The Knowledge-Based Economy: Conceptual Framework or Buzzword?

Benoît Godin

3465 rue Durocher
Montreal, Quebec
Canada H2X 2C6

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Canadian Science and Innovation Indicators Consortium (CSIIC)
3465 rue Durocher, Montreal, Quebec H2X 2C6
Telephone: (514) 499-4074 Facsimile: (514) 499-4065
www.csiic.ca

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Introduction

The relationship between statistics and policy is far from easy to assess empirically, and the causal link, if any, difficult to establish. [1] Statistics are often presented as instrumental for policies: they are supposed to enlighten choices made by policy-makers. But several studies have shown that statistics serve rather to legitimate policies: policy-makers used them to objectify choices already made. Both theses are probably true to varying degrees, depending on the type of statistics, the context and the forces and interests at work. In this paper, I postulate that the important mediator between statistics and policy is concepts, and importantly, specific types of concepts.

It is concepts, converted into buzzwords, that often influence policy-makers. Recent examples in the field of science and technology are the Information Society, High Technology, the New Economy, and the Knowledge-Based Economy. Concepts, however, are often defined and crystallized with the aid of statistics. The field of basic research is a perfect example of statistics helping to solidify a concept, at least at the policy level, and giving university research a political identity. [2]

There are at least two kinds of relationship between statistics and concepts. In one, statistics gives rise to and defines a concept. This was the case for the New Economy. The growth of information and communication technologies (ICT) had been measured before, but suddenly it came to be closely related to a discourse on a new economy in the 1990s, that is, with changes in the way the economy performs (growth and productivity).

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[1] B. Godin (2002), *Are Statistics Really Useful? Myths and Politics of Science and Technology Indicators*, Project on the History and Sociology of Science and Technology Statistics, Montreal: CSIIC.
[2] B. Godin (2003), Measuring Science: Is There Basic Research without Statistics?, *Social Science Information*, 42 (1), pp. 57-90.

[3] In the other kind of relationship between statistics and concepts, a concept gives rise to specific statistics. This was the case for the Knowledge-Based Economy. Its main promoter – the OECD – currently collects nearly sixty indicators aimed at measuring the knowledge-based economy.

The early (1960s) concept of a knowledge economy and its relationship to statistics was of the first type: the concept originally appeared supported by new trends in the economy and new data. [4] Its revival in the 1990s, however, has nothing to do with numbers and everything to do with politics. In fact, several authors argue that nothing really new has happened, at least with regard to the centrality of knowledge in the modern economy. I suggest that the concept of a knowledge-based economy is simply a concept that serves to direct the attention of policy-makers to science and technology issues and to their role in the economy and, to this end, a concept that allows one to talk about any issue on science and technology and generate a large set of statistics under one roof. This kind of concept I will call an umbrella concept. A related, but less controversial, thesis of this paper is that the (resurgence of the) concept of a knowledge-based economy in the 1990s owes a large debt to the OECD – and to the consultants it supported.

This paper looks at 1) where the concept of the knowledge-based economy comes from, 2) how it is defined and measured, and 3) what role statistics played in its development. A full genealogy of the concept of a knowledge-based economy would have to go back to the 1960-70s and the many authors, mainly in the United States, where buzzwords like Knowledge Society or Information Economy were invented. This history will be dealt with in another paper on the information society. This paper is specifically concerned

[3] B. Godin (2003), *Science, Technology and Economic Growth: The Diminishing Return of Statistics*, Project on the History and Sociology of Statistics, Montreal: CSIIC.

[4] F. Machlup (1962), *The Production and Distribution of Knowledge in the United States*, Princeton: Princeton University Press; M. Porat and M. Rubin (1977), *The Information Economy*, US Department of Commerce, Washington: GPO. Later influential and quantitative studies are: M. R. Rubin and M. Taylor (1984), *The Knowledge Industry in the United States: 1960-1980*, Princeton: Princeton University Press; OECD (1981), *Information Activities, Electronics and Telecommunications Technologies, Volume 1: Impact on Employment, Growth and Trade*, Paris; OECD (1986), *Trends in the Information Economy*, Paris.

with the resurgence of the concept of a knowledge economy in the 1990s, and with its recent causes. This resurgence took place mainly in Europe.

This paper is divided into three parts. The first argues that the concept of a knowledge-based economy re-emerged in the 1990s, arising from limitations in National Systems of Innovation (NSI), the then-current conceptual framework guiding science and technology policies. The second part examines the OECD's efforts to promote the knowledge-based economy, and the indicators developed to measure the concept. The third and final part suggests that viewing the OECD as a think-tank is the key to understanding the popularity of the concept among member countries.

National Systems of Innovation

For several decades, economists have been criticized for their failure to integrate institutions into their theories and econometric models. [5] Partly as a response to this situation, scholars in the field of science and technology studies invented the concept of national systems of innovation (NSI). [6] According to R. R. Nelson, an NSI "is a set of institutions whose interactions determine the innovative performance of national firms". [7] For B.-A. Lundvall, it "is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge". [8] These elements or institutions are firms, public laboratories and universities, but also financial institutions, the educational system, government regulatory bodies and others that interact with the former.

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[5] R. R. Nelson (1981), Research on Productivity Growth and Productivity Differences: Dead Ends and New Departures, *Journal of Economic Literature*, 19, pp. 1029-1064; R. R. Nelson and S. G. Winter (1977), In Search of a Useful Theory of Innovation, *Research Policy*, 6, pp. 36-76.

[6] C. Freeman (1987), *Technology Policy and Economic Performance*, London: Pinter; G. Dosi et al. (1988), *Technical Change and Economic Theory*, Part V: National Innovation Systems, London: Pinter; B.-A., Lundvall (ed.) (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter; R. R. Nelson (ed.) (1993), *National Innovation Systems: A Comparative Analysis*, Oxford: Oxford University Press; C. Edquist (ed.) (1997), *Systems of Innovation: Technologies, Institutions and Organizations*, London: Pinter; B. Amable, R. Barré and R. Boyer (1997), *Les systèmes d'innovation à l'ère de la globalisation*, Paris: Economica.

[7] R. R. Nelson (ed.) (1993), National Innovation Systems: A Comparative Analysis, *op. cit*. p. 4.

