

## **Karl Heinrich Frömmichen (1736-1783) and Adrian Balbi (1782-1848) – The Pioneers of Biblio- and Scientometrics**

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When V. V. Nalimov in his important book *Naukometriya* (Moskva 1969) postulated research on the process of development of science with the aid of quantitative methods, he listed many different indicators. There were among them the number and growth of scientific publications – books and periodicals, the number of scientists, the level of expenditure.

This article shows that the importance of these indicators was recognised by earlier authors.

### **Introduction**

The history of biblio- and scientometrics is closely connected with the history of statistics. Therefore as we search for the beginnings of the former sciences we go back to the 17th century when statistics was taking shape: a trend towards the mathematization of sciences intensified<sup>1</sup> and such disciplines as Herman Conring's "notitia rerum publicarum hodiernarum" and John Graunt's and William Petty's political arithmetic<sup>2</sup> were being born. In the 18th century statistics took root and developed thanks to the efforts of Gottfried Achenwall, Johann Peter Ancheren – one of the first "tabularists", Anton Friedrich Büsching, who saw statistics as part of geography, and August Ludwig von Schlözer who perceived the possibility of statistical analysis of the past. At the beginning of the 19th century this field boasted not only many representatives, growing literature, presence at universities, but also the existence of special learned societies and official institutions engaged in the collection of statistical data.

Gradually, besides demographic, economic and military data, data about culture in a broad sense came into view of statisticians whereby circumstances conducive to the birth of biblio- and scientometrics arose.

This paper presents two people from the distant past, in whose scientific legacy one can find attempts at applying quantitative indicators to the study of cultural and scientific phenomena, particularly the publishing movement and the condition of libraries.

### **Bibliometric study by Frömmichen: German book production in the light of book trade catalogues**

In 1780 Karl Heinrich Frömmichen (1736-1783), a teacher and the headmaster of the Andreas-Gymnasium in Hildesheim as well the author of several philosophical and pedagogical books, published an article entitled “Einige Bemerkungen, welche sich über den deutschen Messkatalogus machen lassen”<sup>3</sup> in the then esteemed literary magazine *Deutsches Museum*.<sup>4</sup> As opposed to the numerous essays about the condition of the contemporary literature, which expressed the authors’ after all subjective views, this was a description documented with numbers since Frömmichen compared the contents of several booksellers’ catalogues dating from the beginning of the 17th century with the catalogue from the spring fair (Ostermesse) held in Leipzig in 1780. He was interested in such indicators as:

- the total volume of book production measured by the catalogues’ size in printed sheets and the number of literature items recorded;
- the linguistic structure of the literature, and specifically the relationship between the literature in Latin and that in German;
- the material and formal structure of the literature: the ratios between the numbers of books for the particular scientific disciplines (e.g. theology, ecclesiastical history, law, politics, medicine, natural history, physics, chemistry, philosophy), the shares of translations and specific types of publications (e.g. periodicals, publications of scientific societies) in the literature;
- the size and structure of the population of authors, particularly the proportions between the representatives of the different scientific disciplines.<sup>5</sup>

It is worth noticing that Frömmichen adopted bibliographies (in this case, book fair catalogues) as a basis for forming opinions about and making assessments of the German publishing output and the changes that had occurred over 160 years. This was at the time when bibliographic registers were treated merely as an immediate, direct source of information about publications. Counting concrete material objects (i.e., books – editions) Frömmichen would draw conclusions about phenomena, and phenomena from the sphere of intellectual culture at that. Frömmichen approached sources

prudently – he was aware of, for example, cases of data understatement due to the fact that not all publications by authors representing science were included.

Taking into consideration the above range of research problems, the fact of forming conclusions on the basis of numerical indicators and the judicious selection and critical approach to sources, Frömmichen can be regarded as a pioneer of bibliometrics. This view cannot be challenged by the obvious shortcomings of Frömmichen's research procedure such as a change in the source base (in the narrative part a catalogue dating from 1619 is analyzed, whereas the one in the table comes from 1620), inconsistencies in the use of quantitative indicators: sometimes expressed in absolute numbers, sometimes in fractions and sometimes as ratios, and the preponderance of factual and numerical data over interpretation.

