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## The International Institute of Agriculture and the Information Infrastructure of World Trade (1905-1946)

*L'Institut international d'agriculture et l'infrastructure informative du commerce mondial (1905-1946)*

Federico D'Onofrio and Niccolò Mignemi

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## **The International Institute of Agriculture and the Information Infrastructure of World Trade (1905-1946)**

**Federico D'ONOFRIO \* & Niccolò MIGNEMI \*\***

**Abstract.** The International Institute of Agriculture was the first institution to engage in the systematic production and circulation of global data on crops, cultivated areas, and trade flows. This article analyses the process whereby statistical output became recognized as a specific mission of this intergovernmental organization, autonomous from other types of world information systems. We will study the Institute's Bureau of Statistics, looking at both its organization and its role in gathering, processing, and publishing data. Last, we will examine the international debates and data dissemination strategies of the Institute to identify how the Bureau's agenda evolved to address new priorities and adapt to the dramatic changes in the structure of world markets.

**Keywords.** agriculture, international organizations, history of statistics, market information systems, international trade

**Résumé. L'Institut international d'agriculture et l'infrastructure informative du commerce mondial (1905-1946).** L'Institut international d'agriculture (IIA) est la première institution à s'engager de manière systématique dans la production et la circulation de données globales sur les récoltes, les surfaces cultivées et les flux commerciaux. Cet article entend analyser le processus qui conduit à identifier la statistique comme une mission spécifique de cette organisation intergouvernementale et autonome vis-à-vis d'autres systèmes d'information à l'échelle mondiale. Le Bureau de la statistique de l'Institut est étudié en s'intéressant à son organisation, mais aussi à son travail de collecte, de traitement et de publication des données. L'examen des débats internationaux et des stratégies de dissémination des données de l'IIA permet enfin de questionner les évolutions dans l'agenda du Bureau, face aux nouvelles priorités et aux changements profonds observables dans la structure des marchés internationaux.

**Mots-clés.** agriculture, organisations internationales, histoire des statistiques, systèmes d'information sur les marchés, commerce international

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The emergence of world markets for agricultural commodities in the late 19th century made the need for global data on production, stocks, and consumption manifest to all parties involved. Private actors jumped in to fill the gap by providing forecasting and estimation services based in the major international ports, thus contributing to the rapid growth of the “information marketplace” over this period.<sup>1</sup> Private services had evident shortcomings, however. This article shows how the International Institute of Agriculture (IIA or the Institute hereafter) was created by governments to respond to these epistemic challenges by providing international statistics as a public good, and how the Institute’s statistical office (Bureau of Statistics or Bureau hereafter) managed to establish itself as a crucial node in the information infrastructure that underpinned world agricultural markets, becoming no less influential than the physical infrastructure of ports, steamboats, railways, and telegraph cables.

During almost 40 years of activity, the IIA contributed decisively to building what Ted Porter would call the “ontic furniture” of the global economy.<sup>2</sup> Its reports on crops and assessments of total world production became essential elements of the world as contemporaries knew it. It also left an enduring legacy to the Food and Agriculture Organization of the United Nations (FAO hereafter). Despite the two organizations’ diverging goals and different institutional cultures, the Bureau of Statistics established routines and models that the FAO maintained. Not by chance, the first of the FAO’s agricultural censuses was named the Second World Agricultural Census after the Institute’s First World Agricultural Census.

The rise of international statistics preceding the creation of the United Nations and related agencies has been the object of a small but growing body of literature.<sup>3</sup> The story of the Institute contributes to this literature, providing an analysis of the way an international knowledge infrastructure managed to maintain its centrality despite dramatic changes in the economic environment. Our article argues that the project to produce data on crops and markets was peculiar with regards to both previous initiatives and the interwar institutionalization under the umbrella of the League of Nations. The existing historiography discussed the IIA through the lens of diplomatic relations and interstate cooperation,<sup>4</sup> or focused on its role as a hub of scientific, economic and professional networks potentially promoting transnational

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1. J. ADELMAN, 2021, p. 192.

2. T. M. PORTER, 1994.

3. M. BEMMANN, 2018; id., 2019a; id., 2019b; A. RIBI FORCLAZ, 2016; R. CUSSÓ, 2012; id., 2020.

4. L. TOSI, 1989; M. HERREN, 2017; J. PAN-MONTOJO & N. MIGNEMI, 2017; N. M. NARYKOVA, 2022.

communities.<sup>5</sup> A thorough examination of the core mission of the Institute, namely to collect statistical data, was lacking, while the literature repeated dismissive remarks based on the politically motivated claims of Arthur Salter and Asher Hobson. This article thus leads to a reassessment of the overall significance of the IIA.

The Institute was created in the 1900s, in the context of a progressively more integrated market for agricultural commodities, where major European industrial powers, such as Britain or Germany, were essentially importers of key foodstuff (cereals, meat) and raw materials (cotton, linen, wood) and extra-European countries were mostly exporters of these same commodities.<sup>6</sup> Statistics quickly became the IIA's major task, since governments recognized that global markets required global figures. Governments not only funded an expanding – but always small and precarious – central structure in Rome. More importantly, they also provided the Institutes with national resources both for the collection of data – official agricultural statistics improved constantly over this period – and for their transmission. Finally, they agreed to harmonize, to a surprising extent, the procedures, methods and goals of data collection. They thus made the IIA a node of the knowledge infrastructure underpinning global markets. Its function could not be replicated either by individual countries – not even Great Britain or the USA – or by private actors, however well connected.

This environment changed, though, with the Great War and, even more dramatically, in the wake of the Great Depression. The market mechanisms of the early 20th century gave way to a structure of international trade that was dominated by bilateral agreements, quotas, and higher tariffs.<sup>7</sup> Nevertheless, the degree of centrality acquired by the Institute was such that it survived and, after a turbulent phase, flourished in the new climate. While the US remained outside the League of Nations, the Roosevelt administration invested significant human and diplomatic resources in the Institute and finally managed to reform its statistical service. For the likes of Rexford Tugwell, adviser to President Franklin D. Roosevelt and undersecretary for agriculture, or Henry C. Taylor, the dean of US agricultural economists, the Institute could provide an essential stream of information to control and manage international trade of agricultural commodities in a world that was increasingly moving beyond free trade.<sup>8</sup>

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5. A. NÜTZENADEL, 2008; S. CASTONGUAY, 2010; A. RIBI FORCLAZ, 2016; F. D'ONOFRIO, 2017; N. MIGNEMI, 2017.