[8] B.-A. Lundvall (1992), Introduction, in B.-A., Lundvall (ed.), National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning, *op. cit*. p. 2.

There are two families of authors in the NSI literature: those centering on the analysis of institutions (including institutional rules) and describing the ways countries have organized their NSI, [9] and those who are more "theoretical", focusing on knowledge and the process of learning itself: learning-by-doing, learning-by-using, etc. [10] From the latter group, the concept of the knowledge economy re-emerged.

Lundvall (Denmark) launched the concept of a learning society or a learning economy in his book on NSI. According to Lundvall, "the most fundamental resource in the modern economy is knowledge and, accordingly, the most important process is learning". [11] For Lundvall, however, learning is not located in R&D departments only, as suggested until recently, but comes also from what he calls routine activities in production, distribution and consumption. And "the most important forms of learning may fundamentally be regarded as interactive learning", [12] that is learning from interactions between the different institutions of an NSI. [13]

> The learning economy involves the capability to learn and to expand the knowledge base. It refers not only to the importance of the science and technology systems – universities, research organizations, in-house R&D departments and so on – but also to the learning implications of the economic structure, the organizational forms and the institutional set-up.

It was to Lundvall – nominated deputy director of the OECD Directorate for Science, Technology and Industry (DSTI) in 1992 (until 1995) – that the OECD Secretariat entrusted its program on NSI. In fact, the OECD always looked for conceptual frameworks to catch the attention of policy-makers. In the early 1990s, it was NSI that were supposed to do the job: getting a better understanding of the significant differences between countries in terms of their capacity to innovate, and looking at how globalization and new trends in science and technology affect national systems. [14] From the start, the

[9] R. R. Nelson (ed.) (1993), National Innovation Systems, *op. cit*.
[10] B.-A. Lundvall (ed.) (1992), National Systems of Innovation, *op. cit.*
[11] B.-A. Lundvall (1992), Introduction, *op. cit*. p. 1.
[12] *Ibid*. p. 9.
[13] B.-A. Lundvall and B. Johnson (1994), The Learning Economy, *Journal of Industry Studies*, 1 (2), p. 26.
[14] OECD (1992), *National Systems of Innovation: Definitions, Conceptual Foundations and Initial Steps in a Comparative Analysis*, DSTI/STP(92)15; OECD (1994), *National Innovation Systems: Work Plan for*

OECD program identified the construction of indicators for measuring NSI as a priority, [15] and indeed early on suggested a list of indicators to this end (see Appendix 1). [16] But the decision to build on existing work because of budgetary constraints [17] considerably limited the empirical novelty of the studies. Nevertheless, the program, conducted in two phases between 1994 and 2001, produced several reports that looked at flows and forms of transactions among institutions, among them: clusters, networks, clusters, and mobility of personnel. [18] The program did not have the expected impact on policies, however. In a recent review paper, the OECD admitted: "there are still concerns in the policy making community that the NIS approach has too little operational value and is difficult to implement". [19]

If Lundvall has been one of the main authors in the literature on NSI, D. Foray (France) is the one behind the current concept of the knowledge-based economy, [20] as well as OECD work on the subject. His entry into the field started while he was consulting for the OECD in 1994-96. In an article written with P. David, he criticized the concept of NSI for being "neither strikingly original, nor rhetorically stirring", [21] and for placing too much emphasis on national institutions and economic growth, and not enough on the distribution of knowledge itself. However, Foray and David concluded similarly to Lundvall on a number of points, among them: "an efficient system of distribution and access to knowledge is a *sine qua non* condition for increasing the amount of innovative opportunities. Knowledge distribution is the crucial issue". [22]

Pilot Case Studies, DSTI/STP/TIP(94)16; OECD (1996), *National Innovation Systems: Proposals for Phase II*, DSTI/STP/TIP(96)11.

[15] OECD (1993), *Work on National Innovation Systems: Road Map*, DSTI/STP(93)8.

[16] OECD (1997), *National Innovation Systems*, Paris, p. 45.

[17] OECD (1992), National Systems of Innovation: Definitions, Conceptual Foundations and Initial Steps in a Comparative Analysis, *op. cit*. p. 10.

[18] OECD (1995), *National Systems for Financing Innovation*, Paris; OECD (1997), National Innovation Systems, *op. cit*.; OECD (1999), *Managing National Innovation Systems*, Paris; OECD (1999), *Boosting Innovation: The Cluster Approach*, Paris; OECD (2001), *Innovative Networks: Co-Operation in National Innovation Systems*, Paris; OECD (2001), *Innovative Clusters: Drivers of National Innovation Systems*, Paris; OECD (2001), *Innovative People: Mobility of Skilled Personnel in National Innovation Systems*, Paris; OECD (2002), Dynamising National Innovation Systems, Paris.

[19] OECD (2002), Dynamising National Innovation Systems, op. cit. p. 11.

[20] D. Foray (2000), *L'économie de la connaissance*, Paris: La Découverte.

[21] P. David and D. Foray (1995), Assessing and Expanding the Science and Technology Knowledge Base, *STI Review*, 16, p. 14.

[22] *Ibid*. p. 40.

Thus, it seems that a central characteristic of an NSI is the way knowledge is distributed and used. As K. Smith, author of the OECD (Oslo) manual on innovation, put it: "The overall innovation performance of an economy depends not so much on how specific formal institutions (firms, research institutes, universities, etc.) perform, but on how they interact with each other". [23] Indeed, "knowledge is abundant but the ability to use it is scarce". [24]

Another consensual view of authors on NSI was that society simply did not have the appropriate tools to measure the knowledge economy. For Smith, the "systems approaches have been notable more for their conceptual innovations, and the novelty of their approaches, rather than for quantification of empirical description". [25] "There are no straightforward routes to empirical system mapping: we have neither purpose-designed data sources, nor any obvious methodological approach. The challenge, therefore, is to use existing indicators and methods" (p. 70). For Lundvall, "the most relevant performance indicators of NSI should reflect the efficiency and effectiveness in producing, diffusing and exploiting economically useful knowledge. Such indicators are not well developed today". [26] Similarly, David and Foray suggested: "A system of innovation cannot only be assessed by comparing some absolute input measures such as R&D expenditures, with output indicators, such as patents or high-tech products. Instead innovation systems must be assessed by reference to some measures of the use of that knowledge". [27] "The development of new quantitative and qualitative indicators (or the creative use of existing ones) is an urgent need in the formation of more effective science and technology policies" (p. 82).

