

Bureaucratization in Public Research Institutions

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Abstract The purpose of this paper is to analyse the nature of bureaucratization within public research bodies and its relationship to scientific performance, focusing on an Italian case-study. The main finding is that the bureaucratization of the research sector has two dimensions: public research labs have academic bureaucratization since researchers spend an increasing part of their time in administrative matters (i.e., preparing grant applications, managing grants/projects, and so on); whereas universities mainly have administrative bureaucratization generated by the increase over time of administrative staff in comparison with researchers and faculty. In addition, I show that research units with higher bureaucratization have lower scientific performance.

Keywords Administrative burden · Administrative bureaucratization · Academic bureaucratization · Scientific performance · Research institutions · Universities

Introduction

Bureaucracy is a factor to be found in many large-scale organizations and in parts of most public sector organizations (Green 1997, pp. 18–19). The bureaucratization process is a complex and dynamic aspect based on the use and implementation over time of tested rules and procedures as a means of introducing order to certain structural features of formal organizations. Bureaucracy has common connotations and it is criticized for its rigidity, though in the study of organizations and

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management the term is not necessarily used in a depreciative sense. In recent years this topic has become a stated policy priority for improving efficiency in public organizations (Keyworth 2006, pp. 260–273). The Organization for Economic Cooperation and Development (OECD 2003) review of bureaucracy emphasizes that, despite the high profile often given to these issues, governments rarely have a detailed understanding of bureaucratization factors. Green (1997) states that bureaucracy is becoming less and less the first-choice organizational shape format; however, it is still present in a large number of public administration bodies, universities and public research organizations. As large national resources of many countries are used for the research sector, it is interesting to investigate the bureaucratization process within public research bodies (PRBs) and to understand whether it affects scientific performance. The first modern studies concerning bureaucratization within public research units were carried out by Crow and Bozeman in 1989; they analyse and compare industry, university and government research units, detecting lower efficiency and higher bureaucratization in US government labs (Crow and Bozeman 1989, pp. 30–32). The fundamental reason for the low efficiency of public bodies is due to the nature of public organizations, which causes high administrative burden and therefore costs (Heckman et al. 1997, pp. 389–395; Gore 1993, 1995). As a matter of fact, the bureaucratization of public research bodies (PRBs) is a poorly developed area of research, though it is an important topic how to increase their efficiency in order to generate technology and knowledge transfer, which is more and more necessary to modern economic growth (Coccia 2004, pp. 31–51; Aghion and Howitt 1998). Furthermore, in the absence of an economic analysis of the relevant causes of bureaucratization in PRBs, the determination of organizational and scientific goals will inevitably be a relatively arbitrary matter (Banarjee 1997, pp. 1289–1332). More specifically, economic and managerial studies addressing the bureaucratic issues of the research sector can underpin better reforms aiming at improving the efficiency of public research units and their efficacy within the national system of innovation in order to boost the competitiveness of the economy (Lundvall 1992).¹

In order to support decision-making processes, public management and policymakers must have satisfactory answers to the following questions:

Have public research institutions undergone a process of bureaucratization and, if so, what kind of bureaucratization?

Does bureaucratization affect the scientific performance of public research units?

The purpose of this paper is to investigate these issues concerning bureaucratization in PRBs by focusing on an Italian case study, characterized by an interesting restructuring that has generated major effects on the organizational behaviour of

¹ Lundvall states that the national system of innovation (NSI) refers to the complex network of agents, policies, and institutions supporting the process of technical advancement in an economy. The narrow definition of NSI includes the research sector subsystem represented by universities and research laboratories, while the broad NSI includes many subsystems such as finance, firms, government, and so on. The efficiency of this broad NSI boosts economic growth.

labs.² This analysis is also important for understanding the strategic change taking place in public research units. In addition, I compare some results with similar research carried out in other countries in order to detect similarities and differences. This research enriches the economic literature about an important topic that has received several contributions particularly in the Anglo-American scientific traditions. First I will review the literature on bureaucratization in PRBs and describe the methodology of the research; then I will discuss the results and lessons learned.