6. K. H. O'ROURKE, 2000.

7. Recent research stresses the important effect of interwar protectionism, V. ARTHI et al., 2022.

8. IIA GA 1934, "Rapport sur la réorganisation des travaux d'ordre statistique, économique, juridique de l'Institut international d'agriculture" by Henry C. Taylor, p. 483.

The main lesson concerning international statistics that can be derived from the history of the IIA is, therefore, how the creation of the Institute coincided with the transformation of world crop forecasts and statistics from a good sold by private forecasters into an international public good provided by an institution (the IIA) acting on behalf of governments, and with their sanction. It demonstrates the importance of international organizations as central infrastructural nodes. It was this position in a network that gave the Institute an advantage over competing private or national providers of statistics.

Based on a thorough examination of the IIA archives and publications now in the historical collection of the FAO and the archives of the League of Nations, this article is structured into five sections and conclusions. The first explains how the IIA came into being and how its statistical work was initially organized. The second and third sections describe the infrastructure underpinning the institute's work – the staff, the telegraph and telephone transmission of data to and from Rome, the budget for the publication of information and the resources that went into spreading that information at national level. The fourth and fifth sections describe the life of the Institute in the interwar period and its relationship with the League of Nations and the United States and how the information infrastructure described in the previous sections enabled the IIA to survive in a changing world.

## **1. The beginning of the IIA: numbers for the market**

Under the impetus of David Lubin, a US citizen with deep connections to the American populist movement, in May 1905, the Italian government convened an international conference for the creation of the IIA.<sup>9</sup> The main mission of the Institute was to “Collect, study and publish as promptly as possible statistical, technical, or economic information”.<sup>10</sup> In a world marked by growing transnational flows of commodities and where price fluctuations in the major markets reverberated globally, this task was deemed essential to stabilize prices against speculators. Scandals originating in the USA had rocked the cotton and grain markets worldwide in 1898-1899, casting a shadow of suspicion on private forecasters who appeared to be intentionally manipulating data.<sup>11</sup> Reliable, objective data were thus deemed indispensable by agricultural organizations across Europe and the Americas to re-establish trade on new bases more favourable to farmers.

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9. L. TOSI, 1989; N. MIGNEMI, 2017.

10. Art. 9 of the Convention between the United States and other powers for the creation of an International Institute of Agriculture, signed at Rome on 7 June 1905, Treaty Series, no. 489, Washington, Government Printing Office, 1908.

11. J. L. PIETRUSKA, 2017; A. POPESCU, 2013.

In the ideal of Lubin, “a live crop-reporting center would be established in Rome under the auspices of all the adhering governments, in constant telegraphic communication with the producing and marketing centers of the world, giving out data of commercial, price-fixing value”.<sup>12</sup> If “price-fixing” world crop statistics were identified as a necessary component of the infrastructure of global markets, there was a widespread awareness that neither individual governments nor private actors were capable of producing this indispensable good. Private forecasters often had opaque vested interests and insufficient resources, while individual governments had limited jurisdiction. Instead, true global figures were needed to report expected supply at every moment. A world “summary” of production demanded a coordinated effort. The US government, for instance, had understood – as Lubin claimed – “that no world’s summary can be had so long as the greater number of units keep no summary, and that those that do keep it ‘helter-skelter’, without agreement as to time, measure or logic”.<sup>13</sup> An international organization that standardized data collection and aggregated information from throughout the world was identified by many governments as a possible solution.

The new institute was created as a truly governmental international organization, thus differing from the more informal structure of the International Statistical Institute.<sup>14</sup> Forty countries signed the initial convention, many of them colonies admitted as members “on the same conditions as the independent nations”.<sup>15</sup> When the IIA was inaugurated on 23 May 1908 and started functioning, it was headed by a president (a position informally reserved for Italians) and a secretary general, while the technical work was carried out by Divisions and Bureaus. Every two years, envoys of the member countries would gather in Rome for the General Assembly. In reality, the operations of the Secretary General and the President were supervised and – to a certain extent – directed by a permanent committee formed by the permanent representatives of the governments to the Institute. It was this Permanent Committee that held the real power in the organization and was itself divided into commissions responsible for the various divisions. Many members of the 2nd Commission of the Permanent Committee, in charge of the oversight of the Statistical Division, were experts in agricultural statistics and their control over their subordinate division was often very tight.

The statistical activity of the IIA reflected its governmental nature. It was meant to centralize, aggregate and communicate data from its members rather than collect data on its own. Following a survey of the crop reporting

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12. O. ROSSETTI AGRESTI, 1922, p. 215.

13. DLA, Part 1, Sect. 13, David Lubin to Luigi Luzzatti, 13 October 1906.

14. For the distinction between governmental and non-governmental international organizations, see B. REINALDA, 2009.

15. Art. 10 of the Convention for the creation of the IIA signed at Rome on 7 June 1905, see also L. TOSI, 1989, p. 31.

systems of the major countries, there was widespread consensus that US crop reports were the most effective.<sup>16</sup> As Lubin claimed in 1910, the most significant aspect of these figures was that the Department of Agriculture (USDA hereafter) published a single number (*une seule constatation numérique*) expressing the general condition of crops as a percentage of the previous year's harvest. Markets were thus informed, as the crop season progressed, of the expected variations in supply for the United States. According to Lubin, the IIA should replicate on a world scale what the US was doing at the federal level, namely "the deduction using the totals obtained for each state, of the big total for the United States".<sup>17</sup> This figure – the "single index", as it came to be called – was of obvious significance for the markets and it was the main goal of the Institute's Bureau of Statistics.

After the General Assembly of 1908, therefore, the Institute leadership selected the USDA statistician Charles C. Clark as the first chief of the 2nd Division and the Bureau of Statistics. The work programme presented by Clark in 1909 planned to collect and publish figures on the cultivated area and yield per crop, number of animals, import and export flows on international markets, existing stocks, and volumes for consumption and other possible uses. In order to publish "price-making" figures, not only the ex-post data on harvest, but also the crop conditions and the estimates of future harvest were of crucial importance. A network of corresponding statistical offices and institutions was therefore established.<sup>18</sup>

Since the Bureau of Statistics aggregated figures coming from the member countries, it was dependent upon the quality and timeliness of national data, which were very diverse. Certain countries, in particular, refused to assess future harvest. The Institute therefore led a campaign for the "Unification of Statistics" based on a methodology resembling the US approach. Indeed, the campaign met with some success before the war.<sup>19</sup>

Already in 1911, despite critical gaps in the data, Clark's successor, the Italian statistician Umberto Ricci was thus able to start issuing some provisional versions of the "single index" for the six crops monitored by the IIA. By giving simple and comprehensive indications on the expected supply, this would have been a real "price-making" piece of information, greedily sought after by market operators. In fact, the Institute had many competitors in the forecasting of world supply for major crops. World crop statistics were in

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16. COMMISSION ROYALE POUR L'INSTITUT INTERNATIONAL D'AGRICULTURE, 1909. This work also relied heavily on previous discussions held at the International Statistical Institute, see for instance, É. LEVASSEUR, 1902.