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[23] K. Smith (1995), Interactions in Knowledge Systems: Foundations, Policy Implications and Empirical Methods, *STI Review*, 16, p. 72.
[24] B.-A. Lundvall and B. Johnson (1994), The Learning Economy, *op. cit*. p. 31.
[25] K. Smith (1995), Interactions in Knowledge Systems: Foundations, Policy Implications and Empirical Methods, *op. cit*. p. 81.
[26] B.-A. Lundvall (1992), Introduction, *op. cit*. p. 6.
[27] P. David and D. Foray (1995), Assessing and Expanding the Science and Technology Knowledge Base, *op. cit*. p. 81.

The OECD gave itself the task of developing the appropriate indicators. To this end, it had first of all to solidify the concept of the knowledge-based economy. In fact, this concept had previously appeared, and then disappeared, in recent history, as a way of describing the new economy. J. R. Beniger has identified 75 such buzzwords invented between 1950 and 1984 (see Appendix 2), one of which, first appearing in 1962, was the Knowledge Economy. [28] The OECD used several strategies to revive the concept, one of them being the enrollment of its promoters as consultants. The second most important strategy was using statistics, which helped crystallize the concept by giving it empirical content.

The Knowledge-Based Economy

The OECD NSI project flirted with the concept of a knowledge economy, as we have seen, having even temporarily redefined the initial objectives of the project around knowledge access and distribution, whereas the original aims concerned institutional factors explaining the efficiency of NSI. [29] The NSI project also flirted with indicators on knowledge distribution, but rapidly concluded, "it has proved difficult to produce general indicators of the knowledge distribution power of a national innovation system". [30] In the end, the concept instead served a rhetorical role in NSI papers: in section titles and introductory texts.

The first step toward the generalized used of the concept of a knowledge-based economy at the OECD came in 1995, with a document written by the Canadian delegation for the ministerial meeting of the Committee on Science and Technology Policy (CSTP). The paper, including the knowledge-based economy concept in its title, discussed two themes:

[28] J. R. Beniger (1986), *The Control Revolution: Technological and Economic Origins of the Information Society*, Cambridge (Mass.): Harvard University Press.
[29] Compare OECD (1993), Work on National Innovation Systems: Road Map, *op. cit.* with OECD (1994), National Innovation Systems: Work Plan for Pilot Case Studies, *op. cit.*
[30] OECD (1996), National Innovation Systems: Proposals for Phase II, *op. cit.* p. 3.

new growth theory and innovation performance. [31] On the first theme, the Secretariat suggested:

> Economics has so far been unable to provide much understanding of the forces that drive long-term growth. At the heart of the old theory (neoclassical) is the production function, which says the output of the economy depends on the amount of production factors employed. It focuses on the traditional factors of labor, capital, materials and energy (…). The new growth theory, as developed by such economists as Romer, Grossman, Helpman and Lipsey, adds the knowledge base as another factor of production" (p. 3).

For the OECD, the work of the organization on NSI built precisely on the new growth theory, for it looked at the "effective functioning of all the components of a national system of innovation".

On the second theme – innovation – a dynamic NSI was again suggested as the key to effectiveness. But understanding NSI required "better measures of innovation performance and output indicators" (p. 5). "Most current indicators of science and technology activities, such as R&D expenditures, patents, publications, citations, and the number of graduates, are not adequate to describe the dynamic system of knowledge development and acquisition. New measurements are needed to capture the state of the distribution of knowledge between key institutions and interactions between the institutions forming the NSI, and the extent of innovation and diffusion" (p. 6). This message was carried over into the 1995 ministerial declaration and recommendations: "there is need for Member countries to collaborate to develop a new generation of indicators which can measure innovative performance and other related output of a knowledge-based economy". [32]

Soon, various committees, working groups and people at the OECD appropriated the concept of a knowledge-based economy: conferences were held that included the

[31] OECD (1995), *The Implications of the Knowledge-Based Economy for Future Science and Technology Policies*, OCDE/GD(95)136.
[32] OECD (1996), Conference on New S&T Indicators for a Knowledge-Based Economy: Background Document, DSTI/STP/NESTI/GSS/TIP (96) 2, p. 2,

concept, [33] papers were published in the policy series (*STI Outlook*) that attempted to promote it, [34] and a whole program of work on new indicators was developed, [35] from which scoreboards were produced. [36]

Defining the Knowledge-Based Economy

In the mid-1990s, the knowledge-based economy was a fuzzy concept. At the OECD conference on employment and growth in the knowledge-based economy, Foray and Lundvall joined forces, arguing that the "economy is more strongly and more directly rooted in the production, distribution and use of knowledge than ever before". [37] According to other authors, however, the concept was rather a rhetorical term, a metaphor "often used in a superficial and uncritical way". [38] Briefly stated, it can be said that the term knowledge-based economy referred to at least two (supposed) characteristics of the new economy. Firstly, knowledge would be more quantitatively and qualitatively important than before. Secondly, applications of information and communication technologies (ICT) would be the drivers of the new economy.

For a "systematic" definition of knowledge-based economies, we have to turn to the OECD *STI Outlook* series. In 1996, the OECD defined knowledge-based economies as: "economies which are directly based on the production, distribution and use of