Research Institutions and Bureaucratization: A Review of the Literature

Weber (1921, 1964) asserts that bureaucracy is the most modern, rational, and efficient administrative structure, and it can be applied to any kind of public and private organization. Weberian bureaucracy entails a formal organization where work is conducted according to formal rules within a hierarchy based on rational-legal authority, and individuals are recruited to fill roles in the organization based on their formal competences and educational qualifications. Crozier (1964) and post-Weber scholars (Merton 1970) consider bureaucracy in organizations as being characterized by slowness and inefficiency: the term denotes a situation where the classical virtues of a Weberian bureaucracy have become perverted. Conversely, the Austrian school focuses on the economic aspects of bureaucracy and the distinction between bureaucratic management and profit management (Von Mises 1944).

Studies on bureaucratization within PRBs have been carried out above all in North America (Crow and Bozeman 1989, in addition, see Bozeman et al. 1992, pp. 290–322; Bozeman and Stuart 1994, pp. 197–223; Gumport and Pusser 1995, pp. 493–520; Crow and Bozeman 1998; Bozeman and Rainey 1998, pp. 163–189; Meier et al. 2000, pp. 590–602). In fact, in the second half of the 1980s (Crow and Bozeman 1989) analysed the National Comparative R&D Study Project, using a sample of over 900 US research and development labs belonging to industry, academia and government. This study measures bureaucratization in terms of the amount of time typically required (in weeks) for each of a variety of policy and management actions; their analysis shows that government labs are the most bureaucratized, whereas industry and university labs have merely one third of the bureaucratization present in public labs.

Gumport and Pusser (1995) analyse Californian universities over a period of 25 years and show that an increase in the number of universities leads to the growth of administrative structures. During the 1967–1992 period, the expenditure on administration functions grew disproportionately in comparison with the expenditure on instruction: *the ratio of Instruction Expenditure to Administration Expenditure changed from 6 : 1 to 3 : 1*: there was an increase in administrative

² Studies on bureaucratization in PRBs is yet an unexplored field in Italy as well as in other Mediterranean countries such as Spain, France, Greece, and so on.

staff, which rose by a staggering 151% in comparison with a 61% increase in faculty.

Conversely, Bozeman and Rainey (1998) analyse the bureaucratic personality within the National Administrative Studies Project by means of questionnaires presented to managers of public and private organizations. The analysis shows that both personal characteristics, such as alienation, and organizational characteristics, such as the number of records kept, show preferences for more rules. In contrast to expectations and public administration literature, managers in private organizations (mostly business firms) were more likely to prefer more rules than managers in public agencies.

Gornitzka et al. (1998) analyse four Norwegian universities during the 1987–1995 period, showing that there was an increase in Total Administrative Positions in comparison with Academic Positions. In this study, the growth of administrative personnel and offices is seen as an indicator of increasing bureaucratization in Norwegian universities. These scholars argue that the bureaucratization of Norwegian universities has taken place because more resources than before are now used for administration rather than for research and teaching.

This research shows that the concept of bureaucratization often has different meanings. In some organizational studies bureaucratization denotes the growth of the part of the organization that does not directly carry out the work but instead regulates, supervises and supports those who do: it is generated in universities and public research labs when administrative positions increase over time more than teaching and research activities. More specifically, *Administrative Bureaucratization* occurs when administrative positions and activities tend to grow faster than productive activities and the staff involved in productive activities (Gornitzka et al. 1998). Gumpert and Pusser (1995) claim that bureaucratic accretion is the disproportionate amount of administrative growth related to growth in instruction. In the majority of cases, the administrative staff in PRBs are engaged in activities that support researchers in performing and delivering a defined set of ‘output’: publications, patents, results of research projects, scientific consultancies and other scientific research outcomes. Kogan (1996) points out that bureaucratization in higher education institutions is also used in two other ways: the move from individual and academic power to the system or institution, and the growth in the power of administrators.

A different concept is that of *Academic Bureaucratization*, when faculty spends an increasing part of their time on administrative matters: for instance, time spent on preparing grant and/or project applications, grant and/or project reports, managing grants and/or projects, recruiting alumni, and so on.

