

Book Reviews

La science sous observation – cent ans de mesure sur les scientifiques 1906 – 2006

Benoît Godin

Book Review - DOI: 10.3395/reciis.v2i1.161en

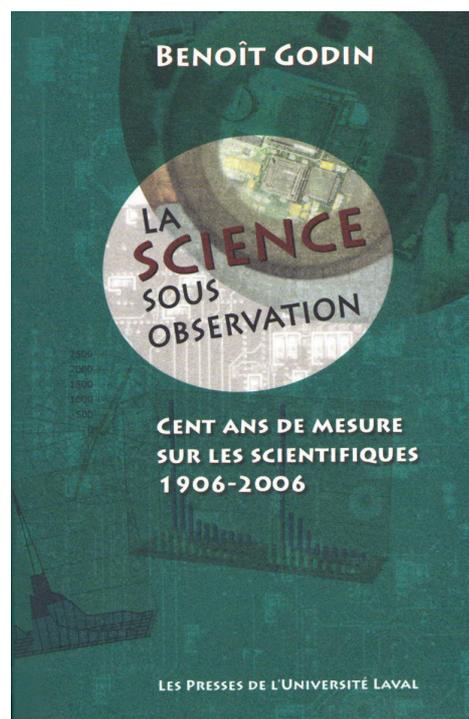
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The stimulation of scientific research and the development of new intensive technologies with high application potential in the industrial sector became center of a set of public actions and debates in the civil society of many countries. Every year, great amounts of money are destined to public and private research institutions and to institutions dedicated to the preparation of new researchers. In spite of the diverse relations between public and private research and production systems, the different forms of government and political arrangements of the societies, the dynamics of technical-scientific production are very similar.

In the XX century we witness the mechanisms for fostering production, training of researchers and technicians and the production, circulation and dissemination of this knowledge assuming a homogenized nature. This process reached first the Western-European countries and the United States of America, but spread quickly over the entire western and eastern sphere. This complex and giant wheelwork is accompanied by studies into the dynamics and the state of sciences and technologies, many of which are associated with the field of Social Studies of Science and Technology (SSST).

In his book *La science sous observation – cent ans de mesure sur les scientifiques 1906 – 2006*, published in 2005, Benoît Godin offers to the reader a dense analysis of this dynamic, however starting from a rarely explored perspective – the measure of science. In fact, Benoît Godin, professor of the *Centre de Recherche in Urbanisation, Culture et Société* linked to the *Institut National de la Recherche Scientifique* (INRS), specialized precisely in the



Quebec, Ed. Les Presses de
L`Université Laval

ISBN: 978-2-7637-8297-3

analysis of science, technology and innovation statistics and its relation with public policies. In the last seven years, Benoît Godin published about 40 articles and two books about this theme (*La Science sous observation* is one of them), among others rescuing the history of his predecessors and of the main organisms focusing on the elaboration of norms and construction of statistics. This production makes part of a project whose amplitude allows me to take it as a basis for a research project called “The culture of the numbers”, in which the science, technology and innovation statistics are analyzed from a socio-historical viewpoint. The material used in the book *La science sous observation* was originally produced for the Conference Cycle of the *Maison des Sciences de L’Homme* under the title *Mesurer la science: pour quoi faire?* (Measure science: why ?) held in 2005. The book maintains the structure used for the conferences and is divided into three themes: the construction of science statistics; the use of statistics; from science to innovation.

Before going on, I consider it important to say that Godin’s book is not meant as an analytical inventory of the technical devices used in statistics. He is interested in the construction of the object of the statistical analysis, which is a constituent element of the measurement. There is a fundamental aspect in statistics – its capacity of measuring depends on the production of categories and parameters capable of defining and characterizing the object to be measured. This is why surveys, censuses and statistical studies of all kinds create manuals explaining in detail the methodology to be followed. To the same extent the rigor of the methodological discipline ensures the scientific reliability of the study, the statistical measure turns the object evident. Statistics constructs the object to be measured by categorizing it, or better, by using taxonomy. Beyond the numbers as such, statistics of science, technology and innovation allow analyzing the different categories and concepts related to each of them in different historical periods; allow registering socio-technical arrangements between science, technology and innovation. Thus, by talking about the changes in the objects (and in their construction) and in the practices used for measuring them scientifically, the book of Godin is dealing with the conceptual dislocations in relation to science, technology and innovation. According to Godin, there is a co-productive relation between the concepts used by statistics and the concepts circulating in science, technology and innovation. In other words, the statisticians do not use concepts defined elsewhere for constructing their categories; they participate actively in the production of new concepts and categories and consequently of new arrangements of science, technology, innovation and society. In this sense, the statisticians conceive and organize science, technology, innovation and society as much as the economists, sociologists and scientists of the most different fields.