[33] OECD (1996), *Employment and Growth in the Knowledge-Based Economy*, Paris; OECD (1997), *Industrial Competitiveness in the Knowledge-Based Economy: The New Role of Governments*, Paris.
[34] OECD (1996), *Science, Technology and Industry Outlook*, chapter 5, Paris; OECD (2000), *Science, Technology and Industry Outlook*, chapter 1, Paris; OECD (2002), *Science, Technology and Industry Outlook*, chapter 1, Paris.
[35] A workshop and a conference on a new generation of indicators for the KBE were organized in 1996 and 1998 (Blue Sky Project). See OECD (1996), *Conference on New Indicators for the Knowledge-Based Economy: Summary Record*, DSTI/STP/NESTI/GSS/TIP (96) 5; OECD (1997), *Progress Report on the "New S&T Indicators for the Knowledge-Based Economy" Activity*, DSTI/EAS/STP/NESTI (97) 6; OECD (1998), *Seminar on New Indicators for the Knowledge-Based Economy: Development Issues*, CCNM/DSTI/EAS (98) 63; OECD (1998), *New S&T Indicators for a Knowledge-Based Economy: Present Results and Future Work*, DSTI/STP/NESTI/GSS/TIP (98) 1.
[36] OECD (1999), *STI Scoreboard: Benchmarking Knowledge-Based Economies*, Paris; OECD (2001), *STI Scoreboard: Towards a Knowledge-Based Economy*, Paris.
[37] D. Foray and B.-A. Lundvall (1996), The Knowledge-Based Economy: From the Economics of Knowledge to the Learning Economy, in OECD, Employment and Growth in the Knowledge-Based Economy, *op. cit*. pp. 11-32.
[38] K. Smith (2002), *What is the Knowledge Economy? Knowledge Intensity and Distributed Knowledge Bases*, UNU/INTECH Discussion Paper, ISSN 1564-8370, p. 5.

knowledge and information". [39] A more or less identical definition has carried over into every subsequent document of the organization dealing with the knowledge-based economy.

In the course of its efforts to define the knowledge-based economy, the OECD invented two related concepts that gave it more substance. The first concerned "investment in knowledge", and the definition was entirely statistical: "expenditures directed towards activities with the aim of enhancing existing knowledge and/or acquiring new knowledge or diffusing knowledge". [40] According to the OECD, investment in knowledge is the sum of expenditures on R&D, higher education and software. The second newly-coined concept was in fact a variation on the (controversial) indicator of high-technology intensity: knowledge-based industries. Knowledge-based industries were defined as those that had the following three characteristics: 1) a high level of investment in innovation, 2) intensive use of acquired technology, and 3) a highly-educated workforce. [41]

But the main conceptual work on the knowledge-based economy at the OECD had to do with collecting a whole set of indicators under the concept of the knowledge-based economy. Recalling Foray and Lundvall's comment that evidence documenting trends in the knowledge-based economy was in fact anecdotal, [42] the OECD suggested five categories of indicators to measure the knowledge-based economy: inputs, stocks and flows, outputs, networks, and learning. [43] The first measurement exercise, to which we now turn, appeared in 1999, in the form of a scoreboard of indicators.

[39] OECD (1996), *The Knowledge-Based Economy*, in OECD, STI Outlook, Paris, p. 3.
[40] OECD (2001), STI Scoreboard: Towards a Knowledge-Based Economy, *op. cit*. p. 14; M. Kahn (2001), Investment in Knowledge, *STI Review*, 27, pp. 19-47.
[41] C. Webb (2000), *Knowledge-Based Industries*, DSTI/EAS/IND/SWP (2000)5; C. Webb (2001), *Knowledge-Based Industries*, DSTI/EAS/IND/SWP (2001)13.
[42] D. Foray and B.-A. Lundvall (1996), The Knowledge-Based Economy: From the Economics of Knowledge to the Learning Economy, *op. cit*. p. 16.
[43] OECD (1996), *The Knowledge-Based Economy*, in OECD, STI Outlook, *op. cit*. p. 20.

In the mid-1990s, the DSTI restructured its publication. [44] Until then, four reviews and/or outlooks had been prepared. The Secretariat suggested merging the "Industrial" and "Science and Technology Policy" reviews into one (*STI Outlook*), to be published every two years. In the alternating year, a scoreboard of indicators would be published.

The idea of the scoreboard followed the construction of the STAN database (Structural Analysis) and its affiliates in the early 1990s. One of the first reports to come out of the new databases was a scoreboard of sixteen indicators covering R&D, investment, international trade, employment and structural change. [45] Thereafter, and starting in 1995, an *Industry and Technology Scoreboard of Indicators* was published every two years. It included a series of economic and science and technology indicators, graphically illustrated, ranking countries on different dimensions, and with a very brief analytical text (two to five paragraphs per indicator).

From the scoreboards, the DSTI also produced compendiums specifically designed for ministerial meetings: one in 1995, [46] and another in 1999. [47] These documents were "synthetic and attractive" statistical and analytical documents that "tell a story readily understandable by generalists and the press". [48] It included a set of indicators, each presented on one page, with graphs and bullet points highlighting the main trends.

The 1999 issue of the compendium dealt with the knowledge-based economy. It collected 32 indicators, [49] of which nine were specifically identified as measuring the

[44] OECD (1994), *Developing STI Review/Outlooks: A Proposal*, DSTI/IND/STP/ICCP (94) 4; OECD (1995), *Réunion ad hoc conjointe sur l'intégration des rapports relatifs aux perspectives*, DSTI/IND/STP (95) 1.
[45] OECD (1993), *Manufacturing Performance: A Scoreboard of Indicators for OECD Countries*, DSTI/EAS/IND/WP9 (93) 2.
[46] OECD (1995), *Science and Technology Indicators*, Meeting of the Committee for Scientific and Technological Policy at Ministerial Level, Paris.
[47] OECD (1999), *The Knowledge-Based Economy: A Set of Facts and Figures*, Paris.
[48] OECD (1998), *Possible Meeting of the CSTP at Ministerial Level: Statistical Compendium*, DSTI/EAS/STP/NESTI (98) 8, p. 3.
[49] Including, for the first time in an OECD statistical publication, bibliometric indicators.

knowledge-based economy (Appendix 3). The indicators showed, among other things, that: 1) knowledge-based industries have been outpacing GDP growth (up to 50% that of GDP), 2) OECD countries spend more and more resources on the production of knowledge (8% of GDP, a share as important as that on physical investments), 3) over 60% of the population aged 25-64 has completed upper secondary schooling, 4) OECD economies invested 7% of GDP on ICT, 5) R&D was expanding (US$500 billion in 1997), 6) the business sector was the main funder and performer of R&D (over 60%). The statistics were updated in 2000, [50] and the indicators increased in 2001 (Appendix 4). [51]

The work behind the measurement of the knowledge-based economy was conducted in part by the group of National Experts on Science and Technology Indicators (NESTI), via a project called Blue Sky, launched in 1996. [52] Six priority areas were identified for the development of a new generation of indicators:

- Mobility of human resources,
- Patents,
- Innovation capabilities of firms,
- Internationalization of industrial R&D,
- Government support to innovation,
- Information technology.