### **Balbi's statistical approach to the literary geography**

The geographer and statistician Adriano Balbi (1782-1848),<sup>6</sup> well-known and enormously popular during his life but with time forgotten, attracted the attention of the historians of the statistics of printed matter primarily as the author of the dissertation "Essai statistique sur la presse périodique du globe," which appeared in the periodical *Revue encyclopédique*<sup>7</sup> in March 1828. In 1911 Bolesław Iwiński (1879-1919)<sup>8</sup> used Balbi's data, rating the latter's paper as "la première statistique de la presse mondiale qui mérite ce nom".<sup>9</sup> In 1978 Balbi was remembered by Robert Estivals, who rated him among the pioneers of international current bibliographical statistics (la statistique bibliographique internationale courante),<sup>10</sup> and in 1995 by Krzysztof Migoń.<sup>11</sup> In 1986 in the USA another work of Balbi was remembered – through the publication of its English translation – in which he applied the statistical method to research on libraries: "Essai statistique sur les bibliothèques des Vienne, précédé de la statistique de la Bibliothèque Impériale comparée aux plus grands établissements de ce genre ancien et modernes" (Vienna 1835)<sup>12</sup> and the translators: Larry and Janet Barr pronounced that the work "anticipated the concern of modern librarians for measures of library effectiveness".<sup>13</sup>

Balbi included elements of the statistics of publications and biblio- and scientometric data also in his other works such as: "Essai statistique sur le royaume de Portugal et d'Algarve, comparé aux autres états de l'Europe et suivi d'un coup d'oeil sur l'état actuel des sciences, des lettres et des beaux arts parmi les Portugals et des 2 hémisphères" (Vol. 1-2, Paris 1822), *Atlas ethnographique du globe ou classification des peuples anciens et modernes d'après leur langue* (Vol. 1-2, Paris 1826),<sup>14</sup>

“L’Empire Russe comparé aux principaux États du monde, ou Essai sur la statistique de la Russie, considéré sous les rapports géographique, moral et politique” (Paris s.a.).<sup>15</sup>

Defining the scope of his research as “la statistique historique, physique, morale et politique”,<sup>16</sup> Balbi included also cultural (in a broad sense) and scientific matters in it and tried to find quantitative measures of their condition. This direction of research on culture and science Balbi named “literary geography” and considered its subject to be “tous les établissemens littéraires et d’instruction publique”.<sup>17</sup> He acquired numerical data from official sources (at that time official national statistics were already systematically compiled in many countries) and also through contacts with aristocrats and politicians in Austria, France and Portugal and with luminaries of science, thanks to which he would quickly get to new scientific, journalistic, etc., publications.<sup>18</sup>

Thus the literary geography of Portugal<sup>19</sup> included information about the physical and spiritual character of the country’s inhabitants, language, educational system, scientific societies, libraries, museums, botanical gardens, laboratories, observatories, printing and book trade. Not all of the problems were equally subjectable to quantitative analysis. Concerning schools and education, Balbi gave statistics on, e.g. the salaries of the professors employed at the Coimbra University (pp. 38-41) and the number of students (per individual years in the period 1800-1820 and per individual faculties, pp. 41-42) and similar statistics on lower-level schools (p. 53 and next) as well as analogous information for other European countries (p. 146, pp. 150-152).

Often information especially interesting for bibliology (whose representative the author of the present paper considers herself to be) and for bibliometrics – statistical information about book production (publishing) and libraries – appears in Balbi’s works. It is found, though in varying amounts, in all the cited above works by Balbi.

The statistical profiles of book production presented by Balbi – which can be seen as embryo bibliometrics – included such data as: the total number of publications in the particular countries (in chronological order, but only for individual consecutive years: Balbi usually did not add up data for longer periods), the relationships between books and periodicals, between publications by native authors and the translations, the countries and languages the translated works originated in, new editions and reissues, and the subject structure of literature.