The socio-technical arrangements and the differences in the production of concepts become clear right in the first part of the book – the pioneers. There we find a light and inspiring narrative about the pioneers in measuring science – the Swiss Alphonse de Candoll

(1873), the English Francis Galton (1874) and the American James Mckeen Cattell (1906) – with special attention to the latter two. The measurement conducted by the pioneers concentrated on the researcher. Even so, in spite of the short period of time separating the works of Galton and Cattell, some subtle changes can be observed. Galton focuses entirely on the scientists, their formation and their motivation for embracing the scientific career, which is their taste for science. Among the variables proposed by Galton are formal education, the motivations for being a researcher and the role of the family. Although his analysis is strongly inspired by eugenic concepts, it is interesting to observe that some of the themes he approaches are reappearing in contemporary studies about the scientific career.

James Cattell in turn starts from a completely new repertoire, beginning with his first work, *American Men of Science*. The biographic repertoire about American scientists arises from the initiative of a philanthropic institution aimed at granting funds to researchers. The biographic repertoire should help selecting the researchers. I consider this history of the origin emblematic, not only of Cattell’s entire later work but also of the variety of uses attributed to science statistics over the XX century. This is because this origin contains the embryo of the current association of statistics, first with the science and technology policies, and second with decision-making. Later I will come back to these two points, here I only want to anticipate that the analysis of Benoît Godin contributes to deconstruct the use of statistics (or its reduction) as a basis for decision-making. For now, I want to emphasize a dislocation from measuring science based on the number of talented man dedicating themselves to the knowledge of science (Galton) to another one based on the quality and quantity of the performance of the scientists (Cattell). Cattell’s work does not loose focus in the emblematic figure of the scientist but Godin highlights like in his “repertoire” that there already is a subtle concern with *what the scientists do* and *where they do it* (in geographical terms). In this sense, Cattell manifests a clear perception of the potential relations between science and technology and the North-American productive sector. As a matter of fact, Godin also emphasizes the fact of James Cattell being the first to estimate the economic value of “a man of science” on the basis of his salary (Cattell). The work of James Cattell and other initiatives mentioned by Benoît Godin emerge from a context favoring the development of concepts seeing science as an “activity” proximate to the industrial productive world, distant from the concept of science as a manifestation of individual genius. It is thus symptomatic that the National Research Council published in 1920 (15 years after the publication of Cattell’s study) the first edition of the *Repertoire of American Industrial Laboratories* (GODIN, 2005: 20).

Before finalizing my comments about the part dedicated to the pioneers, I would like to make two more observations. Cattell, like the entire following generation of statisticians of science, was above all concerned with reflecting about the relations between science and

the North-American society of his time. Benoît Godin concludes his observations about Cattell calling him “the origin of what we agreed to call “scientometry” (GODIN, 2005: 12). Furthermore, Cattell points to a geographically concentrated preparation of researchers and advocates the need to take measures for deconcentration. The geographic concentration of scientists and science and technology institutions is a valid question when considering science in our time with its various branches extending to the field of Social Studies of Science and Technology, with which I identify the academic production of Benoît Godin. In countries like Brazil, where the regional differences are intense, deconcentration has been target of public policies for the last three decades. However, the worldwide dynamics of the production system and of the circulation of technical-scientific knowledge is still deepening this concentration. Among other factors, I emphasize: a) the high technification of science that hampers the access to equipment and techniques considered last generation for the laboratories outside the more dynamic centers of knowledge production; b) the criteria used for research funding privileging publication and citation rates that hamper the access to these resources for new research groups; c) the concentration of teaching institutions for researchers in certain countries, making it easier for these institutions to attract and hold young researchers.