17. FAO Archives, IIA/CIS, E1, f. 26, Lettre circulaire aux délégués et aux amis de l'Institut (10 June 1910) by David Lubin [authors' translation].

18. PPC 1920, No. 11, 25 June 1920, Sous-Annexe E-1 "Le Service de la statistique générale ce qu'il est et ce qu'il pourrait devenir" by Umberto Ricci, pp. 586-611.

19. G. FEDERICO, 1982; F. D'ONOFRIO, 2016; N. M. NARYKOVA, 2022.



themselves a highly competitive market that the Institute was meant to disrupt by introducing – as we shall see – a new logic of public service.

## **2. The staff of the Bureau of Statistics**

Information collection was only one side of the problem. The IIA needed to create a permanent infrastructure equipped with adequate know-how to receive, process and communicate this information. An examination of the staff of the Bureau of Statistics shows the strategic importance of the Bureau within the Institute, but also the limits of the resources available and the poor working conditions, which made it relatively unattractive for enterprising and innovative researchers.

Despite its strategic role, the Bureau of Statistics was initially part of the 2nd Division, together with the Bureau of Agricultural Intelligence and Plant Diseases. These two bureaus formed the information service of the Institute, and their missions were interlinked even if each bureau was relatively autonomous, with its own chief. Thus, when Charles C. Clark arrived in Rome from the USA, he had to coordinate the work of the German Wilhelm Preyer and the Italian Italo Giglioli, in charge, respectively, of the Bureau of Statistics and the Bureau of Agricultural Intelligence and Plant Diseases.<sup>20</sup> In 1911, the two bureaus were established as independent services, but collaborated on specific projects or through regular exchange of data on fertilizers and oil cakes.<sup>21</sup>

Punctual and meticulous calculations were the core mission on which the reputation of the Institute's statistics relied, and one Bureau member was appointed to constantly monitor and validate the flow of data. However, there was no real enthusiasm among staff members, who judged this task dull, annoying and unrewarding.<sup>22</sup> The editors-translators preferred to focus on the editorial work which already filled their schedule. Each was in charge of several specific countries and products, a role which involved going through different materials and new publications, writing short notes and memorandums, and updating files and data. Moreover, they were regularly asked to make translations, manage correspondence, and answer requests from the member-countries. Editors were responsible for reviewing the proofs of the monthly bulletin and preparing the new yearbook, a task which fell primarily on French and English-speaking editors.<sup>23</sup>

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20. PPC 1909, No. 29, 10 May 1909, p. 202.

21. PPC 1911, No. 51, 4-5 May 1911, p. 113.

22. FAO Archives, IIA/CIS, H12, f. 61 (Dore, V.), Paul van Hissenhoven to the Secretary General, 10 April 1918.

23. FAO Archives, IIA/CIS, H12, f. 61 (Dore, V.), Victor Bruck, Pierre de Viguerie, Ralph John Peidmore and Charles J. Robertson to the Secretary General, 20 February 1933.

The statistical service was the Institute's largest department, employing more staff than the bureau of the Secretary General. It was even photographed in an official brochure presenting the IIA (Figure 1). The earliest list of staff members we were able to locate, dating from 1909, mentions two section chiefs – the second had just been appointed because of the heavy workload – under the supervision of the service chief, ten editors-translators and four stenographers, three of whom were in charge of calculations. All staff members save one were men, even the stenographers, a position often occupied by women in the other services of the IIA.<sup>24</sup>

Figure 1. *The mechanical calculator room*



Source. "Salle des machines à calculer", *L'Institut international d'agriculture. Son organisation, son activité, ses résultats*, Rome, Imprimerie de l'Institut international d'agriculture, 1923, p. 33 (courtesy of the David Lubin Memorial Library of the FAO, Rome, Italy).

As in other IIA services, most of the staff in the Bureau of Statistics were Italians, among subordinate positions especially.<sup>25</sup> The proportion decreased in the following years, and in particular from the 1920s, when non-Italians accounted for nearly half of the bureau's employees. This was a concern for other countries.<sup>26</sup> From the outset, the British delegate T. H. Elliott underlined that the most powerful member countries needed to have their representatives on the staff, "if only because it strengthens the confidence of the respective governments and affords a ready means by which the special experience

24. PPC 1909, No. 33, 24 September 1909, Annexe B "Liste du personnel", pp. 395-396.

25. A. HOBSON, 1931, p. 170.

26. For considerations on Italian attempts to maintain control over the Institute, also through the human resource policy, see E. TOLLARDO, 2018.

and knowledge of those governments can be utilised for the general good”.<sup>27</sup> Positions were thus assigned by balancing language requirements and the relative power of each member state.<sup>28</sup>

Remarkably, after Clark's resignation in 1911, no US employee worked in the Bureau, despite worries that the Institute may not respect the customary standards of the USDA.<sup>29</sup> In fact, the Americans did not abandon their attempts to influence the work of the Bureau of Statistics and promote their experience in this domain. For instance, in the summer of 1923, the USDA hired the Italian agricultural expert Cesare Longobardi, under a programme “for members of the staff of the Institute to become better acquainted with agricultural methods, agricultural institutions and organisations in the United States”.<sup>30</sup> Longobardi eventually served as assistant director in the Bureau of the World Census, headed by the American agricultural expert and former Chief of Statistics of the USDA, Leon Estabrook. Nevertheless – as further proof of the resistance of the entrenched Italian IIA bureaucracy – the Bureau of World Census, funded by the International Education Board, had to be created as a separate special body, only loosely connected with the Bureau of Statistics.<sup>31</sup>

The profiles of the Bureau employees were rather homogeneous. If a high-school diploma was sufficient for stenographers and accountants, editors generally had a bachelor's degree in commerce, economics or agricultural science, and arrived in Rome after serving in state offices, the civil service, or agencies specialized in agriculture and statistics in their own country. Among them, a small group of Russians and Ukrainians – then stateless – joined the Bureau after the Bolshevik Revolution. They were part of waves of recruitments that occurred after the Great War and in the mid-1920s, when the IIA was able to expand thanks to funding by the Rockefeller Foundation, but the level of turnover remained low and careers stagnated within the same bureau, with few advancements or promotions.

