &c. I was much relieved, therefore, that the unfortunate delay in my arrival had not actually caused me to miss any of the real work of the Conference. I was added to several of the Committees already formed, and from that date until conclusion of the Conference was fully occupied on work in connection therewith.

7. I attach for your information a printed report* of the work of the Conference, with the text of the several resolutions adopted. On page 64 thereof will be found a list of the Home and overseas Government officers attending the Conference. In addition Sir Henry Row, K.C.B., attended and gave valuable assistance during the discussions on agriculture statistics; Mr. L. J. Kershaw gave information in regard to the work of the International Labour Conference at Washington; whilst Mr. Haldane Porter and the representatives of the Overseas Settlement Committee attended during the discussion on migration statistics. Professor Bowley addressed the Conference on points relating to trade statistics on which he had given evidence before the Dominions Royal Commission. The Conference attended at the offices of the League of Nations and discussed with the Secretary-General (Sir Eric Drummond) "the relations of the contemplated Empire organization of statistics to the plans which are maturing in the minds of League of Nations Secretariat with reference to an international organization," while the overseas representatives of India and the self-governing Dominions also met the Secretary of the Imperial Mineral Resources Bureau (Sir R. Redmayne, K.C.B.) in regard to the supply of mining statistics.

8. The work of the Conference falls generally under two main headings, viz.—

(1.) Proposals for the establishment and organization of a British Empire Statistical Bureau in London; and

(2.) General statistical work—*i.e.*, the general lines of inquiry and presentation, methods of work, &c., desirable in regard to the main branches of official statistics, with special reference to statistics of trade, production, population, prices, labour, and finance.

Since the printed report with the resolutions adopted cover the ground and are self-explanatory, it will not be necessary to report them here, but the following brief remarks in regard to them are respectfully submitted for consideration:—

9. British Empire Statistical Bureau: The Conference unanimously recommended the establishment of such a Bureau in London. The functions of the Bureau, its work and publications, its control and staffing, with an estimate of costs, are set out in detail in Resolutions Nos. 1 to 10 on pages 13 to 17 of the report. The defects of our Empire statistics have been generally recognized, and experience during the war years has clearly shown the disadvantages resulting from "the lack of systematic statistical investigation and of complete and comparable records relating to Imperial resources and developments." The proposal is that the Bureau should be controlled by a Council incorporated by Royal Charter, consisting of representatives of the several Governments (United Kingdom ten members, India and self-governing Dominions two members each, and colonies and protectorates two members), with the Prime Minister of the United Kingdom as President in his capacity as *ex officio* President of the Imperial Council; that it should be adequately equipped and staffed under a Director (an expert statistician of approved administrative and official experience), with a number of chief professional assistants and such other technical and clerical assistants as may be necessary: it is recommended that as far as practicable the assistants be representatives from the statistical staff of the Home, Indian, and Dominions Statistical Offices. The Bureau, as proposed, would provide the co-ordinating link between the various statistical organizations throughout the Empire, and would be a body to which all Statistical Offices in the Empire could refer; it would be in a position to furnish advice as to methods for the tabulation, mechanical or otherwise, the analysis, and the presentation of statistics; and it is obvious that the professional assistance obtainable from a Bureau of the character proposed would prove of great value and be much appreciated. Sir Auckland Geddes, President of the Board of Trade, the Right Honourable Edward Shortt, Home Secretary, and Mr. Bridgeman, Parliamentary Secretary, Board of Trade, addressed the Conference at different times, and conveyed to the delegates the impression that the British Cabinet was favourably disposed, so far as the United Kingdom was concerned, to the creation of such a Bureau. The Secretary of State for the Colonies wrote: "I understand that in the course of their deliberations the Conference has surveyed the whole field of statistics, and has made recommendations dealing with statistics of such subjects as trade, agriculture, mining, finance, population, cost of living, labour, and migration, apart entirely from the recommendation which it has submitted on that most important subject of all—which, indeed, furnished the main motive for the summoning of the Conference—the creation of an Imperial Statistical Bureau. It is unnecessary for me to say that I am convinced of the importance—or, rather, the necessity—of having available the fullest possible statistics on all the matters referred to and their proper co-ordination if we are to develop and utilize to the fullest extent the resources of the Empire. I am sure that the deliberations of the Conference have contributed in no small degree to the attainment of that end, which, I need hardly say, I shall do anything in my power to further."

* "Report and Resolutions adopted by the First Conference of Government Officers engaged in dealing with Statistics in the British Empire, held at the Board of Trade on 20th January–26th February, 192 )," presented to Parliament by command of His Majesty. (Cmd. 648.)

I understand that at the meeting of the Associated Chambers of Commerce of the British Empire to be held in Ottawa next August a resolution recommending Government to give effect to the resolutions of the Imperial Conference on Statistics will be passed. The *Times* in a leader in the issue of the 25th February said, with reference to the proposed Empire Statistical Bureau, that "Every one will realize the importance of this object. Never has it been more necessary that the public should be in possession of incontrovertible facts. In the process of reconstruction it is essential that the various portions of the British Empire should be enabled to play a part commensurate with their resources and potentialities. Yet little exact information is forthcoming concerning much of the King's vast domain. Cotton, medicine, health, and industrial efficiency, to name subjects now uppermost in the popular mind, to say nothing of many others, illustrate the abiding need for the most careful compilation and analysis of statistical returns. The projected Bureau may ultimately provide such a conspectus of the whole Empire as it is and as it might become, and may throw such a light on its commerce, agriculture, industry, and movement of population, as to become invaluable. . . . In Germany before the war the Statistical Bureau was ceaselessly employed in working on everything that might illuminate the future of the German people, and in the era which is now opening there can be little doubt that the nation which studies the drift of events as it is revealed by statistical analysis will be infinitely better equipped to take advantage of its opportunities than another which perhaps trusts only to the methods of empiricism. Business men, there is good authority for believing, are prepared not only to avail themselves of the services of such a Bureau as is suggested, but pay for them. No one who watched public events can doubt that Labour is already alive to the importance of statistical research."

It is estimated that the initial annual outlay for the maintenance of the Bureau will be about £30,000, to which New Zealand would be expected to contribute a proportionate share. On any basis of apportionment the annual contribution of New Zealand on a total expenditure of this amount would not exceed £1,000. I am of opinion that, apart from the importance to the Empire, the creation of a central Statistical Bureau such as is contemplated would be of great advantage to New Zealand, and I have no hesitation in recommending that the New Zealand Government should approve of and join with the other Governments of the Empire in giving effect to the resolution of the Conference for the establishment of a British Empire Statistical Bureau in London. Resolution No. 10 asks that if this scheme be approved by the various Governments of the Empire their representatives in London be appointed without delay, and I shall be glad if the matter can be dealt with immediately on receipt of this Report.

### General Statistical Work.

*Functions of a Statistical Office.*—Resolution 11 sets out the unanimous view of the Conference as to the functions of a Statistical Office, and may be quoted in full:—

"The Conference desires to place on record its opinion that the functions of no Statistical Office can be exercised properly when limited to the initial work of collecting and compiling figures. The Conference is agreed that the prescription of so narrow a function has resulted in the past, on the one hand, in a tendency to an unintelligent massing of undigested statistical material, compiled at a considerable and other wasteful expenditure of labour and money, and, on the other hand, in a failure to render information which is of value readily available for public use.

"The Conference therefore accepts the view that a Statistical Office should include within its functions—

"(*a.*) The presentation of the results of its compilations primarily in such a form as clearly to indicate their essential elements, with or without supplementary detailed information, which, though necessarily secured in the process of compilation, need not be published unless it serves a sufficiently useful purpose.

"(*b.*) The utilization of the special knowledge and experience gained in the course of the work of tabulating the statistics, and the critical analysis of the results in such a way as to indicate most clearly their value and significance.

"(*c.*) The elimination in every section of public statistics brought under review of those elements which, when properly examined, are found to serve no satisfactory purpose."

These emphasize to us the necessity of continuing and insisting on the policy already laid down for the staffing of the New Zealand Statistical Office—viz., that only properly qualified men should be appointed to the senior positions. It is only thus the Office can be placed in a position to carry out what the Conference regarded as the more important functions of a Statistical Office. The Conference considered that the mere arithmetical work involved in the collection and compiling of figures constituted only the preparatory and less important stage of the work of such an office, and emphasized the fact that "if this principle be ignored the more important services which thorough statistical work is capable of rendering to the community will be sacrificed."