The aim was to develop two types of statistical products. [53] The first were data and indicators, published on a regular basis, i.e. yearly. The second were data sets for use in specific studies, like those on the knowledge-based economy. Two conferences were held, one in 1996 and another in 1998, where the six above areas were targeted and a program of work was developed for each, the various programs each being led by a

[50] OECD (2000), Progress Towards a Knowledge-Based Economy, in OECD, STI Outlook, *op. cit*.
[51] OECD (2001), STI Scoreboard: Towards a Knowledge-Based Economy, *op. cit*.
[52] OECD (1996), Conference on New S&T Indicators for a Knowledge-Based Economy: Summary Record of the Conference Held on 19-21 June 1996, *op. cit*.; OECD (1996), Conference on New S&T Indicators for a Knowledge-Based Economy: Background Document, *op. cit*.

specific country or group of countries. The criteria for the proposed topics were the following: they must 1) be relevant from a policy point of view, 2) be feasible in terms of methodology, 3) be not too resource-consuming, 4) refer to well identified questions, and 5) be topics in which the OECD has a role to play and a comparative advantage. However, it was clearly mentioned that: "budget restrictions (and the burden for respondents) set strict limits on the possibility of developing new surveys. Against this background, the endeavor for building new data and indicators will consist mainly in extracting more and new information from the existing stock of data". [54] This meant measuring new dimensions of science and technology using links between existing data rather than by producing new data, linking of existing data being far less expensive than developing brand-new surveys. [55]

Frameworks, Labels and Buzzwords

Did the new indicators measure up to their promise? [56] The question can be answered by comparing the output to the recommendations of the promoters of the concept of the knowledge-based economy, among them the OECD itself, or by analyzing the definition and dimensions of the concept and the measurement of these dimensions. On the first comparison, it seems clear that everyone was dissatisfied with the existing indicators and suggested new measurements early in the process:

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[53] OECD (1996), Conference on New S&T Indicators for a Knowledge-Based Economy: Background Document, *op. cit*., p. 2.

[54] OECD (1996), *New Indicators for the Knowledge-Based Economy: Proposals for Future Work*, DSTI/STP/NESTI/GSS/TIP (96) 6, p. 4.

[55] See OECD (1996), Conference on New S&T Indicators for a Knowledge-Based Economy: Summary Record of the Conference Held on 19-21 June 1996, *op. cit.*; OECD (1996), New Indicators for the Knowledge-Based Economy: Proposals for Future Work, *op. cit*.

[56] For an overview of the results of the NESTI program, see the special issue of *STI Review*, 27, 2002.

K. Smith: [57]

- Inter-industry transactions embodying flows of technological knowledge,
- Patterns of use of formal scientific knowledge,
- Patterns of technological collaboration between firms, universities and research institutions,
- Measures of personnel mobility and related interactions.

D. Foray: [58]

- Basic attributes of the knowledge base,
- Systems and mechanisms for transferring knowledge,
- Effectiveness of the knowledge base.

OECD: [59]

- Knowledge stocks and flows,
- Knowledge rates of return,
- Knowledge networks,
- Knowledge and learning.

From an analysis of the OECD scoreboards of indicators, however, one must conclude that the knowledge-based economy is above all a label. Most, if not all, of the indicators collected are indicators that the OECD had already been measuring for years or even decades, or are variations on old indicators that had suddenly become subsumed under the concept of the knowledge-based economy. [60] The documents simply aligned a series of indicators and fact-sheets placed under a new umbrella – the knowledge-based economy. In 1999, nine of the thirty-two indicators were specifically located and analyzed under the concept – although the document as a whole was called *The Knowledge-Based Economy*. By 2001, there were twenty-five. In fact, a simple reorganization of categories (turning indicators from the 1999 category "science and technology policies", as well as some from the "output and impact" category, into the

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[57] K. Smith (1995), Interactions in Knowledge Systems: Foundations, Policy Implications and Empirical Methods, *op. cit*.
[58] D. Foray (2000), Characterizing the Knowledge Base: Available and Missing Indicators, in OECD, *Knowledge Management in the Learning Society*, Paris, pp. 239-257.
[59] OECD (1996), The Knowledge-Based Economy, in OECD, STI Outlook, *op. cit*.

"creation and diffusion of knowledge" category) was responsible for the increase. All 59 indicators from the scoreboard, however, were now analyzed as measuring the knowledge-based economy in the introductory text.

If we now look at the OECD definition of knowledge-based economies ("economies which are directly based on the production, distribution and use of knowledge and information"), we would expect to find indicators on the production as well as the distribution and diffusion of knowledge. And indeed, several indicators dealt with the production side of knowledge, as has always been the case with science and technology indicators (R&D, human resources, patents). But the few that concern distribution and diffusion either concentrated on ICT, or were still measured using input and activity indicators rather than outputs and impacts. It is clear that the indicators draw on available data sets, and that the knowledge-based economy is above all a rhetorical concept.

In fact, a critical analysis of the concept reveals the following three rhetorical moves. Firstly, the concept is justified with the same arguments as those on NSI, information society or New Economy: knowledge and ICT are said to be important factors that bring about important changes in the economy. [61] One finds here a network of concepts that feed at the same source and which reinforce each other. Secondly, the content of the concept is composed of a synthesis or collection of recent ideas in the field of science and technology studies. Like the NSI literature that brought together the latest ideas on tacit learning, learning-by-doing, user-producer interactions, diffusion of technologies, clusters and networks, the concept of the knowledge-based economy collected fashionable ideas from new growth theories, NSI and the information society. Thirdly, the two previous moves combine to make the concept an umbrella concept: the knowledge-based economy is a term that now covers statistics in all areas of science and technology, broadly defined – R&D, ICT, education, etc. Therefore, it is very fertile "theoretically" and empirically, and can be used for any issues in science and technology

[60] This is not peculiar to the OECD. Contrary to its claims, D. Foray did not totally succeed in distinguishing the traditional economics of R&D and innovation from the knowledge-based economy, at least with regard to the policy issues. See: D. Foray (2000), L'économie de la connaissance, *op. cit*.