Throughout the history of the Bureau, the leading positions were occupied by skilled economists and statisticians, with international profiles. As already stated, Charles C. Clark initially headed the 2nd Division where the statistical service was coordinated by the German Wilhelm Preyer and the Swiss Gaetano Donini. Both were experts in agricultural economics and

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27. FAO Archives, IIA/CIS, E1, f. 26, T. H. Elliott to Raffaele Cappelli, 7 June 1910.

28. PPC 1909, No. 27, 5 May 1909, Annexe B “Rapport de la 2<sup>e</sup> Commission permanente sur le programme des travaux du Bureau de la statistique générale des renseignements agricoles et des maladies des plantes”, p. 151.

29. A. HOBSON, 1931.

30. FAO Archives, IIA/CIS, H12, f. 65 (Longobardi, C.), Asher Hobson to Edoardo Pantano, 16 May 1923.

31. A. RIBI FORCLAZ, 2016, p. 56.

had significant political careers in their respective countries.<sup>32</sup> Despite the opposition of Lubin, who supported a US candidate, Clark's role went to Umberto Ricci, "the best among Italian agricultural economists"<sup>33</sup>, according to his colleague Ghino Valenti.<sup>34</sup> Paul Van Hissenhoven, a Belgian expert on international grain trade, succeeded Ricci and headed the service during the First World War. When he left in 1919 after clashing with different members of the Permanent Committee, Ricci came back for an interim period.

Starting from 1923 and until the dismantling of the Institute, the Bureau was headed by Valentino Dore, who had entered IIA service in 1909. Dore concluded his law studies at the University of Rome in 1908, the year before applying to the IIA for the position of editor-translator. Together with a good knowledge of French and German, the quality of his statistical work was soon recognized. Dore thus travelled through Europe and participated in numerous agricultural and scientific conferences as the Institute's representative. Meanwhile, he was responsible for validating all the numbers produced by the statistical service. During the Great War, when he was drafted into the Italian Army, the president Marquis Cappelli wrote to the Supreme Italian Command to reclaim him for the Institute, stressing his importance for the production of data on food supply and trade.<sup>35</sup> Dore was finally able to return to the IIA in the summer 1917 and, in 1923, the Permanent Committee promoted him to chief of the Bureau of Statistics where he remained until 1947, also serving as acting Secretary General in 1928-1929, before the appointment of Alessandro Brizi. Although American observers had identified Dore as part of the so-called "reactionary forces" that orchestrated Fascist control over the IIA,<sup>36</sup> he joined the temporary staff of the FAO after the war. In the spring of 1947, Dore performed several field studies on the statistical services in Turkey, Portugal and Greece, and was employed as a consultant by the Division of Economics and Statistics of the FAO, moving to Washington DC, where he died in November 1948.<sup>37</sup>

Routine work and small salaries relative to the workload required, had made the management of the Bureau unattractive for non-Italians. As Arthur Salter, future head of the economic and financial section of the League of

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32. Preyer (1877-1959) was a prolific scholar of agricultural economics, who had previously worked on the Russian sugar industry, BUREAU DES REICHSTAGES, 1925. On Donini, see P. MOSER, 2022.

33. FAO Archives, IIA/CIS, E1, f. 26, Ghino Valenti to Raffaele Cappelli, 14 May 1910 [authors' translation]. On Ricci, see P. CIOCCA, 2016.

34. FAO Archives, IIA/CIS, E1, f. 26, Lettre circulaire cit. by D. Lubin [authors' translation].

35. FAO Archives, IIA/CIS, H12, f. 61 (Dore, V.), Raffaele Cappelli to Luigi Cadorna, 10 November 1916.

36. A. RIBI FORCLAZ, 2016, p. 55.

37. FAO Archives, IIA/CIS, H12, f. 61 (Dore, V.), Telegram by Albert van Houtte, 26 November 1948.

Nations, pointed out, “At the start a considerable amount of organising skill and imagination were necessary. By now the greatest part of the work is repetition work of a routine character which is left in an ordinary Government Department to quite subordinate clerks, with a relatively small preparation requiring professional skills and very little indeed requiring administrative ability.”<sup>38</sup> This situation and the efforts of the Italian government to be influential in the Institute, on the other hand, gave opportunities for local employees to receive training and gain recognition for their expertise. Foreign economists and statisticians continued to visit Rome but they preferred to lead the work of the Bureau from supervisory positions. As we shall see later, this was the case for two well-known figures appointed as US permanent representatives in the interwar years: Asher Hobson and Henry C. Taylor.

### 3. Dissemination

The Bureau of Statistics produced an enormous amount of information throughout the four decades of the IIA's life. Periodical publications were the primary (but not unique) means used to disseminate these figures. Starting from 1910, a monthly *Bulletin de la statistique agricole* (*Bulletin of Statistics* hereafter) was published in five different editions: French, English, Italian, Spanish, and German. Initially, after long discussions to decide which crops were significant enough for world trade to be included, the IIA monitored six cereal crops (wheat, rye, barley, oats, maize, rice) and cotton. The emphasis in this period was mostly on setting up the statistical machine and demonstrating that world crop statistics were possible, but the list of monitored crops quickly expanded, sometimes also in response to demand from farmers' organizations.<sup>39</sup> In 1912, for example, sugar beet and cane, linseed, vines, tobacco, and silk cocoons were added and, by 1919, potato, olive, hemp, hop and rape, among others.<sup>40</sup>

For each crop, the *Bulletin of Statistics* included the following elements: area under crop; an estimate of crop conditions by means of index figures; statistics of production proper, which usually included a forecast when harvest was approaching followed by a final estimate after the campaign was completed. Data on livestock were also included, as well as statistics on imports and exports per country, existing stocks, freights, and prices on the different cash, delivery and future markets.

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38. UNOG, LON R1026/13A/2594/1308, “Confidential Report on his Visit to the Institute, giving general Information on the Work and the Functions, and criticising its Constitution” by Arthur Salter.

39. DLA, Part 4, Sect. 6, J. P. Dargitz (California Almond Growers Exchange) to David Lubin, 28 June 1910.

40. PPC 1919, No. 1, 29 January 1919, Annexe B “Rapport du Secrétaire général sur les publications régulières de l'Institut”, p. 35.