Resolution 12 recommends that Statistical Offices when reporting the results of any inquiry should publish the more important *questionnaires* used in connection therewith, thereby providing a means whereby the value and significance of the tables can be adequately assessed. This point has generally been followed in New Zealand, and can be given more strict attention in future. It is also desirable that copies of all new forms of return and inquiry used should be sent to the Statistical Offices of the United Kingdom and self-governing Dominions.

Resolution 13 affirms that in all cases where a Government calls for statistics the necessary statutory authority should be provided. New Zealand has always had compulsory power for the collection of all statistical returns required by the Office, but the present Census and Statistics Act is not a satisfactory one, and a new Act should be obtained at the earliest opportunity. I am getting copies of the South African and Canadian Acts, which are of quite recent date, for consideration and guidance in framing a new Act for New Zealand on my return.

Resolutions 14 to 17 deal with statistics of colonies and protectorates, and do not therefore concern New Zealand.

Resolutions 18 to 30 deal with trade statistics, and recommend—

(*a.*) The adoption of the calendar year for trade statistics for all parts of the Empire:
(*b.*) The classification of imports under countries of origin, and exports under countries of final destination, in addition to any other basis (*i.e.*, shipment or consignment):
(*c.*) A uniform classification of geographical divisions, and of the commodities comprised in imports and exports also, to be aimed at throughout the Empire:
(*d.*) The keeping throughout the Empire, wherever possible, of separate records of transit and transhipment trade:
(*e.*) The assignation to the proper import and export headings, whether separately or not, of imports and exports on Government account and by parcels-post (and where possible by registered post):
(*f.*) The valuation of imports c.i.f. and of exports f.o.b.:
(*g.*) Publication of monthly statements of imports and exports

It is also recommended that special studies should be made of the distribution of staple products of Empire origin, and that all trade returns should be accompanied by prefatory remarks explaining in some detail the basis on which imports, exports, re-exports, &c., are valued and their quantities verified; the method by which the statistics are collected and compiled, together with an explanation of the system of classification adopted and of the terms employed.

A good deal of what is recommended is already done in New Zealand, but there are one or two important points raised which I propose to discuss with the Customs Department on my return. Any action required would be one for consideration by the Customs Department and the Census and Statistics Office jointly.

Resolutions 31 to 54 relate to statistics of production, and fall under three heads, according as they relate to one or other of the following classes of statistics: (*a*) Agriculture (including pastoral) and fisheries; (*b*) mining and quarrying; (*c*) factory production.

(*a.*) In connection with agricultural and pastoral statistics, the importance of systematic annual collections of statistics relating to areas devoted to agricultural and pastoral production, numbers of live-stock, and amount of produce, is stressed, together with the desirability of annual crop forecasts. It is also suggested that a valuation of agricultural and pastoral production should be made at least once in five years; the values would be computed as nearly as possible on wholesale prices prevailing in the market nearest the place of production, due deductions being made from the gross produce for such products as are used by producers for seed, manure, or feeding of stock.

The collection of statistics of the following is also recommended: Stocks of the principal agricultural and pastoral products, and the course of supplies; price quotations of agricultural produce; systems of land-tenure and irrigation; extent of land capable of being brought into agricultural and pastoral use; areas in forest; annual output of timber and other forest produce; annual production of inland and sea fisheries.

(*b.*) For mining, including quarries, &c., statistics are recommended showing production and finance, with particulars as to machinery employed, conditions and terms of labour, accidents, &c.: and it is suggested that for statistics of mining production the value of mine-products at the mine itself should be taken regardless of any treatment the product may undergo subsequently, particulars as to such subsequent processes being included in the factory statistics.

(*c.*) Complete annual statistics of all industrial (factory) production are also recommended.

So far as the statistics of agricultural and pastoral production are concerned, New Zealand is already doing practically all that is suggested, but in regard to both forestry and fisheries practically no particulars are at present available in New Zealand. There are also one or two other points arising out of these resolutions, such as periodic valuations of agricultural and pastoral production, particulars as to irrigation, further statistics of mining and quarrying, which will require attention.

The annual collection of statistics of factory production in New Zealand was being taken when I left the Dominion, so that in this respect the resolution of the Conference was anticipated. One of the difficulties of dealing with these statistics is the range or size of factory to be covered. In the very small factories where proper books are not kept, although the total output and total expenditure are fairly correctly returned, the details of both output and expenditure are so apparently unreliable that their inclusion in the tabulation tends to vitiate and destroy the value of the statistics, while the rejection and omission of such returns would quite seriously affect the totals of the factory production of the country. I discussed the point with the Board of Trade Statistician, and was interested to find they had come to the same conclusion as we had in New Zealand—namely, that the best way to treat these small unreliable returns was to omit them from the main tabulation of the details, and to simply add their totals separately to obtain the total factory production of the country, thus enabling the relations of the various factors entering into production for any industry to be set out accurately from year to year.

Resolutions 55 to 66 deal with the population census, and raise some very important points. Resolution 55 affirms that a decennial census is insufficient, and that the aim should be to take a census at intervals of not more than five years. A quinquennial census has been always taken in New Zealand.

Resolution 56 recommends that all censuses within the Empire should be taken in the same year within two months before or after the 15th April. This is important to New Zealand, for it allows the selection of a date in February when the weather is at its best for the work of the sub-enumerators in the country districts particularly.

Resolutions 57 and 58 affirm that the *de facto* population should be taken, and that census legislation in each part of the Empire should be placed upon a permanent basis. New Zealand census gives the *de facto* population, and permanent legislation exists for the taking of the census.

Resolutions 59 to 66 refer to the details of the census *questionnaire* and the presentation of the results, stressing the necessity for uniformity as to treatment of divorced persons and of fertility statistics; the importance of classifying workers both by industries and by personal occupations, and of obtaining particulars as to unemployment; while special attention is to be given to inquiries as to aliens.

Several matters raised here will need attention. The points in regard to classification of industry and occupation are particularly important, and will require to be carefully gone into on my return.

Resolution 67 recommends that in the presentation of statistics of (*a*) population and (*b*) births, marriages, and deaths the distribution shall be shown by single years of age in conjunction with sex and conjugal condition; while resolution 68 proposes that a uniform basis for the standardization of death-rates to be determined on by the proposed Empire Bureau should be adopted throughout the Empire. The former is already the practice in New Zealand, while the latter could readily be complied with immediately the British Empire Statistical Bureau determines the standard death-rate to be adopted.

Resolution 69 points out the desirability of—(1) All birth-registers containing a record of the age of each parent and the number of issue previously born to the same marriage, distinguishing living and dead; (2) the compilation of statistics of still-births; (3) the recording in death-registers of the conjugal condition of deceased persons; (4) the adoption of the international classification of causes of death as revised from time to time, for tabulation of deaths.

Resolution 70 suggests that the error introduced into death statistics by the present system of open certification would be eliminated by a system of confidential certification.

Resolution 71 recommends the recording of particulars as to—

(*a.*) At birth-registrations—(1) occupations and nationalities of parents; (2) ages and sexes of previous issue, living and dead.

(*b.*) At death-registrations—(1) occupations and nationalities of deceased; (2) sexes and ages of his (or her) issue, if any.

I recommend that these resolutions be referred to the Registrar-General and myself for consideration and report.

Resolutions 72 to 75 affirm that it is desirable to obtain adequate statistics in connection with the movements of persons, British and foreign, between the various countries of the Empire and between the Empire and foreign countries. Such statistics it is recommended should be collected as far as possible in the form of an individual record to be furnished by each person, including information as to sex, conjugal condition, age, occupation, nationality (present and original), country of last permanent residence and of intended future residence, which experience has proved to be the simplest and most accurate and effective method of securing the requisite information.

It is also urged that, in view of the fact that an Empire census is to be taken in 1921, this new system for the collection of these statistics should be brought into operation *not later than 1st January, 1921*. I have already dealt with their application to New Zealand in paragraph 5 relative to the system of collecting migration statistics in South Africa, which is the same as that recommended in these resolutions.

Resolutions 76 to 82 affirm the necessity of publishing in the future at least as frequently as once in each month systematic records of retail prices of as many staple items of household expenditure as possible, together with an index number thereof, the commodities thus considered being selected so as to give the most representative price possible in each country rather than attempting to evolve a regimen identical for all countries or for all purposes.

In countries which hitherto have not made systematic collections of prices, special investigations in order to secure corresponding data for back years are desirable.