It is interesting to outline some theoretical causes of bureaucratization processes (Gornitzka et al. 1998):

- Diseconomies of scale if the size and growth of institutions have effects on bureaucratization processes; this is based on the hypothesis that larger organizations have higher administrative costs and more personnel, since complexity itself demands administrative resources.
- Administrative and academic bureaucratization are results of state regulations and demands from society; universities and public research bodies are

constantly interacting with the world beyond and they have been under increasing government pressure to satisfy external expectations. In particular, the environmental changes for PRBs cause administrative changes and generate bureaucratization. The resource-dependence theory emphasizes that external subjects provide the resources, which sustain and develop the activities of organizations, and to secure a flow of resources, organizations meet the needs and demands of those providing the resources (Pfeffer and Salancik 2003). As a matter of fact, it is now more common for universities and PRBs to supplement their public resources with market funding, which is more and more necessary to fund the activities of researchers: projects funded by the market have different accounting procedures than those carried out via public funds. Therefore, from a resource-dependence perspective, the consequences for public research organizations of extracting and cultivating external funding mean administrative growth (Leslie and Rhoades 1995, pp. 187–212).

- Administrative growth can also be a result of internal processes: the administrative and academic/scientific staff support the introduction of new administrative routines and more administrative staff, as an adaptation to regulations as well as to environmental changes and complexity. Moreover, administrators use state regulations to legitimate new activities, when faced with scientific staff that are sometimes reluctant to accept new administrative procedures or to spend funds on administrative activities.

In general, PRBs expand and diversify, performing more tasks in response to environmental changes (Gumpert and Pusser 1995). This adaptation to turbulence (complexity + uncertainty) generates bureaucratization. In other words, the scenario has changed and the growth of administrative units and burden that is associated with greater complexity and uncertainty, entails the consumption of more and more public resources.

This paper begins by examining the characteristics of bureaucratization in universities and public research labs. In particular, as government argues that Italian research institutions and universities are affected by bureaucratization and lower efficiency, the aim is to find out whether, similarly to institutions in Norway (Gornitzka et al. 1998) and California (Gumpert and Pusser 1995), there is administrative bureaucratization also in Italy (i.e., a greater increase, over time, in administrative staff in comparison with researchers and academics). The paper then focuses on the largest Italian public research body (the National Research Council) to investigate the nature of bureaucratization and to find out whether bureaucratization affects scientific performance. It might be expected that increased bureaucratization would reduce scientific performance; but before analysing this main aspect, I will introduce the methodology of the research.

Research Methodology for the Analysis of the Bureaucratization and Scientific Performance of Research Institutions

Data are from the Yearbooks of the Italian National Institute of Statistics (ISTAT 1991–2004) and the Reports of the Italian National Research Council (in short, CNR) (Data from Consiglio Nazionale delle Ricerche Report 1999, 2000, 2001, 2002).

The subjects investigated within the Italian national system of innovation are:

- Public Research Bodies (PRBs), mainly financed by the Government, include:
 - *research organizations in the strict sense* that carry out research activities with institutional purposes: the Italian Space Agency; the Italian National Research Council (CNR); the National Agency for New Technologies, Energy, and Environment; the National Institute for the Physics of Matter, now part of the CNR; the National Institute of Nuclear Physics; the National Institute of Statistics; the National Institute of Health, etc.;
 - *other public institutions* controlled by the government (i.e., laboratories and institutes under the authority of the various departments: retirement and nursing institutions with scientific scope, local health authorities, etc.);
- Universities are institutions dealing with both education and scientific activities; public as well as private universities are included in the university sector without distinction.

The internal organization of these bodies is analysed considering:

- Researchers;
- Technicians and ‘other staff.’

More specifically:

- (a) *Researchers*: scientists involved in the creation of new knowledge, products, processes, materials and so on. In universities, this heading comprises current full time faculty, lecturers and teaching assistants, researchers; whereas in the case of PRBs the heading includes researchers, senior researchers, and directors of research.
- (b) *Technicians and research assistants*: they support research activities under the supervision of one or more researchers.
- (c) *Other staff (assigned to R&D)*: this group includes workers, secretaries, and administrative staff involved in research activities.

They are all public servants. Moreover, within the Italian research sector the official position of technicians and administrative staff is, in some cases, only in the organization chart, since one can find technicians who carry out administrative activities and vice versa. Aggregate data do not distinguish between technicians and administrative staff, so they are considered in the same group; whereas in the case of CNR we are able to analyse these groups separately.

The statistical analysis provides some graphs of time series that show the trends for each institution. In addition to these geometric figures, we apply bureaucratic indicators, i.e., researchers : other personnel ratios. The purpose is to analyse, within Italian research and academic organizations, the trends of researchers and faculty in comparison with technicians and administrative staff, so that a comparison can also be made at an international level with California (Gumport and Pusser 1995) and Norway (Gornitzka et al. 1998).