Over the 30 years that separate the 1920s from the 1950s of the XX century, statistics of science became a fundamental element in academic works about science and technology. Since the 1950, statistical surveys became regular. In the 1960s we have the beginning of the elaboration and dissemination of manuals stipulating the methodology for surveys of great extent, for example the Frascati Manual produced by the Organization for Economic Co-Operation and Development (OCDE) in 1962. This movement has to do with the position of science and technology in relation to the national governments and to the public and private productive sector. During this period, science and technology became permanent targets of public policies. It is the stage of the creation, institutionalization and growth of the agencies and organisms dedicated to the production of statistics of science and to the production of studies and technical reports of the government about science and technology activities. Here we must talk about the creation after the Second World War of international organisms, whose statistics influence institutions in different countries, as well as the creation of public science and technology policies in different socio-economical contexts over the last 40 years of the XX century. In Brazil, for example, the creation of the National Research Council (CNPq), principal funding agency for science and technology, dates from the 1950s. Generally, a homogenization of the science and technology policies and concepts can be identified with the emergence of these international institutions. However the point that interests the social scientists, particularly those compromised with the Social Studies of Science and Technology, is to find out how this process (of homogenization) takes place and reproduces

itself. Benoît Godin observes how the dissemination of the science and technology statistics played an active role in the homogenization process, a role owed to the practice of precisely defining the methodologies for data collection and analysis involving in the first place the conceptualization of what is to be measured. Consequently, this position is directly related to the production and worldwide dissemination of manuals, among them the Frascati Manual (OCDE – 1962), the Oslo Manual (OCDE, 1992) besides those produced by organizations such as the National Foundation of Science (NFS) from the 1950s onwards.

Godin observes how the political position of the statistics of sciences is always associated with support of the decision making of governments and international agencies. He also observes that, invariably, statistics assume an auxiliary and neutral position. In other words, statistics collect and systematize data about a certain field of activity which, from a certain moment in history, gained high political and economical value; statistics as such however has no relation whatsoever with the production of these values. Public policies make use of statistics but neither statistics nor statisticians make policy.

This is precisely what Benoît Godin wants to emphasize: the policy of the numbers present in the statistical practice. The statistician is a political actor seeing that statistics participate actively in the decision making process. Again, what the researchers influenced by the Social Studies of Science and Technology want to know is how this happens. For Godin, this participation occurs basically in two ways: with the institutions in charge of statistics of science deciding what will be measured; with the same institutions conceptualizing what is going to be measured. In both cases we are dealing with a ruling activity; conceptualization in special is a form of ruling. By circumscribing the target, defining how to act and what categorization to adopt the statistical survey establishes and bases its practical action on a determinate standard. Godin reminds us how the economy of knowledge and during the last years the innovation economy is providing the conceptual framework for the statistics of science (GODIN, 2005: 5). The innovation economy illustrates very well the type of dynamics Godin wants to analyze in his investigations about statistics. The innovation economy produced a very well elaborated reference for the research and development activities and for the relations between research and the production sector besides proposals for public funding for innovating institutions. Statistics helped disseminating these references by supplying data. The proposition around which Godin structures his history of the statistics of science is that it participated in the ruling of contemporary science and technology, instead of supposedly being limited to register numbers; statistics participated exactly by measuring their activity qualitatively and quantitatively. Benoît Godin gives us a number of examples supporting his proposition but I will concentrate on what in my opinion is the best aspect – the analysis of how statistics participated in the dislocations of sense between science

and research; from research to the binomial basic and applied; how statistics added development and, more recently, innovation. Obviously it is not the intent of a summary to reproduce the wealth of details of Godin's description of these dislocations of senses and creation of new categories. However, I think it is important to call the attention of the future readers of *La science sous observation* to some points that mobilize these dislocations.

The first great dislocation occurs when the object to be measured is no longer *the scientist* but the *scientific activities*. In a first moment this dislocation produces the category *research*. This way, "the official conception of science as transmitted by the statistics about science rests on a definition centered on research" The research activity reinforces the concept that we are dealing with and consequently measuring a dilettante knowledge production; an organized and systematic enterprise of knowledge production however follows certain parameters and is conducted in institutions organized according to a specific standard. The character and the intensity of this systematic will acquire enormous importance in statistical surveys. To define if an activity is systematic or not is crucial, for example for determining if some industry is or is not developing research. It is noteworthy that the dislocation of senses and the definition of categories occur together with the emergence of the management of science or the planning of scientific activities (GODIN, 2005: 16); emergence of a set of public actions for articulating funding activities, preparing human resources and giving priority to research areas. Right away statistics and its methodologies put forth efforts for demarcating the limits of research and consequently for enumerating the research institutions, the main targets for the scientific policy undertaken by public and international organisms.