The Conference further recommends that in all cases where an index number is either first issued or revised a statement of the methods adopted should be published, together with the actual data employed. The Conference also recommends the universal adoption of the aggregate-expenditure method of constructing index numbers designed by the Australian Commonwealth Statistician, the regimen being subject to revision every decade, or thereabouts, so as to conform to variations in the national usage. Most of the work recommended is already being done in New Zealand, and the method of constructing index numbers adopted by us is that here suggested. In further development of this branch of our work these resolutions will be carefully considered and followed.

Resolutions 83 to 85 emphasize the necessity for more and better statistics of labour, and for special attention being given in the British Empire to this field of statistical inquiry. The Conference recommends that statistics of as complete a character as possible should be obtained bearing on the rates of wages and the earnings of workpeople; the hours of labour; the causes, duration, and mode of conclusion of strikes and lockouts; on employment, including unemployment; on industrial organization, &c. The subject of labour statistics came up at the end of the Conference, and there was only time for a general resolution on the subject. This branch of statistics in New Zealand is very incomplete, and I recommend that these resolutions be referred to the Secretary, Department of Labour, and myself for co-operation in their further development.

Resolution 86 states the desirability of having Budget and debt statistics of the Empire, to include national, provincial, municipal, and other local budgets. New Zealand now has fairly comprehensive statistics under these heads.

Resolution 87 recommends that wherever taxes on incomes or on estates of deceased persons are in force, such detailed statistics as are possible should be prepared, with the object of throwing light on the national wealth and the distribution of property and income. This should be referred to the Commissioner of Taxes and myself for consideration as to the statistics obtainable from the particulars in the possession of the Income-tax Department.

Resolutions 88 to 93 affirm the desirability of compiling full information as to—(1) Amounts and descriptions of currency in circulation, including stocks, note issues, and movements of coin and bullion; (2) monthly returns of banking operations; (3) movements of capital; (4) index numbers of prices of various classes of securities; (5) financial operations of insurance, land, mortgage, investment, trust, and financial companies generally. The finance statistics of New Zealand should be carefully overhauled and brought into line with these resolutions, and I propose to give the matter attention as soon as possible after my return.

Resolution 93 recommends the collection and publication of statistics of the operations of insurance companies and friendly societies. Limited statistics of life and accident insurance have been available in New Zealand for a long time, and the collection of returns relative to fire

insurance were initiated just prior to my leaving the Dominion. The further statistics covered by the resolutions should be taken in hand as soon as possible, and will have attention on my return.

While the Conference was sitting the overseas representatives were the guests of His Majesty's Government at the Carlton Hotel, Pall Mall S.W. 1, and every courtesy and attention was afforded by those officers of the Home Departments with which we came in contact.

Facilities were afforded representatives for inspecting calculating, tabulating, and adding machines of all kinds at work in the offices of Departments employing such. The Conference discussed the use of such machines for statistical work, and the matter is referred to in the report in the following terms: "The Conference recognized that advancing requirements for statistical information render the use of mechanical calculating appliances and of sorting and tabulating machinery not only advantageous but essential in dealing with many classes of returns." A Committee is at present sitting in London, composed of representatives of the Treasury, the Stationery Office, and other Departments, in order to see how far the use of mechanical tabulation may be largely increased. The question of introducing mechanical tabulation in the Statistical Office of H.M. Customs, as has been done in the corresponding office of the U.S.A. Customs, is also separately under consideration. The Conference visited the installations in the following offices: Board of Trade Industrial Inquiry Branch; Ministry of Labour Unemployment Insurance Branch; Prudential Assurance Company (Limited) (mainly for Powers tabulating-machines); Registrar-General's Office, War Pensions Department; London Gaslight and Coke Company (Limited) (Hollerith tabulating-machines); Office of Director of Statistics, Medical Research Committee (Millionaire, Madas, Burroughs, and various other calculating-machines). After the Conference I revisited these offices by myself in order to get a thorough grip of the working of the machines, and make a comparative study of the respective qualities of the Powers and Hollerith tabulating-machines with a view to deciding which would be most suitable for New Zealand. In addition I also visited, in some cases more than once, the offices of the British Tabulating-machine Company, the Powers Accounting and Tabulating Machine Company, the agents for the Burroughs adding-machines, the Millionaire and Madas computing-machines.

I also spent the best part of a day in each of the following offices, studying the general office methods and systems of work in use, particularly in regard to recording and statistics: Board of Trade (registry and statistics of manufactures); Ministry of Labour (prices, wages, and index numbers); Ministry of Food, Home Office (alien registration and law and crime statistics); Scottish Office (registry); Board of Agriculture (agriculture and fisheries); Registrar-General of England (registration, vital statistics, and census); War Pensions (system of registration for conscription); Inland Revenue (income-tax collection); Customs (trade statistics); Registrar-General of Scotland, Edinburgh (registration, vital statistics, and census); General Statistical Office in Paris.

In regard to the latter I found a tabulating and printing machine in use not seen elsewhere; it is the invention of the Director of the French Statistical Office, and I was much impressed with its work. I am obtaining full particulars as to cost, &c., for consideration as to whether it could be employed economically in New Zealand.

This practically concludes my work to date. I had not intended reporting at this stage, as time scarcely permits my dealing with the various points raised as fully as I would like, but in view of the fact that the Conference considered the preliminary steps for creating the British Empire Statistical Bureau were urgent and should not be delayed until after my return in August, I decided to forward this report by mail. I shall feel obliged, therefore, if you will submit the portion dealing with the creation of a British Empire Statistical Bureau to the Hon. the Minister with my recommendation for New Zealand's participation, in which I trust you will concur. If the recommendation is adopted by the Government the New Zealand representatives in London on the proposed Council (of which, of course, our High Commisisoner would be one) should be immediately appointed and the Board of Trade advised by cable.

All other matters arising out of the work of the Conference and of my visit should await my return, in order that each point requiring any alteration or action in connection with our present statistical work could be submitted for approval by a separate memorandum in which the point involved would be more fully explained.

In conclusion I wish to record my very great appreciation of the courtesy and kindness received from all officers of the High Commissioner's staff with whom I came in contact. All were most obliging and helpful, and any assistance required was most readily given.

MALCOLM FRASER,
Government Statistician.

The Under-Secretary, Department of Internal Affairs, Wellington.

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13th August, 1920.

Continuing my report posted from London and dated the 26th April, I have to say that I visited Edinburgh and saw Dr. Dunlop, Registrar-General for Scotland, and discussed census work with him. One suggestion made by him I think worthy of adoption for New Zealand—namely, that a question should be inserted on the census schedule to ascertain the orphanhood in the country in regard to all children under fifteen or sixteen years of age. Beyond this I think New Zealand is quite as advanced, if not more so, in regard to census and vital statistics as they are in Scotland.

I also looked through the Statistical Division of the Department of Agriculture in Scotland, which is organized on much the same lines as the English office. I am quite satisfied that the agriculture and live-stock statistics in New Zealand and Australia are superior and more advanced than elsewhere, and my subsequent visits to the United States and Canada confirmed this opinion. A branch of work in connection with agricultural and pastoral statistics in which all these countries were in advance of New Zealand is that dealing with market-price reports, movements of stocks, and supplies in sight, &c. A good deal of this work is made possible by the employment of special correspondents in the various centres. So far this Office has not adopted the system of

special correspondents, as I think it more economical to use existing Government organizations, which, when there is cordial co-operation, are quite satisfactory. I have obtained sets of their forms and notes of their procedure for consideration in the further development of this branch of our New Zealand work.

I had several interviews with Mr. Greene, of the British Tabulating (Hollerith) Machine Company, and endeavoured to obtain quotations for the purchase of a Hollerith machine installation for the New Zealand census, but was unsuccessful. These machines are only rented, and I received particulars as to the rents which would be chargeable in New Zealand if we decided to install their machines. While in London I also visited the offices of the Comptometer adding-machines and the Gamameter duplicating-machines and obtained particulars.

I reached New York on the morning of the 15th May, and immediately made arrangements to meet Mr. Impey (then in New York), of Messrs. Morland and Impey, Birmingham, owners of the Australasian rights for the Powers tabulating-machines. I made representations to him to give the New Zealand Government terms for the purchase outright of the machines for their own use rather than the usual renting conditions, which he subsequently did, forwarding the quotations from Birmingham, England.