With around 40 octavo pages at the end of the 1910s, the *Bulletin of Statistics* was a small brochure compared to the more than 100 pages of the *Bulletin des renseignements agricoles et des maladies des plantes* and the *Bulletin des institutions économiques et sociales*. However, unlike the other two, which could be easily delayed, regularity was of paramount concern for the statistical bulletin and its publication had to be scheduled every month at the same date. It was exceptional for another reason: the copies of its English edition were largely superior in number to the French version, despite the fact that French was the Institute's official language. The limited number of pages was probably one of the reasons why, during the first years, the price of the *Bulletin of Statistics* was two thirds lower than that of the other bulletins. It was only in 1919 that the Secretary General proposed to equalize the costs of the annual subscriptions, partly because the statistical notes, and the data on the international trade of fertilizers and concentrated animal feed had been provided at no extra cost to readers until then.<sup>41</sup>

These publications weighed heavily on the finances of the Institute. Initially, given the value of the information, Lubin had expected that subscriptions and sales would cover the cost. Moreover, the Institute had even imagined that its bulletins would attract advertisement, encouraging international relations in the machine, seed, and crop markets.<sup>42</sup> However, while more than 7,000 copies of the *Bulletin of Statistics* were printed every year, private subscribers were still rare, as noted by a 1919 report.<sup>43</sup> As shown in Table 1, more than a half of the printed bulletins were, in fact, given out for free. Copies could be sent to member countries, kept for the delegates in Rome, exchanged for other journals and periodical publications, or made available through subscriptions paid by governments. This was the case for the territories of the British Empire and for the around 1,800 copies of the *Bulletin of Statistics* that flooded into the US in the 1910s in return for the US government's annual special contribution. Private subscribers were limited in total numbers but their proportion was higher for the Italian and the Spanish editions, proving the interest in the Institute from these linguistic areas, Latin America in particular.

Alongside the monthly bulletin, in 1911, the Institute added the *Annuaire international de statistique agricole* (*Statistical Yearbook* hereafter), which, over time, acquired a table of contents in English, French, Italian, Spanish, and German. It included data on the total area (productive and unproductive), the population of all countries and the area under various crops and their yields, along with livestock statistics. It also provided comparative tables showing

41. PPC 1919, No. 1, 29 January 1919, Annexe B cit., pp. 31-32.

42. PPC 1911, No. 52, 11 May 1911, Annexe "Compte-rendu moral et administratif des travaux de l'Institut pendant l'année 1910", pp. 179-180.

43. PPC 1919, No. 1, 29 January 1919, Annexe B cit., pp. 19-49.

Table 1. Recipients and printed copies of the Bulletin of Statistics per type and language, 1913-1918

Bulletin of Statistics 1913-1918	French			English			Italian			Spanish			German*			Total	
	Average	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Average	
Recipients																	
Governments	681	596	699	370	328	438	38	37	38	290	280	297	110	131	134	298	
Country delegates	27	23	30	3	2	3	11	10	12	7	4	9	2	2	3	10	
Governments in exchange for contributions or subscriptions	-	-	-	1,853	412	2,151	-	-	-	-	-	-	-	-	-	371	
Private subscribers	72	48	104	111	57	283	149	96	206	109	96	126	22	14	47	93	
Exchanges with other journals and periodicals	208	185	270	83	67	107	132	115	150	56	44	70	135	157	165	123	
Free copies	332	264	464	385	94	1,789	253	199	304	99	85	111	96	104	122	233	
Printed stocks	30	30	30	30	30	30	30	30	30	30	30	30	25	30	30	29	
Bureaus of the IIA	72	67	75	41	31	53	58	53	65	36	27	46	31	29	45	48	
Official correspondents and propaganda	20	20	20	20	20	20	20	20	20	20	20	20	17	20	20	19	
Printed copies	1,717	1,500	1,900	3,333	3,100	3,600	833	800	1,000	700	700	700	617	600	900	1,440	
% Bulletin of Statistics in the total number of copies of the three Bulletins	32%			48%			33%			20%			32%			35%	

Note. \* Publication of the German edition of the *Bulletin of Statistics* continued until 1917 while the two other bulletins stopped in 1915, after Italy entered the First World War.

Source. PPC 1919, Annexe B "Rapport du Secrétaire général sur les publications régulières de l'Institut", pp. 44-45.



the number of livestock and extent of productive area over the years.<sup>44</sup> Next to the agricultural statistics, there was a section on trade, with data on world trade, the consumption of agricultural commodities, their prices, freight and exchange rates. The yearbook also published figures for fertilizers and chemical products useful to agriculture, showing production, international trade and prices.<sup>45</sup> By 1946, the last year of its activity, the number of products surveyed by the IIA had grown to 80, of which 42 crops (providing data on their cultivated area, production and yield per hectare), 5 processed products including silkworm, dairy and poultry farming, and 13 species of livestock. The volume on international trade provided an inventory of 67 crops and processed plant products, and 13 livestock and animal products. Published in three volumes after the dissolution of the Institute, *The International Yearbook of Agricultural Statistics 1941-42 to 1945-46* was the “swansong” of the Bureau of Statistics.<sup>46</sup> This joint work of the IIA and the European Bureau of the FAO testifies to the continuity between the Institute and the new agency of the UN.<sup>47</sup>

Despite the often-lamented shortages of funds and personnel, the staff and the tabulating machines available to the Bureau of Statistics represented significant calculating and editing power for the time. Nevertheless, it was not so much the resources concentrated in Rome that made the difference, but the continued support of governments.

From the very beginning, the Permanent Committee members who supervised the work of the Bureau of Statistics worked hard to convince representatives of governments gathered in the General Assembly of the validity and importance of IIA’s data compared to what was already available on the information market. At the General Assembly of 1911, for instance, the German delegate to the Permanent Committee, Traugott Mueller, himself an expert on agricultural statistics, presented an extended defence of the first two years of IIA statistics. He compared the figures published by the IIA with the forecasts and assessments of its English and French private competitors, describing the goals of the Institute and the constraints it faced.

Mueller concentrated on wheat production and examined three publications widely available to subscribers: J. E. Beerbohm’s *Evening Corn Trade List*, Georg Dornbusch’s *Floating Cargoes Evening List* and Broomhal’s *Corn Trade News*. With major producers located in different hemispheres, he remarked, uncertainty about the actual harvests continued all year long: as

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44. The monitored crops were initially wheat, rye, barley, oats, maize, rice, potatoes, sugar beet and cane, vines, olives, coffee, hops, tobacco, cotton flax and linseed, hemp, rape, sericulture.