The production of more precise data about the research activity by statistical surveys implied not only in qualifying this activity but also in considering if this activity was conducted systematically. More extensive surveys depend on more precise definitions and characterizations of what is really done. Thus, according to Godin, we owe to the NFS and the OCDE a number of activities allowing us to define more appropriately what was comprised under the macro-category scientific research: basic research, applied research, engineering, testing, prototyping. Nearly immediately the last four formed what we today call development (GODIN, 2005: 21). These categories were not coined by the NFS or the OCDE. Godin remembers that fundamental or basic research, applied research and development already figured in academic reflections about science since the 1930s. As an example for this he cites the production of John Bernal (GODIN, 2005: 21). Bernal's division did not lead to surveys about each activity. His intent was mainly to separate the targets, i.e. to better characterize the activities performed in the industrial laboratories, which raised numberless doubts and discussions in studies developed before 1950. The today classical division between fundamental (or basic) research, applied research and development should appear in a table prepared for

a survey about industrial research in the United States of America in 1953. The table was inspired in the work of R.N. Anthony (DEARBON et al., 1953). This point is intriguing because the surveys for the industrial sector always occupied part of the methodological discussions about the statistics of science. In countries like Brazil, where industrial research is concentrated in very few public companies, does it fall on the researchers to investigate the methodological dilemmas of the statistics of science?

The emphasis given to development however arises a little later, already in the 1960s. This was strongly influenced by the work of R.N. Anthony as well as by the closer relations between statisticians of science and economists. For Benoît Godin, one will not understand the weight of the category development and later innovation without considering the industrial origin of both. And there is more. There is an important dislocation of the statistics and policies of science and technology in this movement, a dislocation pointing to a measurement of the capacity of generating and producing new products and processes. Development should thus agglutinate activities specific to these purposes, such as engineering, design and prototyping. By analyzing the emergence, in the 1960s, of development in the surveys and explicative models of science, Godin rescues the position occupied by statistics in the production of the contemporary world or in the relation science, technology, innovation and society. In relation to the linear model, during the last 20 years target of vehement contestations, he observes that the "(.) model was in part constructed thanks to the statisticians. It is the industrials and the researchers from the management schools but also the individuals and institutions, which attempt measuring using taxonomy based on these three terms that formalize the model. On the contrary to what is reported in the literature, the linear model was not originated in V. Bush" (GODIN, 2005: 26). Godin believes that the bases of the linear model are the works of researchers in the management area and of economists, who sought improving categories and the comprehension of science itself for analyzing the companies with emphasis to the market. In this respect they were influenced by the proposals of R. N. Anthony (DEARBON et al., 1953). Innovation is a more recent construction although the term has been used since the 1950s. As a category emerging in the science and technology analyses however, innovation is a phenomenon of the 1990s, and thus an event of the end of the century. I consider this event an effect of the studies about the new economy, in which science and technology emerge like elements sustaining and dynamizing the modern production of value. I believe that this affirmation fits well into the arguments of Benoît Godin, above all in the chapter dedicated to the use of statistics (GODIN, 2005: 54 to 62). The conceptual framework of the new economy, in which the bio- and information technologies play a predominant role, has great influence in the design of the statistics of science. In return however, statistics are essential for the construction of the idea of a new intensive economy in the use and in the production of

techno-scientific knowledge. In *La science sous observation* we find a variety of examples of how this co-production occurs. The economists make extensive use of statistical data and avail themselves of arguments based on visual rhetoric, generally taken from statistical surveys. The analyses also make widely use of categories produced and improved by statisticians and economists, who were working in organisms dedicated to statistics.