In New York I visited the Statistical Division of the Customs, where the import and export statistics for the whole of the United States are centralized. The Statistical Division, which is quite separate from the rest of the Customs Department, is for administrative purposes under the control of the Collector of Customs for the Port of New York, but so far as the work carried on in the division is concerned it is under the direction of the Department of Trade and Commerce at Washington. All reports prepared in the division are sent to the latter, and there, with other matters, incorporated in the publications of the Department. The work was all handled on Powers machines, and I was very much impressed by the efficiency and economy of the plant and the methods used. The Customs entries—imports and exports—were forwarded daily from each port. Immediately on receipt the entries were coded, then handed out to the card-punchers, who, averaging over three thousand per day per operator, transferred the particulars on each entry to a card. When the cards were punched they were immediately, in the chronological order received from each port, put through the tabulator, which listed them in full detail in duplicate. The lists were called back with the entry schedules and any necessary corrections made. The original of the list was then despatched to the Collector for the district concerned to bind and keep as the record of entries passed in his district; the carbon copy of the list was handed to a clerk, whose duty it was to have fresh cards punched for the corrected entries on list, and see these were inserted in place of the incorrect cards. It was this clerk who was charged with keeping the records of the punch-operators, whose individual weekly results, with number of errors, &c., were exhibited on the staff notice-board in the punch-room. The correct cards were then passed into the next room, where they were sorted and tabulated as required for the production of the statistical tables. The demonstration shown here convinced me that the Powers machines, on account of their automatic printing of details, are preferable for trade statistics to the Hollerith, the Powers slide punch being particularly economical and effective on this class of work.

When the Immigration Officers came on board the "Columbia" I got into touch with one of them, and discussed and noted their methods of dealing with immigrants. Later on I spent a day at the Immigration Offices on Ellis Island, and had thoroughly explained to me their method and procedure in dealing with the immigrant. The Canadian immigration authorities were, I found, provided with free office accommodation there to enable them to deal with immigrants for Canada arriving at New York, similar provision being made by the Canadian authorities for United States Immigration Officers (at Quebec) dealing with immigrants for America arriving via the St. Lawrence. The inquiries made and method of procedure of both the American and Canadian officers, which are almost identical, are extremely exhaustive and thorough. Not only are these exhaustive inquiries made in regard to the immigrants and emigrants, but the same exhaustive *questionnaire* has to be furnished by the shipping companies in regard to each member of the crew of every vessel entering or leaving a port of the United States. Fairly comprehensive and exhaustive statistics of the immigration and emigration to and from the United States are prepared, the tabulation work being carried out in America on the electric tabulating-machines of the United States Census Bureau, and in the case of Canada in the Bureau of Statistics at Ottawa. The greatest importance is attached to these, and I think rightly so; it is, I submit, essential for the study of the general drift of the nation to know and keep track of the character and growth of the population from migration—the complement of which would be the statistics of births and deaths similarly analysed, while, following the same uniformity in analysis, the position at each census is reviewed and studied.

As I have previously said, I do not think enough attention has been paid to these statistics in New Zealand in the past, and I have already recommended the South African card system for adoption in New Zealand. The South African card system is merely a modified edition of the system in force in the United States and Canada. In the United States the ship is required to furnish a manifest on which the full detailed particulars (some thirty-nine questions) in regard to each passenger and member of crew are entered. These are bound into volumes, and form a splendid permanent record in the Immigration Office, forming the foundation on which all letters of naturalization are subsequently issued.

I visited the offices of the Superintendent of Insurance for the State of New York, and ascertained the extent to which statistics of insurance (life, accident, fire, &c.) were obtained and published there. I found that insurance offices were required to furnish most detailed particulars in regard to their status and operations. I obtained forms and took notes of their work for consideration and guidance in the development of this branch of statistics in New Zealand.

I also visited the offices of the Moon-Hopkins computing-machine and the Dalton adding-machine, where the capabilities and various uses of these machines were demonstrated for me.

Several visits were made to the offices of the Hollerith and Powers machines, and different points in regard to the machines discussed with them. Following their advice as to where the best railway installations of their machines could be seen, I subsequently visited the offices of

the Southern Railroad at Washington (Hollerith—audit, disbursement distribution, and freight accounting); the Pennsylvania Railroad at Pittsburg (Hollerith and Powers in combination—freight accounting and statistics); the New York Central Railroad at New York (Hollerith—freight accounting and labour-cost statistics); the Boston and Maine Railroad at Boston (Powers—freight accounting). In each I obtained sets of the cards and forms used, &c., for reference after my return, and, as I fully discuss the merits, &c., of these machines subsequently, I need not further deal with them here.

In Washington, D.C., I spent a good deal of time in the United States Bureau of Census and Statistics, and was interested to observe that while the population census was being handled on the Department's own electric tabulating-machine, the agriculture statistics were being tabulated on a Hollerith outfit, one of the largest installations in existence, consisting of 488 punches, 49 verifying-punches, 65 sorters, and 59 tabulators.

The United States Census Bureau is quite a large establishment, there being over four thousand people employed when I was there, and additions were still being made. The point which impressed me here, apart from their excellent mechanical appliances and organization, was the number of qualified statisticians employed to study and write up the data handled. For the proper organization of a central statistical office, it has to be remembered that its work, unlike that of most Government Departments, which are mainly concerned with some one special duty, ranges over the whole field of the social and economic activities of the people. Obviously, therefore, the ideal statistical office should include on its staff a number of professional men and technical experts in the various fields, with a knowledge and experience of statistical methods and work; and it is essential for the production of good work that there should be sufficient specially qualified and able men on the staff. In the Canadian office, where centralization was so largely effected, the Officer in Charge of Transport and Power Plant Statistics (railways, waterways, tramways, electric- and water-power works, &c.) held engineering degrees, and while I was there a mining engineer was being added to the staff to take care of the examination and scrutiny of the returns collected for mining-production statistics. While I strongly hold that our own Statistical Office should have only properly qualified and able men in the responsible positions, I recognize that New Zealand is such a small country that the volume of statistical work is not sufficient to warrant technical specialists of this nature; such assistance should rather be obtained from the professional men and technical experts in the several administrative departments concerned; and the problem, therefore, in our case is to find a *modus operandi* whereby the technical and professional knowledge of the administrative departments may be closely linked up with and made available for the Statistical Office.

I saw over the branch (housed in a separate building) of the United States Bureau of Statistics dealing with vital statistics, which were tabulated on the Department's own electric tabulating-machines, and also the mechanical branch of the same bureau where these machines were made and experiments carried on for the further improvement of the machines—punches, sorters, and tabulators.

In the Post Office Audit Office at Washington I saw one of the most efficient Hollerith plants seen during my tour. The system adopted for the audit of the money-orders issued and paid was extremely simple, economical, and effective. The same cards which were punched and used for checking the money-order-paying office accounts were kept, resorted, and used for audit of the issuing office, thus establishing an absolute check on the two offices.

In the office of the Army Medical Statistical Division I was interested to learn they were just completing the tabulation of statistics in regard to the medical examination of men for their selected drafts, and also of the casualties in camp and overseas. Several tables shown me of the examinations of men rejected for the army were very informative as to the causes of rejection, &c. Before I left New Zealand it was arranged that the particulars as to casualties of the New Zealand Expeditionary Force should be tabulated in the Census and Statistics Office with the assistance and advice of a medical officer of the Defence Department, and bearing this in mind I arranged for sets of the forms, cards, &c., showing exactly what they were doing at Washington, to be sent to New Zealand for our consideration when on this work. The work was being carried out on a Hollerith machine outfit. If a tabulating-machine installation, either Hollerith or Powers, is obtained for our Statistical Office I would strongly recommend the tabulation of statistics of our New Zealand Expeditionary Force medical rejections also, which are probably even more important than statistics of the casualties.

In the Inland Revenue Income-tax Office at Washington there was a most efficient installation of Powers sorting and tabulating machines at work, on which very exhaustive and complete statistics of the incomes of the people were being compiled. The cards used were retained for some time and employed to ascertain various kinds of information for the Government, such as the effect of altering the rates of tax, or the numbers, size, and location of certain industries, &c. Much more use for statistics could be made of the information on our income-tax returns in New Zealand than is done, and I have already recommended my conferring with the Commissioner of Taxes for co-operation in the development of these statistics.

I also visited the offices in Washington of the Southern Railroad, the Department of Trade and Commerce (to see how the returns received from their Customs Statistical Division in New York, previously referred to, were dealt with), the offices and card-factory of the Hollerith Company, the offices of the Powers sorting and tabulating and Dalton adding machine companies.