– and anywhere: titles of whole reports; chapters or introductory sections; lists of indicators; and … policies.

How can we explain the situation? Do we really need such fuzzy concepts? Do we really need another concept *en lieu et place* of the previous but more or less identical one? To explain the pervasiveness and popularity of these concepts in the official literature, we must examine the policy process and the role of the OECD in this process. [62]

The OECD is a think-tank, not an advocacy think-tank looking for media exposure, but a research think-tank that feeds policy-makers. It uses two strategies to this end. The first is institutional, and concerns the activities below:

- Organizing conferences and workshops to discuss policy issues.
- Publishing books, reports, studies and journals, brief texts (for ministers) and press releases.
- Setting up committees and working groups composed of national delegates.
- Sharing workload with member countries.
- Inviting or hiring national bureaucrats to join the organization.

Academics are regularly enrolled in these activities. They are consulted or invited to participate in various forums to "enlighten" bureaucrats and share ideas. With regard to statistics, for example, the OECD: 1) digests academics' works by reading (and citing) recent studies, inviting academics as speakers to workshops and conferences, and hiring

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[61] B. Godin (2003), Science, Technology and Economic Growth: The Diminishing Return of Statistics, *op. cit.*

[62] Policy-makers are no exception, however. Buzzwords are also much in vogue in academic circles, like "Mode 1/Mode 2", "Triple Helix". For critical analyses, see: B. Godin (1998), Writing Performative History: The New "New Atlantis", *Social Studies of Science*, 28 (3), pp. 465-483; T. Shinn (2002), The Triple Helix and New Production of Knowledge: Prepackaged Thinking in Science and Technology, *Social Studies of Science*, 32 (4), pp. 599-614. Lundvall recently imitated the strategy of the authors on the Triple Helix to re-launch the concept of NSI in a special issue of *Research Policy*. See: B.-A. Lundvall, B. Johnson, E. S. Andersen and B. Dalum (2003), National Systems of Production, Innovation and Competence Building, *Research Policy*, 31, pp. 213-231.

them as consultants or staff; [63] 2) internationalizes its statistics (as well as official national statistics) to make them comparable between countries, and constructs standards, rankings, and policy targets. [64]

It is based on this material that a second strategy is developed, a rhetorical strategy: organizing and packaging the previous material into a conceptual (or policy) framework with buzzwords and slogans as labels. Figures and graphs are also used liberally to facilitate reading. Such a strategy dates back to the beginning of this century, at the very least, and was one of the factors for the success of the National Science Foundation *Science Indicators* publication in the 1970s. [65] As early as 1919, W. C. Mitchell suggested such a way of presenting statistics to policy-makers: [66]

> Secure a quantitative statement of the critical elements in an official's problem, draw it up in concise form, illuminate the tables with a chart or two, bind the memorandum in an attractive cover tied with a neat bow-knot (…). The data must be simple enough to be sent by telegraph and compiled overnight.

The rhetorical strategy is motivated by several factors. Linked as it is to the policy process, the OECD has to feed ministers regularly for their meetings. An easy way to do this is to turn readily available academic fads into keywords (or buzzwords), then into slogans in order to catch the attention of policy-makers. Buzzwords and slogans help sell ideas: they are short, simple, and easy to remember. At several places in its documents, the OECD recognized that its indicators were "not adequate to describe the dynamic system of knowledge development and acquisition". [67] But they probably appeared

[63] B. Godin (2003), Science, Technology and Economic Growth: The Diminishing Return of Statistics, *op. cit.*
[64] B. Godin (2003), *The Most Cherished Indicator: Gross Domestic Expenditure on R&D (GERD)*, Project on the History and Sociology of S&T Statistics, Montreal: CSIIC.
[65] B. Godin (2003), The Emergence of Science and Technology Indicators: Why Did Governments Supplement Statistics with Indicators?, *Research Policy*, 32 (4), pp. 679-691.
[66] W. C. Mitchell (1919), Statistics and Government, *Journal of the American Statistical Association*, 125, March, pp. 223-235.
[67] OECD (1995), The Implications of the Knowledge-Based Economy for Future Science and Technology Policies, *op. cit*. p. 6.

sufficiently "objective", simply because they were quantitative, to draw the attention of policy-makers, politicians and the general public to matters of science and technology.

A second factor explaining the OECD strategy is the rush to publish. The OECD publishes biannual, yearly and biennial reports, among them those for ministers' conferences, where timeframes are very tight. Umbrella concepts are very fertile for producing documents. They synthesize what is already available, what comes from day-to-day work conducted in other contexts and, above all, what is fashionable, often at the price of original work.

It remains that the concept of the knowledge-based economy is a rhetorical concept. Certainly, important methodological difficulties await anyone interested in measuring intangibles like knowledge. But the objective of a policy organization is not, above all, accuracy, but influence. As Foray and Lundvall once suggested: "One function of the notion of the knowledge-based economy is to attract the attention of statisticians and other experts in the field of social and economic indicators". [68]

Conclusion

The knowledge-based economy is an umbrella concept: it allows one to gather existing ideas and concepts on science and technology, and any indicators, into a conceptual framework, i.e.: all under one roof. This is a fertile strategy for rapidly producing new papers and discourses, and alerting policy-makers to new trends. But what impact has the concept had in recent history? Three possible areas of influence could be explored.

The first is policy. The concept has probably helped to sustain, or at the very least give increased visibility to, science and technology policies. In a context of budget constraints, and after a decade of haphazard trends in R&D investments, buzzwords such as the

[68] D. Foray and B.-A. Lundvall (1996), The Knowledge-Based Economy: From the Economics of Knowledge to the Learning Economy, in OECD, Employment and Growth in the Knowledge-Based Economy, *op. cit*. p. 18.

knowledge-based economy helped re-launch discourses on science and technology. Several recent new science and technology policies now include the concept. [69]

The second area of possible impact is statistics. To date, however, the concept of the knowledge-based economy has had a very limited impact on statistics. Traditional statistics and indicators, based on input and activity data sets, still dominate the measurement of science and technology and, above all, the concept of the knowledge-based economy. Certainly there have been some efforts in new fields (i.e.: mobility of personnel) – although none really fruitful yet – but there has been far less effort on the central and new characteristics of the supposed knowledge-based economy, like tacit knowledge. The major innovation remains simply the collection of several indicators from different sources under a new label.