45. PPC 1919, No. 1, 29 January 1919, Annexe B cit., pp. 36-38.

46. FAO Archives, IIA/CIS, H12, f. 65 (Longobardi, C.), Cesare Longobardi used the expression in a letter to Albert van Houtte, 31 October 1946.

47. A similar process could be observed for the library collection, see N. MIGNEMI, 2020.



soon as the harvest was being assessed in the Northern hemisphere (by the end of October), assessments of surfaces under crop began for the Southern hemisphere whose harvest was not expected until December and January. Private forecasters, argued Mueller, ventured into risky speculation about global production. In August 1910, he explained, while the IIA only had information from 7 European and 2 American countries, Broomhall and Dornbusch published information on 22 European and 6 American countries, and Beerbohm on 19 European and 6 American countries. Mueller emphasized the arbitrariness of these forecasters' evaluations. He calculated that only one third of the quantities they assessed had a solid basis, and pointed out that the degree of agreement between private forecasters actually decreased in October, when more reliable data became available and when the forecasts should have become much more similar!<sup>48</sup>

But once Mueller had ascertained that private forecasters were unreliable, what could be said of the Institute? For the countries that reported on wheat, IIA data was more accurate than those of Broomhall, Beerbohm or Dornbusch, but the crop reports were issued much later. Figures for the wheat harvest of 1910 were published in December by Beerbohm and Dornbusch, while the Institute only released them in March 1911, and the difference between the IIA's and the forecasters' numbers was only 2.48 (Beerbohm) and 3.24 percent (Dornbusch). It is evident that for market operators – merchants and sellers – the IIA's delayed numbers could only have value as historical records.

The problem did not really lie with the Institute. It was the task of governments to improve the quality and frequency of crop reporting. Indeed, at the General Assembly of 1913, Mueller boasted a massive expansion in the comprehensiveness of the Institute's figures, since more countries by then were reporting not only the figures for harvest but also their expectations about future production, and were doing so faster. By 1913, 27 countries reported forecasts and data according to the methodology prescribed by the IIA and 11 more were following other systems but promised to standardize their methodology. The number of observations reported to the IIA increased from a total of 166 in 1910, to 244 in 1911 and to 246 in 1912.<sup>49</sup> With more and more observations coming from the member states, the quality of the IIA's statistics improved and the Institute reinforced its position as an information hub. At the same time, efforts were made to increase dissemination, for example, by sending supplements to the subscribers of the *Bulletin of*

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48. IIA GA 1911, "Rapport présenté à l'assemblée générale sur la question du programme des travaux, concernant le service de la Statistique agricole générale" by Traugott Mueller, p. 187.

49. IIA GA 1913, "Statistique Agricole" by Traugott Mueller, pp. 310-311. This happened despite the fact that some countries, including Russia, one of the major wheat exporters, opposed the publication of reports on crop conditions. See N. M. NARYKOVA, 2022, p. 130.

*Statistics* to provide updates on “information of vital interest for world agriculture or the international trade of agricultural products”.<sup>50</sup>

The distribution of IIA publications does not fully represent the dissemination of the data, however. Various organizations cited or republished the information produced by the Institute, and the *Bulletin* and the *Statistical Yearbook* were held in libraries to serve as reference for a variety of actors. In the 1910s, for instance, the Bund der Landwirte, the strongest agrarian lobby in Germany, and the Landwirtschaftsrat made the data available to local farmers as did the French Confédération nationale des associations agricoles. The Institute itself hired a press agent to communicate data to the media, while governments of the member countries could request specific information via cable. Moreover, in the interwar period, the information produced by the IIA was disseminated by specialized journals in at least ten countries.

Crucially, after the war, the Institute’s data were republished by the most important international organizations of the interwar period: the League of Nations in its monthly bulletin and yearbook, the Institut International du Commerce, and the International Statistical Institute.<sup>51</sup> While the IIA did not replace private forecasters, the success of its statistics was indirect and proven by their dissemination and reproduction all over the world.

#### 4. The IIA and the consequences of the war

The IIA was created to respond to the needs of farmers and merchants who operated on a global market, within a “food regime” characterized by unprecedented integration of international markets for agricultural commodities.<sup>52</sup> In this context, IIA statistics were meant to restore the laws of supply and demand in markets distorted by speculation. But when the First World War turned agricultural commodities into central strategic assets, the Institute tried very hard to make itself important and necessary despite disrupted trade flows. In 1915, faced with the pressing needs of the Allied governments, the IIA added the *Notes statistiques sur la production des céréales* to the monthly bulletin. The *Notes* were issued every six months, in April or May and October, with the fundamental aim of comparing world supplies and world requirements of the principal cereals in order to anticipate a food surplus or deficiency. It included tables of areas harvested, yields, stocks, imports and exports, estimates of consumption for every country where they were available, and for each hemisphere. Finally, it listed prices and freight rates.<sup>53</sup>

50. PPC 1919, No. 1, 29 January 1919, Annexe B cit., p. 31 [authors’ translation].

51. IIA GA 1932, “Rapport du Secrétaire général sur les Services et l’Administration de l’Institut” by Alessandro Brizi, p. 335.

52. H. FRIEDMANN & P. McMICHAEL, 1989; F. KRAUSMANN & E. LANGTHALER, 2019.

53. LEAGUE OF NATIONS, IIA & ISI, 1919; PPC 1919, No. 1, 29 January 1919, Annexe B cit., p. 38.

Lubin, the US delegate, insisted that collection of data on the supply of cereals should not be interrupted since Washington needed them to plan the wheat campaign while keeping the needs of the allies in mind. Yet, it is unclear whether the Institute was capable of satisfying the expectations of the Allied governments or whether it was Lubin himself who wanted the Institute to just do something.