An interesting office at Washington is the Efficiency Department, under Dr. Brown. The office, a small one, is staffed with experts in office organization, &c., charged with the duty of investigating the methods employed in the various Government Departments, and advising as to how economy can be promoted and efficiency raised throughout the service, with special reference to the introduction of mechanical and labour-saving devices where suitable.

From Washington I went to Pittsburg to see the Pennsylvania Railroad machine installation, then back to New York, and on to Boston to see the Boston and Maine Railroad installation. From there I went on to Ottawa, where I spent nearly a fortnight visiting Government offices. The Government Bureau of Statistics at Ottawa was only recently created as a separate Department, and I found the statistical work still in course of reorganization.

In Canada there are fairly complete statistics of fisheries, forestry, and internal trade and transport, in regard to which New Zealand is woefully deficient; but, generally speaking, in most other branches New Zealand statistics are quite up to the Canadian standard, and even a little in advance in some fields.

A feature of the Canadian Bureau was the mechanical branch, organized on the lines of the similar branch of the United States Census Bureau. The branch has a comprehensive plant, quite a number of machines of all kinds—adding, computing, sorting, tabulating, &c.—being employed. The machines in the branch were also made available for work of other Government Departments, and while I was there they were engaged on work for the Income-tax Department.

The census of Canada is taken on the *de jure* system, following the United States in this respect, while in New Zealand the census is taken on the *de facto* system, as in the United Kingdom and all other British countries.

*Trade Statistics.*—The trade statistics of Canada are now compiled in and issued from the Bureau of Statistics. The trade statistics are presented in three reports: No. 1 gives the general statement of trade for the year; No. 2 gives in detail the trade of Canada with each other country; while No. 3 gives a *résumé* of the trade statistics of other countries. The last is prepared largely for the use of Canadian producers and exporters; it appealed to me as deserving of consideration for imitation by New Zealand. The Canadian Bureau, apart from their *Statistical Monthly* and the Canada Year-book, issue their reports on the respective branches of statistics dealt with in separate volumes, some of which, such as mining and the like, are marked as compiled in collaboration with the administrative department concerned. Collaboration and co-operation of this kind is both advantageous and economical to the country, and there is scope for improved work along these lines in New Zealand.

In the office of the Superintendent of Insurance at Ottawa I found that the most complete details as to the operations and standing of the various insurance companies were obtained, tabulated, and published, showing particulars for individual concerns, considerably more extensive than the statistics of fire insurance in New Zealand initiated just before I left. After having seen the work being done in other parts of the world by the tabulating-machines referred to I am quite satisfied now that it would be easy to organize a system whereby the most detailed analysis of the fire-insurance business done in New Zealand could be compiled and produced. Given the co-operation of the various fire offices, an experience could be built up in a few years which would be of the greatest value. It is a matter I have noted for consideration when the Statistical Office is equipped with a tabulating-machine plant.

A suggestion of some importance in connection with census work was made to me here—namely, that the census schedule should be used to ascertain the number of people in the Dominion who are covered by life insurance. I think this is a social factor of the greatest importance, and I recommend that if possible room be found for an inquiry on this point on the next census schedule.

The vital statistics of Canada are at present in course of reorganization. They are primarily dealt with in the respective provincial offices, who report to the Bureau of Statistics at Ottawa. These statistics are not yet uniform throughout the provinces, some provinces being more advanced than others, &c. In order to see what was being done locally in regard to these, I returned from Ottawa to New York via Toronto, where I saw through the Registrar-General's Department there. I am satisfied that the New Zealand system of registration of births, deaths, and marriages is more complete and efficient, and that more advanced work is being done in this branch of statistics in New Zealand, than elsewhere within the Empire.

From New York I took train through to San Francisco via Los Angeles. The "Marama," on which my passage was booked prior to leaving London, was scheduled to leave on the 3rd July, but did not do so until Tuesday, the 13th July, at 11 a.m.

Taking a general survey of the various discussions, inquiries, investigations, &c., of my tour, two questions impress me as of outstanding importance, and deserving of special consideration, namely:—

(1.) The centralization of a nation's official statistics; and
(2.) The application of mechanical appliances to statistical analysis and accounting work.

A full discussion of each is therefore now submitted:—

### (1.) Centralization of a Nation's Official Statistics.

During my tour I endeavoured to ascertain the views held as to the position of statistics generally in each country, in addition to investigating the methods of collection and tabulation in use in connection with the respective classes of statistics, and the following remarks summarize the results of my observation in this connection. I found the experience everywhere was that for some years past greater attention to statistics had been manifested, and that greater demands were being made for more information and statistics; that the war very greatly accentuated this demand, and emphasized the need for accuracy and completeness in the statistics required. The necessity enforced by conditions arising out of the war of attempting to control and regulate supply and consumption showed how essential it was to have complete and accurate statistics as to all sources of supply and as to the nation's requirements for consumption. Where these were non-existent special steps had to be taken to obtain them, and, where the statistics were defective, to verify and correct them. The effect of all this was to direct the attention of all as never before to the value and importance of statistics in the study and direction of the life of each nation. The general drift of things could not be ascertained, studied, and watched without complete and accurate statistics. Consideration of the problem and of the reason why the war conditions should find the statistics in all countries deficient in so many respects has gradually forced the conclusion that the method hitherto generally or partially followed in regard to statistics, of allowing them to be dealt with as the by-products of administrative departments, was fundamentally wrong; that, while statistics were the by-products in many cases of administrative departments, there was also a distinct field for statistics apart from administration where

the statistician should be required to see that the statistics of each branch was properly and accurately compiled, and the whole co-ordinated and arranged so as to give complete and comprehensive information as to all social and economic activities and a general view of the national drift. In this field the statistician is held responsible not only for the mere collection and compilation of figures, but for the critical analysis of the results in such a way as to indicate most clearly their value and significance. This movement is evidenced by the creation in the several countries of separate statistical offices to which is transferred all purely statistical work, or, where that is not practicable, the administrative department is required to co-operate with the statistician for the production of the statistics he requires.

In Canada, as already stated, the Government Bureau of Statistics at Ottawa was only recently created as a separate Department. A departmental Commission appointed to investigate the unsatisfactory condition of the Canadian statistics recommended centralization as the remedy, and the creation of the Bureau, under a Dominion Statistician, in which the control of all Dominion statistics is centralized, followed. The following quotations from the Bureau's first report sets out the position :—

"The establishment of the Dominion Bureau of Statistics under the Statistics Act, assented to on the 24th May, 1918 (8–9 George V, c. 43), marks a fundamental departure in statistical policy and organization, and the beginning of a new era in Canadian official statistics. Briefly, the Statistics Act, which it is the function of the Bureau to administer, calls for the centralization and consolidation of all the purely statistical work of the Government, with provision for its organization on a scale commensurate with the national needs."

In the preface to the same report national statistics are referred to as follows :—

"The statistics of a nation are, in point of fact, the quantitative expression of the character and activities of the people, and hence are of the most profound significance. Once mere by-products of departmental accounting, they have long since passed the stage of being ancillary to administration in the narrow sense, and are a scheme or organization in themselves, framed with the broadest purposes in view. Their application is now, in fact, so general that a review like the following may have an interest if only as a correlated statement of the features in modern life which are of importance from a sociological and economic standpoint, the ceaseless interplay of which forms that bewildering composite usually described as the progress of the nation."

The report of the departmental Commission above referred to is instructive, and I think the following extracts will be of interest and pertinent to the present discussion :—

"Each department or branch charged either directly or indirectly with statistical investigation has concerned itself primarily with the immediate purpose only in view. This is, from the usual standpoint, quite as it should be: a department is not to be expected to regard points of view beyond the scope of the administration assigned to it. Nevertheless, the effect statistically has been to inculcate routine and the neglect of opportunities for furnishing wider information and service.

"The statistics are unequal in quality and value. There are instances, both Dominion and provincial, of imperfect statistical method resulting from (*a*) lack of expert knowledge of the subject under investigation, and (*b*) lack of appreciation of the nature and conditions of statistical measurement. The absence of leadership is nowhere more apparent than in the varying extent to which statistical methods have been developed in different branches. The whole question of reliability is involved in this. Without careful adjustment of method accuracy is impossible."

The Commission recommended "That there be created a central Statistical Office to organize, in co-operation with the several departments concerned, the strictly statistical work undertaken by the Dominion Government. The object of this organization should be to co-ordinate the statistics of Canada under a single comprehensive scheme, and so to extend them that they may meet the present needs of the country and follow the probable course of its development."