Results are presented in the following order: firstly PRBs, secondly Universities, and thirdly the Total Research Sector; lastly, the research focuses on the largest

Italian public research organization, i.e., the Italian National Research Council (abbreviation: CNR).

A second problem that I will investigate is how bureaucratization affects the scientific performance of public research units. This issue is analysed by means of a “face-to-face” questionnaire, as this method has several advantages in relation to the quality of the data collected, though time and costs are higher in comparison with other techniques. These interviews are carried out in some research units of the CNR. In particular, the sample includes 100 people (researchers, technicians and administrative staff) from six institutes and five decentralized units in Piedmont and Lombardy, two large regions of Italy with highly developed manufacturing and commercial sectors and investments in research.

As bureaucratization can also be measured by the time spent on administrative matters (for instance the time spent on preparing grant and/or project applications, grant and/or project reports, managing grants and/or projects, and so on—i.e., academic bureaucratization) (Crow and Bozeman 1989; Gornitzka et al. 1998) the relationship between this kind of bureaucratization and research performance of Italian research units is:

$$Y = f(T_1, T_2, T_3, T_4, T_5, T_6, T_7, N)$$

where

Y = average scientific production (number of domestic and international publications per institute) per year;

T_i = time spent on the i -th administrative activity;

N = number of documents filled in.

Remarks: Patents are not good indicators of scientific production for Italian research units because they have a low number of patents over time; and some research fields such as economics, mathematics, and so on are not able to produce patents. Consequently, domestic and international publications are preferred as proxy of the scientific production of research units.

Moreover, as bureaucratization is a latent variable, it can be measured by the following manifest variables:³

T_1 = Contract-staff recruitment: average time needed to recruit fixed-term contract personnel (topic 1 in the questionnaire).

T_2 = Organization of events: time needed to organize events such as meetings, seminars, and conferences (topic 2 in the questionnaire).

T_3 = Other scientific activities: time needed to participate in meetings and to deal with projects/grants (topic 3 in the questionnaire).

T_4 = Drawing up final balance sheets and budgets: time needed to compile budgets and to draw up research project balance sheets, to manage projects/grants, etc. (topic 4).

³ One of the most relevant and debated topics in the field of statistics is the so-called *latent variable*, i.e. a variable that is not directly observed, lacking both an origin and a unit of measurement. In particular, a latent variable is a variable that cannot be measured directly and that is believed to exert a causal influence on several variables that are directly observable (manifest variables).

T_5 = Approval by headquarters: time elapsing from the presentation of a research project or joint agreement/collaboration to the moment when the project/agreement starts (topic 5).

T_6 = Financial activities: time needed to approve budgets and to make changes to the expenditure capacity of the research unit (topic 6).

T_7 = Purchases: time needed to purchase scientific material such as books, journals, personal computers, software, equipment, etc. (topic 7).

N = Documentation (number): number of documents filled in for scientific activity within the research units (topic 11 in the questionnaire).

The relationship is important to answer the question about the variables T_i , N and Y : if T_i and N increase (indicators of the *Academic Bureaucratization*, latent variable), then there is a decrease in variable Y (scientific production).

The data are analysed by cluster analysis, a non parametric technique, using the SPSS statistics software. The *Cluster Analysis* detects a number of subsets within a set of variables, i.e., clusters, with high internal (intra-cluster) homogeneity and high external (inter-cluster) heterogeneity. Therefore, if the classification is successful, values within the same cluster are close to each other; whereas values belonging to different clusters are further away from each other. Each group is then analysed through descriptive statistics showing its organizational behaviour. The cluster analysis uses Ward's method and the squared measure of the Euclidean distance; results are summarized in the dendrogram.

What Goes on Inside the Public Research Body: Academic or Administrative Bureaucratization? Results

Analysis of Public Research Bodies (PRBs): 1991–2001 Period

Research personnel in PRBs (Fig. 1) shows that the number of researchers increased by +6.8% (arithmetic mean) over 1991–2001; whereas the technical and administrative staff dropped in average by –7.9%. In addition, the ratio researchers divided by technicians and administrative staff increased from 0.64 to 0.78 over 1991–2001, though it decreased in two periods: from 0.78 to 0.70 between 1997 and 1998, and from 0.85 to 0.78 between 2000 and 2001.