While the Institute's statistical network survived the war, the establishment of the League of Nations and of its specialized agencies, such as the International Labour Organization, led to the emergence of fierce competitors for the IIA. The League was eager to assert its primacy, and this led to a discussion on the Institute's autonomy and its role in creating statistics. In 1919, Arthur Salter criticized the IIA's statistical work: "Its sources are governmental, its channels of communication are governmental and it is principally to governments to which it circulates its information and results. With private internationalism it has practically no connection".<sup>54</sup> In particular, he pointed out its unwillingness and inability to convert into a centre of analysis: "The Institute is essentially an intelligence department drawing at second-hand upon work already accomplished by the various Governments".<sup>55</sup> The reliance on government sources stood in stark contrast with the mission of the Financial Committee of the League, which Salter eventually headed and which put so much effort into economic analysis and studies of economic cycles.<sup>56</sup> The IIA, instead, had to accept all the figures coming from governments. Originally, this had been decided to prevent manipulation of information by private actors, but for Salter the conflict was no longer between market speculators and well-meaning governments. Governments were just as likely to lie and the Institute was unable to denounce such lies: "Even if experts know that the figures supplied by a Government are incorrect or deliberately falsified, the Institute is still bound to publish them without comment".<sup>57</sup> For him, the authority of the figures could not be based on government claims, but had to be validated jointly by multinational experts: "some endeavour might be made to get more effective criticism of the figures by arranging periodical meetings of the official statisticians responsible for producing the figures in each country".<sup>58</sup>

Nevertheless, in terms of membership, the Institute had an unquestionable advantage over the League. It was much more international and much less European, since it included a number of American (the USA among them) and Asian countries that were not League members. Initially, at least, the post-war situation enabled the Institute to promote its statistical service

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54. UNOG, LON R1026/13A/2594/1308, "Confidential Report cit." by A. Salter.

55. *Ibid.*, p. 5.

56. P. CLAVIN, 2013.

57. UNOG, LON R1026/13A/2594/1308, "Confidential Report cit." by A. Salter.

58. *Ibid.*

on a global scale and led to the inclusion of the IIA figures in the Statistical Yearbook of the League of Nations. Already in June 1920, despite Salter's perplexity, the Economic and Financial Committee invited the IIA to join the International Statistical Committee set up to coordinate international statistics.<sup>59</sup> At the same time, the importance of IIA statistics was recognized by the inter-governmental World Economic Conference held in Genoa in 1922, where the Institute managed to establish its exclusive competence for international agricultural statistics.

The relationship between the IIA and the League of Nations deteriorated quickly for a number of reasons, including the "diplomatic activism" of the Italian fascist regime and the worsening relationship between the US government and the Institute – which led to a dramatic cut in IIA's funds and a much-publicized spat between the Italian leadership of the Institute and the American delegate Hobson. Over time, though, the United States proved, perhaps, to be the Institute's major supporter.<sup>60</sup>

## **5. American interwar initiatives: a new role for the Institute**

As a major exporter of agricultural products and a major importer of certain agricultural raw materials – a role that the war and the post-war European protectionism did not alter – the United States had a very well-established service to observe trends in world agriculture,<sup>61</sup> but even the USDA Foreign Agricultural Service was not in a position to replace the Bureau of Statistics of the IIA. Instead, as observed by the American economist and US delegate Asher Hobson, the IIA could "render a foreign agricultural information service for all nations".<sup>62</sup> The USA, therefore, continued investing heavily in the Institute while remaining outside the League of Nations.

Hobson became the US delegate to the Institute in 1922. His appointment helped to revive American support and develop the Institute's activity, thanks also to the fact that, unlike many of the national delegates to the IIA Permanent Committee, he was not a low-ranking diplomat but an enterprising agricultural economist who had studied with Henry C. Taylor at the University of Wisconsin-Madison.<sup>63</sup> Hobson was thus well integrated in the community of agricultural economists and reformers from Cornell, Columbia, and espe-

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59. UNOG R291/10/12142/80, Representation of the International Institute of Agriculture on the International Statistical Committee – Correspondence concerning the Services of Mr Louis-Dop, 17 December 1920.

60. L. TOSI, 1989; M. HERREN, 2017.

61. On the USDA Foreign Agricultural Service, see H. TYLER, 2023.

62. A. HOBSON, 1930, p. 59.

63. University of Wisconsin-Madison Archives, Oral History Interview: Asher Hobson (361), 1983.

cially the University of Wisconsin, who underpinned the “agricultural New Deal” launched after Roosevelt’s victory.<sup>64</sup>

Soon after his arrival in Rome, Hobson managed to secure Rockefeller willingness (from the International Education Board) to fund a World Agricultural Census under the lead of an American, the USDA official Leon M. Estabrook who had helped to renovate the crop reporting services of Paraguay and Argentina.<sup>65</sup> Despite the failure to involve all members of the Institute (only 38 countries actually provided the data), the importance of the census for the Institute’s crop reporting system cannot be underestimated, as it provided a reference point for all subsequent calculations of areas under crop. As the Institute’s Secretary General put it in 1924, the census “would mark a decisive step towards the unification of statistics relating to agriculture and towards the improvement of the international service of agricultural statistics”.<sup>66</sup>

The Census nonetheless highlighted the rift between the Americans and the Italian leaders of the IIA who tried to maintain Italy’s hold on all top positions. Hobson, who hoped to become the first non-Italian Secretary General, engaged in a furious battle with the president of the Institute, Giuseppe De Michelis. When Hobson left in 1931, the United States stopped paying its membership fees and the lack of funding was greatly resented in Rome. This did not prevent the Secretary General, Alessandro Brizi, from controversially boasting, before of the General Assembly of 1932, about the major expansion of the monthly *Bulletin of Statistics*, not only in terms of pages, country and products included, but also in terms of the exactitude and rapidity of results thanks to the steadily increasing use of telegrams to receive and communicate data, as shown in a publication paying homage to President De Michelis (Figure 2).

The unification of statistics, Brizi claimed, had greatly progressed, with the establishment of statistical services between 1930 and 1932 in China and Persia, the creation of a service for the assessment of surface planted with winter cereals in Germany, annual livestock surveys in Poland, improvement of methods for measuring surface under crop in Poland, Czechoslovakia and Italy, biannual surveys of livestock in Canada, improvement of statistics in Austria, better census data in Kenya, improvement of Brazilian coffee statistics, better measures of wheat stocks in Canada and USA.<sup>67</sup>

It was not until 1933, through the mediation of J. J. L. van Rijn, the Dutch delegate and future vice-president of the Institute, that the Italian

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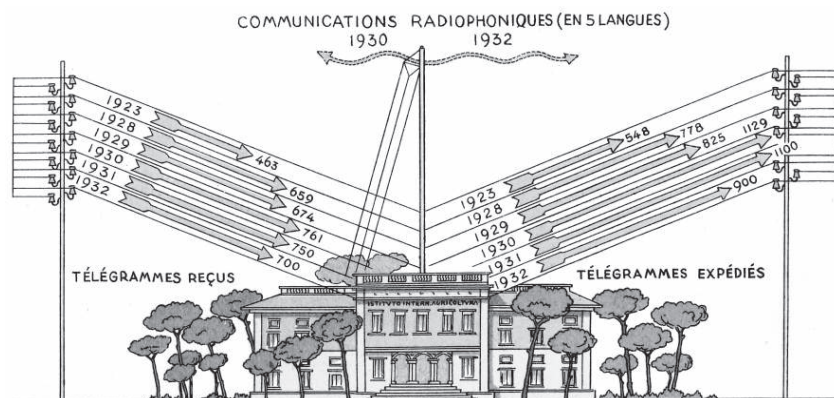
64. J. C. GILBERT, 2015.