Following the report of the Commission the Dominion Government, in June, 1915, appointed a Dominion Statistician, and in 1918 created the Dominion Bureau of Statistics with complete jurisdiction in statistics, defining subsequently by Order in Council the interdepartmental relations of the Bureau as follows :—

"(1.) That all purely statistical investigations relative to the commercial, industrial, social, economic, and general activities of the people shall be carried out in the Dominion Bureau of Statistics.

"(2.) That with respect to such records of any department or branch of the Public Service as are of a statistical character the Dominion Statistician shall confer with the head of such department or branch, with a view to arranging that such records be collected and compiled in so far as possible in conformity with the methods and organization established in the Bureau, the object of such arrangement being the prevention of overlapping, the increase of camparability, and the utilization of departmental organizations in the best manner for statistical ends.

"(3.) That after such conference the Dominion Statistician shall, at as early a date as practicable, prepare a report on the statistical work of each department or branch of the Public Service, with a view to carrying out the above requirements, such report to be submitted to Your Excellency in Council for approval, with a view to effecting a permanent arrangement for dealing with the statistics collected by the Government; and

"(4.) That to further promote efficiency and economy all statistical compilations for the Government be carried out, in so far as practicable, by mechanical appliances, and that for this purpose use be made of the machines installed in the Bureau of Statistics."

In South Africa a central Statistical Office for the Union Government was established on the 1st April, 1917, under the charge of a Director of Census, assisted by a Statistical Council. The Council is to consist of not less than four and not more than eight members: at present there are four official and four non-official members, the Director of the Census being chairman. The function of the Council is to advise the Minister in regard to matters connected with the Act. Among the early general recommendations of the Council were the following which are apropos to the present discussion :—

"(1.) That the collection, tabulation, and publication of statistics for the whole Union should devolve upon the central office (excepting certain sections of statistics in regard to which existing arrangements were deemed to be sufficiently satisfactory).

"(2.) That the publication of statistics should be effected by the central office in sectional form according to the subjects dealt with, instead of in the previous form of one annual publication.

"(3.) That, in the absence of any reliable statistics in the following respects, advantage should be taken of the powers conferred by the Act—(*a*) To take a complete annual census of manufacturing industries; (*b*) similarly to take a complete quinquennial census of agricultural and pastoral production, and a census annually in less detail; (*c*) to make investigations as allowed by the Act in regard to rates of wages, hours and conditions of labour, the cost of living, and kindred matters.

"(4.) That in respect of various other matters where little or no statistical information has been available the deficiency should, as far as possible, be made good at the earliest opportunity.

"(5.) That, in spite of the abnormal conditions induced by the war, having in view the changes and developments to be expected after the cessation of hostilities, the work of obtaining accurate and sufficient data as to all the resources and affairs of the Union was one of pressing necessity.

"(6.) That an official year-book of the Union, giving in abstract all available statistical and official information, should be published annually."

The policy adopted in South Africa of having a Statistical Council, comprising both official and non-official members, to advise and assist the Statistician has much to commend it. The Council has power to co-opt other officials when dealing with the statistics connected with their administration, and aims at linking up the administrative with the statistical in each case so as to facilitate their co-operation. I discussed the work of the Council with the Statistician for the Union Government, and he assured me the arrangement was working very well indeed.

In Australia each State has a separate Statistical Office under a Government Statistician, while the Commonwealth Bureau of Statistics in Melbourne, under the control of the Commonwealth Statistician, Mr. Knibbs, is responsible for the Commonwealth statistics. The work there is largely centralized, and there is a very close co-operation between the State Statistical Offices and the Commonwealth Bureau.

In India there is a Director of Statistics, and during the sitting of the British Empire Statistical Conference in London a special Committee comprising all the representatives of the colonies and protectorates attending the Conference made the following recommendation for consideration of the Colonial Office:—

"That in all colonies and protectorates not possessing an adequately organized Statistical Office there should be instituted at the earliest possible moment a Statistical Council comprising the Colonial Secretary, the Collector-General or principal Customs authority, and one or two other officers of standing and experience, to deal with all questions affecting the statistics collected and compiled in the colony or protectorate."

Thus throughout the several parts of the Empire there has been a movement for the centralization and specialization of statistics as a field of its own apart from administration. There is also a strong feeling for centralization and unification in the United Kingdom itself, but so far, owing to what may be termed the vested interests of the several administrative departments concerned, it has not found concrete expression in the formation of a central Statistical Bureau. The calling of the Conference itself is merely another expression of the same idea, and of the desire to have a proper statistic showing the drift of the Empire as a whole. It is satisfactory, therefore, to find that the policy of centralizing statistics which is being gradually adopted in New Zealand thus finds confirmation in other parts of the Empire as the correct one to follow for producing a complete and accurate statistic. Centralization has only been partially carried out in New Zealand, and its extension requires careful consideration in each case.

(2.) Application of Mechanical Appliances for Statistical Analysis and Accounting Work.

During the course of my tour I took every opportunity of inspecting all kinds of adding, computing, and tabulating machines. Among those inspected the following deserve special reference:—

*Adding, Computing, Sorting, and Tabulating Machines.*

*Dalton.*—A ten-key electrically driven adding and listing machine, somewhat after the style of the Burroughs adding and listing machine in the Census and Statistics Office, but, owing to its having only ten keys, the Dalton is capable of being operated much faster. It has special facilities for computing also, but is primarily an adding-machine. I should like to see one obtained for use in our Statistical Office.

*Madas.*—This is a computing-machine very like the Millionaire, but with special facilities for division. A Madas would be very useful in conjunction with the Millionaire, and I recommend that one be obtained for the Statistical Office.

*Moon-Hopkins.*—This is a combination typewriter and computing-machine, manufactured in New York. It is specially adapted for commercial work, invoices, &c., all extensions and additions being made by the machine. I was much impressed by it, but it has not yet been adapted for English money. The manufacturers are unable to supply the local demands, and are therefore not yet considering the foreign market.

*The Pierce Tabulating-machine.*—The Pierce is a new machine, of which there are as yet only one or two in actual use, but is wonderful and almost superhuman in its operation. Each machine has to be specially built for the work to which it is to be put, and is not adaptable for other purposes. I was told of one being obtained for the War Risk Insurance Department at Washington. It is to be operated by a keyboard similar to that of an ordinary typewriter. A master card is first made. It will at the one operation both type the matter to be put on the card and punch a series of holes on the card which symbolizes the same matter. The master card will show the name and number of the insured, amount insured, the rate of premium, how

payable, due date, &c., and there is provision at foot to note the particulars and payments for five years. Once the master cards are made the machine will sort them into the order required; then when notices are to be issued the master cards are put through the machine, which will prepare the notice (typed and punched) for issue, and note on the master card that it has been issued, and the date. The notice is then posted to insured, who takes it to the nearest post-office when making payment. The postal clerk taking the payment detaches the punched part of the notice, receipts the typed part, which is returned to insured as his receipt. The punched part is sent to Washington as advice of payment. These advices as received are put through the machine along with the master cards. The machine sorts the advices into the same order as the master cards, notes the payment on the respective master cards, lists the outstandings in respect of which there is no payment, issuing at the same time a reminding notice, and marking in the appropriate place on the master card that such reminding notice has been issued, and the date. Necessarily a machine capable of doing what I have just described is complicated and costly. I do not think there is any work of such magnitude in New Zealand as would justify its adoption, and I merely mention it here to show the development of mechanical tabulation and accounting.

*United States Census Bureau Electric Tabulating-machine.*—The Mechanical Branch of the Census Bureau of the United States at Washington has produced an electric tabulating-machine of its own, which is used for compilation of census, vital, immigration, and emigration statistics. As in the case of both the Hollerith and Powers tabulating-machines, the work is handled on three machines—the punch, the sorter, and the tabulator. The machines of the Census Bureau are not on the commercial market, nor are they in use outside the Census Bureau except in the Canadian Statistical Bureau, which has a similar mechanical branch and has been allowed to copy and make the United States models. On these machines, as on the Hollerith and Powers, the method of work is to transfer the data dealt with to cards by punching a series of holes thereon symbolizing the various factors involved. The cards are then passed through the sorting and tabulating machines to obtain the tabulated results required. The cards are divided in the case of the United States machines into fields or zones, each corresponding to the respective details to be tabulated, while in the case of the Hollerith and Powers machines the card has forty-five columns with ten to twelve positions each, one or more columns, according to requirements, being allotted to each of the different factors being dealt with.