An exception was the treatise on Portugal where Balbi gave the total number of books published between the year 1801 and 1819 (1766 books plus 116 works published by the University and Academy of Sciences in Coimbra), calculated their annual average (about 100 works) and their distribution for the particular years, breaking them down into the following groups: originals, translations, periodicals, new editions and reprints.<sup>20</sup> In the descriptive commentary Balbi compared the data with the

numerical indicators of publishing output for other countries: Sweden, Norway, Germany, France and the Italian states. Though these comparisons seldom are fully correct: the choice of years was biased and so the data are not fully comparable, hardly ever all the indicators could be applied to all the countries.

This is evident in cases when Balbi did not produce the statistics himself and did not have any influence on the principles on which the official guidelines for the collection of data in the particular countries were based, but had to handle the existing material. Therefore it is not surprising that for some countries the statistics are on *book production* while for others, statistics on the number of *books offered* at book fairs are given and there, where the official statistics distinguished (as in France) books, brochures, musical scores, Balbi does the same, whereas for the Italian states he distinguishes books and prints.<sup>21</sup>

Balbi noticed the diversity of computational units adopted in different countries, pointing out that in the French and Italian statistics neither works (“ouvrages”) nor volumes (“volumes”), but kinds of typographic products (“les articles différens qu’on y a imprimé”) were the units.

For the needs of the statistics of periodicals he defined his own selection criteria: Balbi took into account all periodicals published with a less than one year frequency (political and literary magazines, advertising periodicals, price catalogues – “tout ce qui forme la presse periodique”), neglecting yearbooks, almanacs and publications of scientific societies to ensure reliability by rather understating than overstating the number of periodicals.<sup>22</sup>

Balbi searched for ways which would make it possible to compare sets (collections) of publications in both publishing production and library collections: he thought highly of the practice of Adrien Beuchot – a pioneer of French national bibliography – who in his statistics included the number of printed sheets<sup>23</sup> (this principle is common today but at the beginning of the 19th century it was a novelty).

Also library institutions, whose size and value he wanted to measure, attracted Balbi’s attention. Already in the work on Portugal<sup>24</sup> a table recording the size of the principal collections of Europe’s libraries appeared. Also therein Balbi, lamenting the inaccuracy of and the discrepancy between the literature data on this subject, called for the compilation of more complete statistics on the libraries: “un tableau complet du nombre des volumes, accompagné de l’indication des ouvrages les plus précieux contenus dans les principales bibliothèques de l’Europe”.<sup>25</sup> He came back to this subject in 1835 in his work “Essai statistique sur les bibliothèques des Vienne, précédé de la statistique de la Bibliothèque Impériale comparée aux plus grands établissements de ce genre ancien et modernes”. In separate statistics he showed the growth of the

collections in time, the size of the budgets, the librarians' salaries (in the Imperial Library in Vienna), he compiled data on the size of the main European libraries scattered in many contemporary works, and so on.<sup>26</sup>

Seeing the fallacy of identifying the size of collections with their ranking and value, Balbi regarded this indicator as a basis for the comparison of libraries (*la statistique comparé des bibliothèques*).<sup>27</sup> As regards library collections, particularly manuscripts, leaflets, dissertations, documents and records, he proposed to introduce a conversion factor to obtain a computational unit equivalent to a book: each single manuscript, but also each 10 brochures, each 50 documents, were to be counted as one volume.<sup>28</sup>

In all the above works Balbi – as many of his predecessors in the field of statistics, particularly the representatives of the so-called “tabularists” – included tables with numerical data on selected aspects of the contemporary world and he did not limit himself to the presentation of one country but consistently and systematically provided relevant data for other cities, regions and countries allowing the reader to make comparisons. He applied time series (e.g. of the number of students or publications by years) and geographic series (by parts of the world, countries and cities). Treating critically the existing, often misleading, contradictory or differing information, he tried himself to acquire reliable data (e.g. he searched for, unfortunately without result, accurate information on the number of students at Italian universities since he did not want to repeat the phrase: “*les évaluations inexactes que l'on rencontre dans tous les ouvrages des géographes étrangers*”).<sup>29</sup> In places where some information was missing Balbi put question marks and marked cases when the data were for a period of many years or when they were averages calculated by him. But those were, as a rule, only simple statements showing series of numbers: when giving, for example, the size of population for countries or cities and the number of students or periodicals published in a given country or city Balbi did not calculate scholarization indicators or the indicators of the saturation with the press of the local or country population. But only this could have led to the interpretation of data. Therefore it is no wonder that commentaries interpreting the significance of the numbers rather rarely, unfortunately, can be found in Balbi's works.