Where the concept has been most effective, however, was in spawning other concepts. The concept of the knowledge-based economy recently gave rise to another concept, now much in vogue in the OECD and among its member countries – knowledge management: [70]

> Once there was a focus on the production, transmission and use of productive knowledge, a policy interest of the 90s, the need for knowledge management, and its understanding was an obvious next step (…). Knowledge management covers any intentional and systematic process or practice of creating, acquiring, capturing, sharing and using productive knowledge, wherever it resides, to enhance learning and performance in organizations. [71]

Under the directorship of its Center for Educational Research and Innovation (CERI), the OECD recently launched a project on the economics and management of knowledge. In line with OECD recommendations, some countries have now initiated surveys on

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[69] See, for example: CEC (2000), *Innovation in a Knowledge-Driven Economy*, COM (2000) 567; Commisariat du Plan (2002), *La France dans l'économie du savoir: pour une dynamique collective*, groupe de travail Vignier, Paris; Government of Canada (2002), *Canada's Innovation Strategy, I. Knowledge Matters: Skills and Learning for Canadians; II. Achieving Excellence: Investing in People, Knowledge and Opportunity*, Ottawa: Industry Canada.

[70] OECD (2000), Knowledge Management in the Learning Society, *op. cit*.

[71] D. Foray (2001), *Terms of Reference for a Project on Design, Implementation and Exploitation of an International Survey of Knowledge Management in the Private Sector*, DSTI/ICCP/IIS/RD (2001) 5, p. 2.

knowledge management practices, [72] and the European Commission will soon launch a survey of innovation-management methodologies. [73] The surveys aim to measure the kinds and uses of knowledge management practices in firms, the reasons for doing their use, and the budget allocated to the activities. To date, however, the results are far from original. Learning that a majority of firms (86% in the case of Canada) manage some aspect of their knowledge, for example, is not particularly informative, [74] and is even less so since knowledge management practices were defined very loosely (see Appendix 5).

Nevertheless, from recent history, we can predict without much hesitation that the buzzword of the next few years will be knowledge management, and the same rhetorical strategies will be applied anew. In fact, the same authors that participated in the OECD writings on the knowledge-based economy continue to contribute to the new work, among them Lundvall and Foray. A case of institutional coherence but, above all, a marvelous case-study in progress on the semantic fertility of concepts and the rhetorical side of science and technology policies.

[72] L. Earl (2002), *Are We Managing our Knowledge? Results from the Pilot Knowledge Management Practices Survey, 2001*, Ottawa: Statistics Canada, 88F0006XIE No. 06; J. Edler (2002), *German Pilot Study*, Fraunhofer Institute for Systems and Innovation Research, Karlsruhe; Center for Ledelse (2002), *Report: Danish Pilot Survey*.

[73] CEC (2003), *Innovation: Forthcoming Policy Studies – Innovation Management and the Knowledge-Driven Economy*, pp. 22-28.

[74] The opposite would have been problematic.

Appendix 1.

Indicators of Knowledge Flows in NSI

(National Innovation Systems, OECD, 1997)

Type of knowledge flows	Main [source of] indicator
Industry alliances	
Inter-firm research co-operation	Firm surveys
	Literature-based counting
Industry/university interactions	
Co-operative industry/university R&D	university annual reports
Industry/University co-patents	patent record analysis
Industry/University co-publications	publications analysis
Industry use of university patents	citation analysis
Industry/University information-sharing	firm surveys
Industry/University institute interactions	
Co-operative industry/institute R&D	government reports
Industry/institute co-patents	patent record analysis
Industry/institute co-publications	publications analysis
Industry use of research institute patents	citation analysis
Industry/institute information-sharing	firm surveys
Technology diffusion	
Technology use by industry	firm surveys
Embodied technology diffusion	input-output analysis
Personnel mobility	
Movement of technical personnel among	labor market statistics
industry, university and research	university/institute reports

Appendix 2.

Modern Societal Transformations Identified Since 1950

(Beniger, 1986)

Year	Transformation	Source
1950	Lonely crowd	Riesman 1950
	Posthistoric man	Seidenberg 1950
1953	Organizational revolution	Boulding 1953
1956	Organization man	Whyte 1956
1957	New social class	Djilas 1957; Gouldner 1979
1958	Meritocracy	Young 1958
1959	Educational revolution	Drucker 1959
	Postcapitalist society	Dahrendorf 1959
1960	End of ideology	Bell 1960
	Postmaturity economy	Rostow 1960
1961	Industrial society	Aron 1961; 1966
1962	Computer revolution	Berkeley 1962; Tomeski 1970; Hawkes 1971
	Knowledge economy	Machlup 1962; 1980; Drucker 1969
1963	New working class	Mallet 1963; Gintis 1970; Gallie 1978
	Postbourgeois society	Lichtheim 1963
1964	Global village	McLuhan 1964
	Managerial capitalism	Marris 1964
	One-dimensional man	Marcuse 1964
	Postcivilized era	Boulding 1964
	Service class society	Dahrendorf 1964
	Technological society	Ellul 1964
1967	New industrial state	Galbraith 1967
	Scientific-technological revolution	Richta, 1967; Daglish 1972; Prague Academy 1973
1968	Dual economy	Averitt 1968
	Neocapitalism	Gorz 1968
	Postmodern society	Etzioni 1968; Breed 1971
	Technocracy	Meynaud 1968
	Unprepared society	Michael 1968
1969	Age of discontinuity	Drucker 1969
	Postcollectivist society	Beer 1969
	Postideological society	Feuer 1969
1970	Computerized society	Martin and Norman 1970
	Personal society	Halmos 1970
	Posteconomic society	Kahn 1970
	Postliberal age	Vickers 1970
	Prefigurative culture	Mead 1970
	Technetronic era	Brzezinski 1970
1971	Age of information	Helvey 1971
	Compunications	Oettinger 1971
	Postindustrial society	Touraine 1971; Bell 1973
	Self-guiding society	Breed 1971
	Superindustrial society	Toffler 1971
1972	Limits to growth	Meadows 1972; Cole 1973
	Posttraditional society	Eisenstadt 1972
	World without borders	Brown 1972
1973	New service society	Lewis 1973