*United States Punch.*—The punch used is extremely simple, but not so good, in my opinion, as that of either the Hollerith or the Powers. The operators were not nearly so fast as on the other punches, 170 to 200 per hour being regarded as satisfactory work.

*United States Sorter.*—This machine seemed to be a fast and reliable sorter, working at the rate of 250 to 300 a minute.

*United States Tabulator.*—This is a really wonderful machine for the work on which it is used. It is adapted for unit analysis work, each card being counted only as one; it will not add, and cannot therefore be used where each card may represent more than one. It is an electric machine, and will print the totals in table form ready for the printer, extracting sixty different factors from the cards at one run. When I was in Washington the Department was at work on their 1920 census, and with inexperienced operators (two to each tabulator) each machine was averaging just on 100,000 cards per day. I was told that on vital statistics they had put through as many as 175,000 cards per day. One such machine would handle the New Zealand census in a few weeks.

I discussed the question of our obtaining some of their machines for New Zealand, and they were most cordial in their desire to assist in any way. They had no objection to our making the machines ourselves so long as we did not allow them to be used for commercial purposes. They also expected to be finished next year with some of the machines in use, and thought some of them might then be available for us on sale or otherwise. They suggested that the question should be raised by correspondence on my return if we wished to procure any. The Canadian Bureau of Statistics took advantage of the permission granted them to make and use these machines, and for this purpose they created a separate mechanical branch on the lines of the similar branch of the United States Census Bureau. I do not think, however, in the event of our obtaining permission from the United States and adopting their electric tabulating-machines, New Zealand should establish a mechanical branch on the same scale; rather the manufacture, application, and development of these machines could more economically and efficiently be carried out in the Electrical Engineering Branch of the Post and Telegraph Department, with which the Statistical Office could work in close co-operation and get the same benefits as if we had a branch of our own. I do not think the cost required to establish the mechanical plant or qualified staff necessary for the purpose in question as a branch of the Statistical Office would be justified. So far as the Hollerith or Powers machines are concerned, a very moderate mechanical equipment would suffice for attending to and keeping these machines in good running-order, and I have no doubt whatever as to the wisdom of New Zealand employing them; but as to whether any endeavour should be made to obtain the rights of the American census machine is a question in regard to which I have not been able to form a definite opinion. I see many advantages to be derived therefrom, but it would require an electrical engineer to determine the cost of manufacture and upkeep. I think to employ this machine for our New Zealand census would be like using a steam-hammer to crack a nut, and would not be economical. But if at any time the tabulator were made to add more than single units (and the mechanics are experimenting to this end), then its range of usefulness would be greatly increased, and it might be an opportunity for the New Zealand Government to obtain an excellent plant of its own. My impression is that at present for a country like New Zealand more efficient and economical service would be rendered by either a Hollerith or Powers plant.

*Hollerith and Powers Tabulating-machines.*—Both these machines operate very much in the same way, and use cards which are identical in form and marking. Although the agents in London would not agree that the same cards could be used on both machines, this was being done in the Post Office at Washington and in the Pennsylvania Railroad Office at Pittsburg. The main difference is that the Hollerith machines are electric, while the Powers are mechanical. Each plant consists of three machines—the punch, the sorter, and the tabulator. In addition

the Hollerith make a special counter for census work (with one, two, or three banks of counters), while the Powers make their sorter count as it sorts. Both plants have been proved out and now give every satisfaction in operation. I found the users of each, both in London and America, emphatic in asserting the superiority of their own plant. My own conclusions, after seeing a number of separate plants of each kind at work, is that they are complementary rather than competitive, each having certain advantages over the other on certain work. The fact that the Hollerith tabulator does not automatically print the results gives it an advantage in speed of operation over the Powers, which does print the results automatically; so that on work where a full record of the details is not required it is advantageous to use the Hollerith for part of the work (punching summary cards) for the totals of the partial results obtained from it, and passing these through the Powers tabulating, getting therefrom the printed results required. Where I saw both plants in operation together they were used in this way. Comparing the respective machines of each plant I make the following remarks:—

*Punch.*—The Hollerith punch is a small, simple machine, easily carried about from place to place. This is a very great advantage, as the operator can pick up the machine under her arm and go to wherever the data originates to punch the cards. The cards are hand-fed and removed by hand. The punch is not so accurate in registration, nor are the holes so clean-cut, as in the case of the Powers punch. Accuracy of registration is an essential feature of the Powers, but not so important with the Hollerith, as the electric brushes can establish contact over portion of the hole. On the Hollerith machine the cards are punched one column at a time, with the disadvantage that every mistake of the operator means a spoilt card. The wastage of cards in this way with poor or inferior operators is considerable, but in the case of good operators remarkably small. On this punch a wonderfully high speed is attained by operators with a natural talent for the work. In nearly all the plants visited an accurate record was kept of the work of each operator; in some a bonus was paid for good work, and in others the results were merely posted in the workroom and taken into consideration for pay and promotion. In a London office visited the operators were expected to do 400 per hour, and were averaging over that, while in the New York Central Railroad Office one operator punching thirty-six holes to a card was averaging just on 500 per hour (499, 501, 502, &c.). These averages were not for mere trial spins, but the actual weekly records.

In addition to this punch the Hollerith also uses another punch for the identification-holes which are common to each card, such as date, district, &c., usually covering the first five to seven columns of the card. This is called the "gang punch" because it punches eight to twelve cards at one time. It is not necessary to use this punch, as, of course, the whole card can be punched in the one operation, but it is found economical in time to do the work in two operations when the first series of holes applies to whole batches of cards. Ordinarily this gang punch is also a small punch operated and fed by hand, but in the Pennsylvania Railroad Office at Pittsburg they used a power-driven automatic feed and ejectment gang punch working at a very high speed; the cards were gang-punched first and supplies handed out to each operator. One machine kept the whole of the operators supplied. Both Hollerith punches can be purchased outright.

*Powers Punch.*—There are two punches made by the Powers—the key punch and the slide punch—and both are electrically driven with automatic feed and ejectment. They are both large and unwieldy in comparison with the Hollerith, and cannot so readily be moved about from place to place; they are usually fixed in one place and operated there. There is, however, no difficulty in having them moved to any place where current is available.

Unlike the Hollerith, the cards are not punched column by column, but in one operation, by the machine when the release-key for the ejectment of the card is touched. This has the advantage of allowing the operator to correct any mistake made before the card is punched, with the result that the wastage on account of spoilt cards is small. An operator is nearly always conscious when she has touched the wrong key, and here she is enabled to make the correction immediately. In the case of the slide punch the matter set up for punching is visible, and can be read off and verified by a glance; it can be operated by both hands, several columns being set at the same time.

Both punches combine the gang features of the Hollerith with the individual. Any column can be readily set and remain fixed as long as desired, thus cutting out the second operation of gang punching required on the Hollerith, which must mean a considerable saving in time. The slide punch particularly has some fine features of great advantage for certain classes of work—its visibility, and the rapidity with which its columns can be fixed and released. The Powers key punch is, I think, capable of being more rapidly operated than the slide by the expert operator, and should, I think, more than equal the Hollerith in speed. The United States Customs statistics were compiled on a Powers plant, and only the slide punch was used, which is specially suitable for that class of work. According to the record kept there the operators were averaging just on 3,000 per day, which must be regarded as excellent work. On New Zealand census work, in transferring the data from the schedules to cards by hand, 500 cards per day was considered satisfactory.

As a machine the Powers punch is, of course, more complicated and costly than the Hollerith. Comparing the two makes of punches, I consider the Powers punch superior to the Hollerith.

*Sorter.*—Both sorters are excellent machines, and there is really very little to choose between the two. Each will sort to twelve classes at from 250 to 300 cards per minute. The Powers sorter is fitted with counters, which count the number of cards sorted in each class, and also the total put through the machine, which is perhaps a slight advantage where such a count is required.

*Tabulator.*—The Hollerith tabulator is made with five counters, each running up to nine figures, with device to make any of them merely list or add; each counter can be further split if desired, and the connecting cords are very simple to operate. Several results can be taken off the cards at one run, and some of the counters can be made to cumulate the totals. An operator must always be in attendance on each machine, and the results are read off and taken down by hand. This is a great disadvantage as compared with the Powers tabulator, which automatically records its own results, clears, and goes on again; but, on the other hand, the

Hollerith works at the rate of 150 cards per minute, as against sixty cards per minute by the Powers. I may mention that the Hollerith Company are at present working on a printing attachment for their machine, which they hope to have perfected and on the market within twelve months.