The emergence of innovation is the landmark of a new dislocation. Innovation is not a product or result but a process involving a wide-ranging set of activities aimed at generating a product of process. This definition makes part of the Steacie Report of the US Department of Commerce in 1967. Several hypotheses help understanding this dislocation and the quick dissemination of the category innovation among statisticians and science researchers. According to Godin, for understanding this dislocation we must consider the political position of innovation and its immediate connection with industrial production. In other words, innovation emphasizes the productive universe of the industrial sector, the commercial dealings and their mechanisms, the market value. An invention becomes an innovation when (and only if) finding a market and an exchange value. But what is the difference in relation to the category development? It is the possibility to take the ulterior dislocation between science – research – development as arrangements for the relations between science, technology and society with emphasis to the position of the industrial sector. There is however a subtle difference. Perhaps for the first time the comprehension of science and technology was decentralized from the research conducted in academic institutions. The effort of the statisticians for apprehending the research conducted in the industrial laboratories is an important if not crucial element in the production of the category innovation. It is noteworthy that that this effort is in the roots of statistics of science as known today. The category innovation is an effect emerging from the process of social valorization of activities performed in determinate spaces and from a question of practical-conceptual nature: how to measure these activities and, at the same time, preserve their singularity? The thoughts of Benoît Godin make us ask how the statisticians participated in this valorization process while seeking the measure of innovation. By doing so, they established its singularities, produced concepts, defined parameters, and in the end they participated in the process of setting the boundaries between development and innovation.

Benoît Godin calls attention to the very weak relation between the statistics of science and other social surveys. In Brazil for example, the statistics of science are generally presented in relation to the gross internal product, history of investments in R&D and, very rarely, in relation to schooling, access to healthcare services and basic sanitation. I consider this interesting when analyzing the innovation discourse widely based on its relation with the qualitative and quantitative growth of the production, with economic growth and with the level of development of the countries. Science and technology gain value through the increased leveling of scientific

production and its economical impacts upon the society. For Benoît Godin, since the late XIX century statistics went through an accelerated dislocation from a practice “destined to participate in the advances of science” to a commitment with the “leveling of science for accounting and economical purposes”. This explains the dislocation of the statistics of science from other social statistics. In any case, when relating innovation to the level of development of a country, this distance (between the surveys about science and other surveys) turns into an interesting question for the Social Studies of Science and Technology because unless they get closer to other social measures, statistics of science will not dimension the dynamics of the relations between innovation, size of economy and social data such as basic schooling (not only university level), access to healthcare services, sanitation, habitation and violence rates.

Finally, the work of Benoît Godin makes us reflect about our own statistics of science, technology and innovation. Brazil is trying to disseminate a concept of management of science and technology based on productivity. This is a concept different from that, which structured and still operates part of the organizational structure of the principal research institutions of the country. The presence of industrial laboratories in Brazil is restricted to few sectors, the most productive of which (oil and agriculture) are linked to the public sector. This alone shows the difference between our context and the environment described by Benoît Godin. Therefore the social scientists need to ask which is the socio-political support for these categories and for the correlated concepts science, technology and society. One of the greatest merits of the work of Benoît Godin (in this and in other books) is to systematize data that materialize the socio-political production of research, development and innovation activities as well as the categories describing them. The activities and categories are not dislocated from a universe of economical and political practices and certain legal regulations. We are dealing with a production that takes place in a unique, dense and turbulent flow, from where the contemporary societies arise, based on capitalist market economy and on socio-educational values and judaic-christian moral values. In ultimate analysis, we are facing a problem of transposition – transposition of models of techno-scientific knowledge production, transposition of models of measures and transposition of relations between science, technology and society.

On the other hand, the local production of statistics about science is greatly influenced by international manuals and by the great data producing institutions like NFS and OCDE despite of the efforts of the Latin-American countries for producing their own manual, capable of reflecting the specificities and methodological difficulties of these countries (Bogotá Manual). Again it falls to us social scientists interested in the field of science, technology and society to ask what are the chances of these efforts. We have countries with different social, political, economical and legal realities. On the other hand, the international manuals participate in the process of globalization of the production and of the measure of

the production of science, technology and innovation. What is the political position of attempts such as the Bogotá Manual in the construction of a production model and hegemonic Sc&T&I production measure in Latin-American countries? Thus, we historians and sociologists should accept the invitation of Benoît Godin and analyze how these differences influence the appropriation of the Manuals, the autochthonous production of manuals and the exercise of statistics among us.

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