Balbi's statistical statements showing culture indicators referred to mainly the current state and/or tiny fractions of the not too distant future. So the more worthy of attention is his attempt at *estimating and forecasting* phenomena in the sphere of the culture of the book. Having no complete data on the growth of the collections in the National Library in Paris for the years 1828-1833, Balbi tried to estimate their size at the end of 1833 by analogy to the period 1822-1827. Comparing the ratios between the number of works registered in the French current national bibliography in the two

periods (50 968 + 49 532 = 100 500 works) and the number of works entered in the Library's catalogue in the years 1822-1827 (58 032 works), he obtained the result: 114 800 works. For the reader today the figures themselves are not so important as the fact that statistics on books and libraries – above all, bibliographic records – were used for the estimations. One can volunteer a cautious statement that a way towards the determination of regularities in the world of books, to be expressed by bibliometric laws in the 20th century, was shown.

Among the sources used by Balbi bibliographic materials and scientific literature played an important role: for the statistics of publications in Portugal Balbi used statements drawn up by the physician Antonio d'Almeida on the basis of the advertisements placed in "Gazette de Lisbonne" as well as the publications catalogues of the Royal Academy of Sciences in Lisbon and the Coimbra University<sup>30</sup> and the Portuguese lawyer Teixeira Aragão, then residing in Paris, helped him to handle the data. In the profile of the book production in Russia in the years 1822-1824 Balbi used statistical statements drawn by E. Héreau,<sup>31</sup> a retired teacher of French in the Grammar School in Wiatka, who published them regularly in the critical-bibliographic journal "Revue Encyclopédique".<sup>32</sup> César Moreau, the French vice-consul in London, was helpful in Balbi's analysis of the state of periodicals in the UK.<sup>33</sup> For the statistics of libraries Balbi used the abundant bibliological literature and the fast growing mass of statistical data (published in, for example, the journal "Journal de la Société française de Statistique universelle"). He approached the data found therein prudently and would compare them scrupulously.

### Conclusions

To recapitulate, it should be stated that the role of those early attempts at biblio- and scientometric analyses consisted in this that their authors:

- saw the possibility – and the need! – for quantitative research on culture in a broad sense and science and included their countable elements in the description of the state of culture;
- used bibliographic registers and bibliographic data not only as sources of immediate, detailed information about literature, but also as a basis for evaluations of and judgements on the state of culture and science.