The Powers tabulator differs from the Hollerith in several respects, but mainly in that it automatically prints off its own results, clears the machine, and starts on again, while the results have to be read off and taken down by hand from the Hollerith and machine restarted. It can be made to list or add, and has seven unit counters of nine figures each, as against the five on the Hollerith; the counters can also be split where required, but a separate connecting-box adjusted to the columns to be operated on has to be specially built for each distinct job. Thus in transferring from one job to another the connecting-box must be changed; the operation of changing the connecting-box is not a difficult one, however, and can be effected in a very few minutes. Where the machines are rented three connecting-boxes are supplied with each machine, and extra rent is charged for every additional box supplied. By arranging the work for the cards so as to use the same fields for more than one job the same connecting-box can be used.

As already stated, the Powers tabulator automatically prints its results; it will either give a detailed record of the data being tabulated on each card, or will omit all details and print only totals, and may be set to either list or add. It will *not*, however, as in the case of the Hollerith, cumulate totals, the machine being cleared each time it prints a total.

While the Powers tabulator works only at the rate of sixty cards per minute as against the 150 cards per minute of the Hollerith, yet on work where there is a large number of small classes being dealt with this disadvantage is largely discounted, owing to the automatic action of the Powers in printing, clearing, and going on again without stopping, whereas the Hollerith stops at the end of each class, and there is a delay taking down the results and in starting the machine again, which considerably offsets the difference in speed. On long runs, of course, this does not hold; also, owing to the same automatic action, so long as there are plenty of cards for it to work on, and paper to print its results on, the Powers tabulator can be left to run itself. In the Inland Revenue Department at Washington one junior clerk was attending to four Powers tabulators, and I was told he sometimes took care of six; all he had to do was to keep the machines fed with cards, and even if he neglected this nothing went wrong as the machine merely stopped. Both Hollerith and Powers tabulators are decimal machines, and require special provision built for English currency; on the Hollerith two columns are required for dealing with pence, while pence can be dealt with on one column in the Powers, which is an advantage in favour of the latter. In both cases, however, it has to be determined beforehand how many counters are to be built for English currency.

In regard to the general efficiency and economy in the use of either plant I desire to emphasize one or two points. I noticed the highest efficiency in each case was obtained from the larger concentrated plants where there was abundant, constant, and continuous work and a well-directed staff of expert punch operators, with a plant sufficiently large to require the continuous attention and care of a mechanic to regularly overhaul, test, and see that all the machines are always working smoothly and accurately. To attain and maintain speed and accuracy in punching the cards an operator must in the first place be properly trained, and then have continuous and constant work on the machine. The fastest operator is frequently the most accurate, and a falling-off in speed usually means an increase in the percentage of errors. Then, where no mechanic is in constant attendance small faults may at any time develop, which if not immediately rectified may result, before being noticed, in incorrect work and then considerable delay and loss. With a mechanic taking care of the machine such faults are not allowed to develop; the machines are all cleaned, oiled, tested, and tightened up twice daily, which, besides avoiding errors and delay, considerably extends the life of the plant. On the New York Customs statistics one mechanic attended to nineteen slide punches, eight sorting-machines, and thirteen tabulators. The card consumption in this office amounted to 750,000 a month.

Properly organized and directed, there is no doubt whatever as to the economy of the machines. They are, of course, seen to best advantage on the big jobs. Where hand methods are to be employed one is usually concerned to study to cut down the detail required to a minimum, but with the machines the extent of detail to be tabulated is of little importance. The bigger the job and the greater the detail involved the greater the economy. Once the detail is accurately transferred to the card it can be tabulated and analysed in any combination and to any extent required very rapidly and cheaply, with absolute accuracy. To all my inquiries as to the extent to which economy had been effected the replies were emphatic as to the value of the machines, but the estimates varied from 20 per cent. to 50 per cent. according to the size of the job. I was informed that it was difficult to say exactly what economy had been effected, owing to the fact that immediately the machines were introduced and their capabilities realized the scope of the work was enormously extended; in the majority of cases, I was told, they were now getting three to four times as much work for practically the same or less cost.

In the case of the United States Customs statistics I was told that in pre-machine time it took a staff of 115 to handle statistics for the New York port alone and issue one report. Now, with the machines and a staff of ninety they are handling five times the volume of work and issuing eight reports. They said that without the machines the increase in work and reports occasioned by the war could not have been handled.

Another great point in favour of the machine is the ease with which additional details to those determined on may be taken out. So long as the cards are retained any further particulars can be obtained from them at any subsequent time and with very little labour. For instance, I was told by the United States Army Medical Statistical Office in Washington that a medical Board sat to consider what statistical tables should be prepared from the records of the medical examinations of men for the United States Army, and determined that fifteen tables would cover all that was necessary. The Statistical Office then set to work, and after some twelve to fifteen months, with a moderate staff and a Hollerith plant, these were completed. As each table was completed it was examined carefully by the Board, and quite a number of unexpected points were brought to light, which led the Board to ask for two new tables. Major Love, in charge of the Statistical Office, told me they were able to get out these additional tables in just a little

over a week, whereas had they been doing the work by the old hand methods, to comply with the request for two such additional tables would have been equal to doing the whole job over again.

These machines are revolutionizing statistical analysis and accounting of all kinds. Their use is being rapidly extended, and the manufacturers are unable to keep up with the demands. The Powers are five months behind on their contracts, and the Hollerith are 400 installations behind, which will take them eleven months to supply, notwithstanding that their factory plant and space were quite recently doubled. These conditions, with an almost unlimited market and demand at home, made them reluctant to quote at all for far-away New Zealand, with its probably very limited demand, and I consider myself fortunate in being able to secure the terms and proposals I did. The adoption of either a Hollerith or Powers outfit involves our sending a man to their factory for training in the building, repair, and care of the machines.

In considering the application of these tabulating-machines to the work carried on in New Zealand Government Departments I am convinced that there is great scope for their employment either on accounting-work or on statistical analysis.

I have no hesitation in recommending, in the strongest possible terms, that a small plant of these machines should be procured and installed in the Census and Statistics Office. The plant could be used to test how far the machines would prove economical on any class of work desired by any Department. Remembering the conditions under which the machines give the best service, I think that, from the point of view of both efficiency and economy, it will be found advisable to centralize the machines in one office, as in Canada, and see that they are operated by experts, properly cared for, and kept in continuous work. In regard to the selection of either Hollerith or Powers plant, I recommend the latter as more suitable and serviceable for all-round purposes.

Before closing this report some brief reference to our statistical publications should be made. Representations were made to me at the High Commissioner's Office in London as to the lack of suitable literature for distribution, and of up-to-date information as to conditions in the Dominion. Certainly one of the disappointments of my tour was to find how little was known anywhere of New Zealand—practically no references to New Zealand were ever seen in the English or American newspapers. Apart from the need for specialized pamphlets, interestingly written and well illustrated, for the immigrant, the business man, and the tourist, I think something more is required from the Statistical Office. At present the Statistical Office issues a *Monthly Abstract of Statistics* and two annual volumes—the Official Year-book and the statistical volume—the latter being in four parts. The defect of the *Monthly Abstract of Statistics* is that it is mainly a mass of tables and figures. Much could be done to make it interesting and more informative if the few notes and comments now made were extended with further information as to conditions, &c., throughout the country. I am sure that this could be made to supply a much-felt want in the High Commissioner's Office, London, and with very little additional work or cost.

So far as the Year-book is concerned there is room for improvement, and it is hoped that more attention can now be paid thereto. The scope and object of the volume is all right, and the crux of the problem for its improvement lies in the employment of properly trained and qualified men in the senior positions on the staff.

With regard to the annual volume of statistics, this purports to give in detail all the statistics in regard to the Dominion, and is, as to scope and form, &c., a legacy from the past. I noticed that in the other countries visited the growing tendency is to issue from the Statistical Office a special report on each particular branch, which includes, besides the detailed tables, an analysis of their contents, with comments, &c., as to progress or movement. This, I think, is on improved lines, as it facilitates collaboration between the professional, administrative, and statistical experts in the writing-up of the data.

In conclusion, I desire to say that I am very grateful for the opportunity afforded me of gaining such extended experience and knowledge of statistical work in other countries, and I trust the statistics of the Dominion will benefit thereby.

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