	Stalled society	Crozier 1973
1974	Consumer vanguard	Gartner and Riessman 1974
	Information revolution	Lamberton 1974
1975	Communications age	Phillips 1975
	Mediacracy	Phillips 1975
	Third industrial revolution	Stine 1975; Stonier 1979
1976	Industrial-technological society	Ionescu 1976
	Megacorp	Eichner 1976
1977	Electronics revolution	Evans 1977
	Information economy	Porat 1977
1978	Anticipatory democracy	Bezold 1978
	Network nation	Hiltz and Turoff 1978
	Republic of technology	Boorstin 1978
	Telematic society	Nora and Minc 1978; Martin 1981
	Wired society	Martin 1978
1979	Collapse of work	Jenkins and Sherman 1979
	Computer age	Dertouzos and Moses 1979
	Credential society	Collins 1979
	Micro millennium	Evans 1979
1980	Micro revolution	Large 1980, 1984; Laurie 1981
	Microelectronics revolution	Forester 1980
	Third wave	Toffler 1980
1981	Information society	Martin and Butler 1981
	Network marketplace	Dordick 1981
1982	Communications revolution	Williams 1982
	Information age	Dizard 1982
1983	Computer state	Burnham 1983
	Gene age	Sylvester and Klotz 1983
1984	Second industrial divide	Piore and Sabel 1984

Appendix 3.

Indicators from

The Knowledge-Based Economy:

A Set of Facts and Figures (OECD, 1999)

1. **Knowledge-based economy**
    a. Investments in capital and knowledge
    b. Human resources (education)
    c. GERD
    d. Fundamental research
    e. Business R&D
    f. R&D in manufacturing industries
    g. R&D in services
    h. Innovation
    i. Venture capital

2. **Information and communication technologies (ICT)**
    a. ICT spending as a percentage of GNP
    b. Use of computers
    c. Internet and e-commerce
    d. ICT sector
    e. Innovation in ICT

3. **S&T policies**
    a. Public R&D/GNP
    b. Socio-economic objectives of R&D
    c. Share of public R&D
    d. R&D financial flows between sectors
    e. Public support to R&D
    f. Business R&D by size
    g. Tax subsidies

4. **Globalization**
    a. R&D abroad
    b. Patent ownership
    c. Technological alliances
    d. Co-signatures and co-inventions

5. **Output and impact**
    a. Scientific publications
    b. Patents
    c. Innovation
    d. Productivity
    e. Share of knowledge industries in added value
    f. High technology trade
    g. Technological balance of payments

Appendix 4.

Indicators from

STI Scoreboard:

Towards a Knowledge-Based Economy (OECD, 2001)

A. Creation and Diffusion of Knowledge

Investments in knowledge
Domestic R&D expenditure
R&D financing and performance
Business R&D
Business R&D by industry
R&D in selected ICT industries and ICT patents
Business R&D by size classes of firms
Collaborative efforts between business and the public sector
R&D performed by the higher education and government sectors
Public funding of biotechnology R&D and biotechnology patents
Environmental R&D in the government budget
Health-related R&D
Basic research
Defence R&D in government budgets
Tax treatment of R&D
Venture capital
Human resources
Human resources in science and technology
Researchers
International mobility of human capital
International mobility of students
Innovation expenditure and output
Patent applications to the European Patent Office (EPO)
Patent families
Scientific publications

B. Information Economy

Investment in information and communication technologies (ICT)
Information and communication technology (ICT) expenditures
Occupations and skills in the information economy
Infrastructure for the information economy
Internet infrastructure
Internet use and hours spent on-line
Access to and use of the Internet by households and individuals
Internet access by enterprise size and industry
Internet and electronic commerce transactions
Price of Internet access and use
Size and growth of the ICT sector
Contribution of the ICT sector to employment growth
Contribution of the ICT sector to international trade
Cross-border mergers, acquisitions and alliances in the ICT sector

C. Global Integration of Economic Activity

International trade
Exposure to international trade competition by industry
Foreign direct investment flows
Cross-border mergers and acquisitions
Activity of foreign affiliates in manufacturing
Activity of foreign affiliates in services
Internationalization of industrial R&D
International strategic alliances between firms
Cross-border ownership of inventions
International co-operation in science and technology
Technology balance of payments

D. Economic Structure and Productivity

Differences in income and productivity
Income and productivity levels
Recent changes in productivity growth
Labour productivity by industry
Technology and knowledge-intensive industries
Structure of OECD economies
International trade by technology intensity
International trade in high and medium-high-technology industries
Comparative advantage by technology intensity

Appendix 5.

Knowledge Management Practices

Statistics Canada (2002)

Leadership

Knowledge management practices were a responsibility of managers and executives
Knowledge management practices were explicit criteria for assessing worker performance
Knowledge management practices were a responsibility of non-management workers
Knowledge management practices were a responsibility of the knowledge officer or knowledge management unit

Knowledge Capture and Acquisition

Firm captured and used knowledge obtained from other industry sources such as industrial associations, competitors, clients and suppliers
Firm captured and used knowledge obtained from public research institutions including universities and government laboratories
Firm dedicated resources to detecting and obtaining external knowledge and communicating it within the firm
Firm encouraged workers to participate in project teams with external experts

Training and Mentoring

Firm encouraged experienced workers to transfer their knowledge to new or less experienced workers
Firm provided informal training related to knowledge management
Firm encouraged workers to continue their education by reimbursing tuition fees for successfully completed work-related courses
Firm offered off-site training to workers in order to keep skills current
Firm provided formal training related to knowledge management practices
Firm used formal mentoring practices, including apprenticeships

Policies and Strategies

Used partnerships or strategic alliances to acquire knowledge
Policies or programs intended to improve worker retention
Values system or culture intended to promote knowledge sharing
Written knowledge management policy or strategy

Communications

Workers shared knowledge by preparing written documentation such as lessons learned, training manuals, good work practices, articles for publication, etc. (organizational memory)
Workers shared knowledge by regularly updating databases of good work practices, lessons learned or listings of experts
Workers shared knowledge in collaborative work by project teams that are physically separated (“virtual teams”)

Incentives

Knowledge sharing was rewarded with monetary incentives
Knowledge sharing was rewarded with non-monetary incentives