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3. K. H. FRÖMMICHEN, Einige Bemerkungen, welche sich über den deutschen Messkatalogus machen lassen, *Deutsches Museum*, 1780 St.8, 176-187. For more information on Frömmichen's article see: A. ŻBIKOWSKA-MIGOŃ, Początki bibliometrii? Oświeceniowa próba analizy statystycznej katalogów księgarskich (Beginnings of bibliometrics? Enlightenment attempt at statistical analysis of booksellers' catalogues), *Roczniki Biblioteczne*, 31 (1987)1:175-188.
4. *Deutsches Museum* was published in Leipzig in the years 1776-1788, edited by Heinrich Christian Boie and Christian Wilhelm Konrad von Dohm – see, e.g., J. WILKE, *Literarische Zeitschriften des 18. Jahrhunderts (1688-1789)*, Bd. 2 Repertorium, Stuttgart 1978, pp.141-145.
5. FRÖMMICHEN, *op.cit.* pp.178-180 (“...so schreiben in Deutschland immer 3 Theologen gegen einen Juristen, und nur 2 Theologen gegen einen Mediziner, 10 Aerzte immer gegen 7 Juristen; 5 Aerzte gegen 4 Philologen und 9 Aerzte gegen 2 Mathematiker”).
6. For biographical data see, e.g., C. VON WURZBACH, *Biographisches Lexikon des Kaiserthums Österreich*, Vol. 1, Vienna 1856, pp.130-131; C. ERRERA, Balbi Adriano, In: *Enciclopedia Italiana di scienze, lettere ed arti*, Vol. 5, Milano 1938, p. 68. Balbi had a high reputation in Russia, where he was often quoted in university lectures on statistics (cf. M. PTUCHA, *Ocerki po istorii statistiki XVII i XVIII veka*, Vol. 1-2, Moskva 1955 pass.); this was probably the reason why from among the special encyclopedias on book and library science only the Russian ones have included a biographic entry on Balbi (*Knigovedenije. Enciklopedičeskij slovar'*, Moskva 1981, p.30; *Kniga. Enciklopedija*, Moskva 1999, p. 51).
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12. A. BALBI, *A Statistical Essay on the Libraries of Vienna and the World*, Mc Farland & Company, Inc., Jefferson, NC, s.a. Reviews: N. D. STEVENS, *Wilson Library Bulletin*, 60 (1986) May, 55-56; A. E. DAY, *Library Review*, 36 (1987) Spring, 65-66; D. W. KRUMMEL, *Collection Management*, 10 (1988)1-2:191-193.
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14. A. BALBI, *Atlas ethnographique du globe ou classification des peuples anciens et modernes d'après leur langue*, Vol. 1, Paris 1826, pp.378-382; *Tableau bibliographique de l'Empire Russe ou Tableau des ouvrages publié en langue russe dans cet empire, pendant les années 1822, 1823 et 1824; suivi de quelques observations sur les ouvrages le plus remarquables*.
15. Giving information on 40 countries of the world Balbi included a table “Ecoliers et étudiants en 1824.”
16. A. BALBI, *L'Empire Russe comparé aux principaux États du monde, ou Essai sur la statistique de la Russie, considéré sous les rapports géographique, moral et politique*, Paris s.a., plano.



17. A. BALBI, *Essai statistique sur le royaume de Portugal et d'Algarve, comparé aux autres états de l'Europe et suivi d'un coup d'oeil sur l'état actuel des sciences, des lettres et des beaux arts parmi les Portugals et des 2 hémispheres*, Vol. 1, Paris, 1822, p. XXVIII.
18. About the role of "la coopération de beaucoup de savans et d'hommes d'état distingués" one can read in the introduction to A. Balbi, *Essai statistique sur la presse périodique du globe...*, p. 594.
19. A. BALBI, *Essai statistique sur le royaume de Portugal et d'Algarve...*, comparé aux autres états de l'Europe et suivi d'un coup d'oeil sur l'état actuel des sciences, des lettres et des beaux arts parmi les Portugals et des 2 hémispheres, Vol. 1-2, Paris 1822.
20. *Ibidem*, Vol. 2, pp. 100-101. This division does not fulfil the disjunction condition: it is hard to figure out on what basis were the groups, for example, "nouvelles éditions" and "reimpressions" distinguished and how they relate to the groups "originaux" and "traductions".
21. *Ibidem*, p. 101.
22. A. BALBI, *Essai statistique sur la presse périodique du globe...* pp. 594-595.
23. A. BALBI, *Essai statistique sur le royaume de Portugal et d'Algarve...*, Vol. 2, p. 102.
24. *Ibidem*, pp. 159-162.
25. *Ibidem*, p. 158.
26. A. BALBI, *Essai statistique sur les bibliothèques des Vienne, précédé de la statistique de la Bibliothèque Impériale comparée aux plus grands établissemens de ce genre ancien et modernes*, Vienna 1835, pp. 14-16, 29, 35-45, 71.
27. *Ibidem*, pp. 32-33.
28. *Ibidem*, p. 74.
29. A. BALBI, *Essai statistique sur le royaume de Portugal et d'Algarve...*, Vol. 2, p. 151.
30. *Ibidem*, Vol. 1, p. XXI.
31. A. BALBI, *Atlas ethnographique...*, Vol. 1, pp. 378-382.
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33. A. BALBI, *Essai statistique sur la presse périodique du globe...*, p. 595.

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