65. A. RIBI FORCLAZ, 2016.

66. UNOG R1026/13A/1475/1308, Carlo Dragoni to the Secretary General of the League of Nations, 29 April 1925 [authors’ translation].

67. IIA GA 1932, “Rapport du Secrétaire général cit.” by A. Brizi, p. 332.

Figure 2. Telegrams received and sent by the IIA 1923-1932



Source. Giacinto COTTINI-AGOSTINELLI, *L'Institut international d'agriculture. Le développement intégral de son activité (XIX planches hors texte en couleurs)*, Stabilimenti Poligrafici Alterocca, Terni, 1933, p. 35 (courtesy of the David Lubin Memorial Library of the FAO, Rome, Italy).

government forced De Michelis to resign, and the USA sent a new delegate to Rome.<sup>68</sup> De Michelis' ousting relaunched the cooperation between the Americans and the IIA, with particular attention to the domain of data production. The new permanent delegate, Henry C. Taylor, was probably the most famous and important agricultural economist in the United States and the American delegation to the General Assembly of 1934 was headed by the charismatic Rexford Tugwell to signify a renewed interest in the Institute's mission. Taylor and Tugwell expected the reformed Bureau of Statistics to now serve a different world of managed international trade, heralded by the conferences on wheat that the Institute had inaugurated. By 1938, the envoy of the Economic and Financial Committee of the League of Nations to the Institute could assert that thanks to American funding, the Bureau of Statistics was operating very effectively.<sup>69</sup> However, Italian aggression against France and Greece in 1940 and the spread of war brought an end to the activities of the Bureau of Statistics, with a suspension of all its publications.

68. Nationaal Archief ten Haag, Box 2.05.37-4207, No. 32073, Message to the Minister of Economic Affairs, 21 October 1933.

69. UNOG, LON R4374/10A/944/944/Jacket2, E. M. Baumont report of his attendance to the 1938 General Assembly of the IIA.

## Conclusions: agricultural data and food regimes

Across four decades, until it was absorbed by the FAO in 1946, the Bureau of Statistics of the IIA pursued its objective of collecting data on crop production in a changing context. It created an unparalleled source of information on agricultural production worldwide and centralized resources – including economic resources – that had no equivalent in other institutions, including the USDA Foreign Agricultural Service. Agricultural statistics benefitted from a sort of network effect that provided grounds for creating a quasi-monopoly in the form of an institution capable of centralizing information from governments – and hence independent from each individual government – but with official status and willing to provide a public good of sorts. International organizations, private associations and governments all relied, to a certain extent at least, on the data published by the Institute.

The agricultural crisis of the last quarter of the 19th century, set off by the “European grain invasion”, was a turning point in both American and European history.<sup>70</sup> For certain European countries, it has been argued that the crisis of the 1880s and 1890s laid the foundations for the right wing nationalist coalitions that determined the course of internal politics for the following decades.<sup>71</sup> In the United States, on the other hand, this period was marked by the emergence of populism, often considered as an isolationist movement opposed to the culturally cosmopolitan north-eastern elites.<sup>72</sup>

The Institute emerged at this critical juncture as a transnational attempt to deal with information asymmetry. Nevertheless, the First World War sparked a revolution in agricultural trade, with the demise of British hegemony and the system of free trade that it underpinned. In a speech to the IIA in Rome on 29 March 1935, Max Sering, a figurehead among agricultural economists and sociologists, characterized the evolution of world agricultural markets. When the IIA was founded, he claimed, these markets were based on free trade, but, especially after 1929, the attitude of governments had changed: “Now everywhere governments take strong measures to avoid the ruin of their farmers...”<sup>73</sup> A year earlier, the USDA Undersecretary Rexford Tugwell, had expressed a similar vision at the General Assembly of the IIA of 1934: a naive faith in free trade had become obsolete, but the world of nationalist protectionism was not favoured by agriculturalists.<sup>74</sup> The IIA tried to evolve

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70. The phrase “grain invasion” was coined by K. H. O’ROURKE, 1997.

71. A. GERSCHENKRON, 1943.

72. For a survey of this tradition, P. A. GOUREVITCH, 1977. For challenges related to the actual degree of protection, G. FEDERICO, 2005, p. 190.

73. The State Historical Society of Wisconsin, Henry C. Taylor papers, Box 23, “The world economic crisis and international research” by Max Sering.

74. IIA GA 1934, “L’orientation nouvelle du commerce international” by Rexford Tugwell, p. 493.



in accordance with this changing world. Harvest statistics, imagined in the 1910s as a tool to stabilize markets, instead became a means to underpin bilateral agreements and quotas.

An examination of the statistical operations of the IIA highlights how international statistics of the pre-war period were meant to serve purposes very different from those of the interbellum and may thus shed light on the changes in the governance of agriculture over the first half of the 20th century. The historian of statistics Alain Desrosières identifies different configurations in the relations between statistics, public action and ideas. He contrasts, for instance, the “classical liberalism” of the late 19th and early 20th century with the controlling attitudes of European and American governments (Desrosières calls them “Keynesian”) that emerged with the First World War. He argues that classical liberalism was characterized by the production of “statistics that favoured market transparency” or measured dominant positions in the market, while post-war statistics focused on the national economy and its composing aggregates, culminating with the introduction of National Income Accounting in the late 1930s.<sup>75</sup>

The international statistics of the IIA evolved in a similar manner. When the Institute was established in the 1900s, they were meant to free agricultural markets from speculation within a “food regime” characterized by a few big food importers – in particular, Great Britain – and relatively free international trade. Unified world statistics of agricultural supply were to serve as a coordinating device for farmers and buyers to keep speculators at bay. With the Great War, markets did not disappear from the picture, but government policies and food provisions moved to the foreground in the contested international arena of the interwar era. Structural changes were also taking place in the world order where bilateral state agreements, quotas and monopolies, rather than market information, governed strategic agricultural commodities. The Institute’s mission was radically altered as a result. Remarkably, though, even in this new environment, the Bureau of Statistics of the IIA remained the sole hub where official information on agriculture could be exchanged and centralized.

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75. A. DESROSÈRES, 2003; F. BARDET, 2014, p. 32.



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