Analysis of Universities: 1991–2001 Period

Figure 2 shows the trend of personnel in Italian universities in terms of percent growth. In contrast to PRBs, the university displays a noticeable increase of technical and administrative staff over researchers: technical and administrative personnel had an average growth of +72.5% over 1991–2001; whereas the number of researchers dropped by –10.3% (arithmetic mean). In addition to this result, the researchers : technicians + administrative staff ratio had a falling trend from 2.62 to 0.86 over 1991–2001. This high increase in administrative staff in Italian universities is due to the establishment of several new universities (from 48 in the

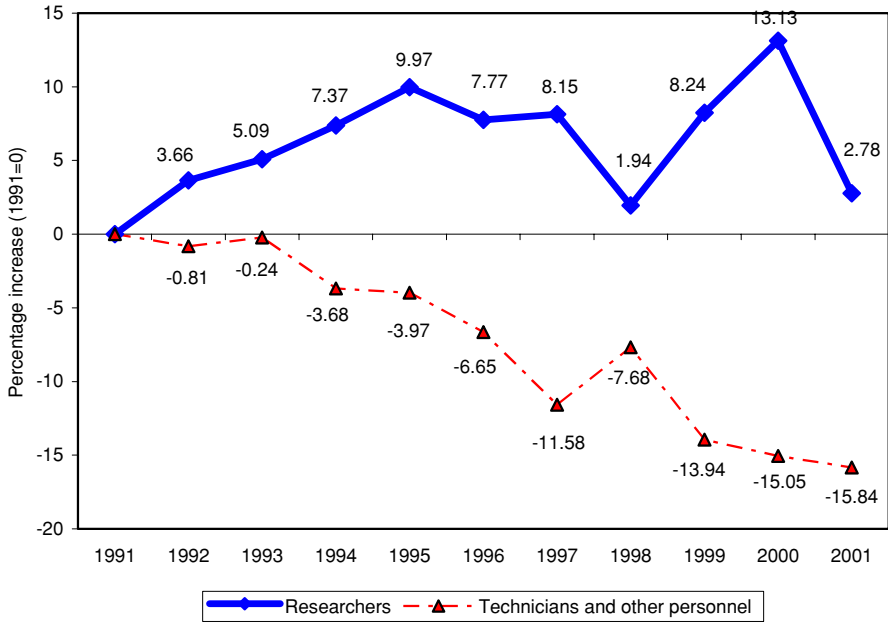


Fig. 1 Percent growth of personnel in Italian Public Research Bodies in 1991–2001. *Source* Istat 1991–2004

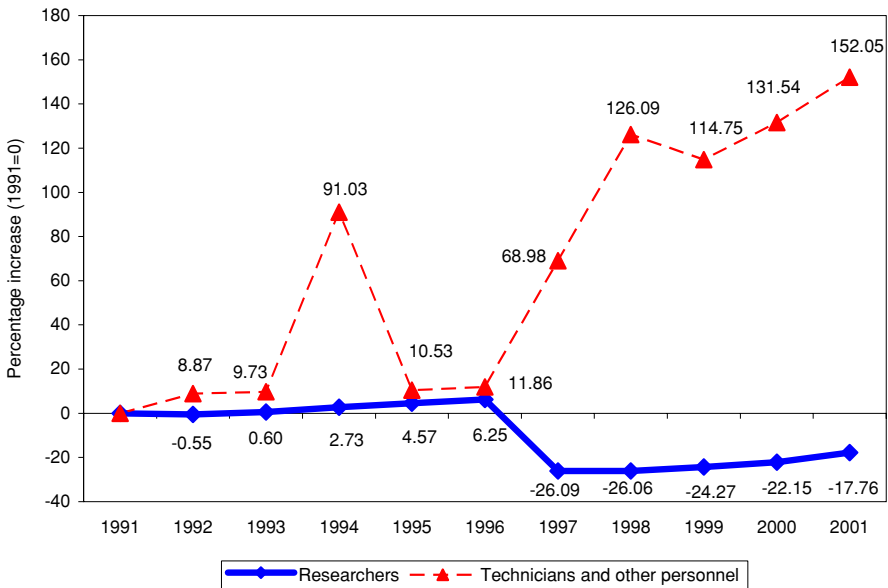


Fig. 2 Percent growth of personnel in Italian Universities in 1991–2001 (the number of technicians and other staff in 1997 is an estimate, since it is not available). *Source* Istat 1991–2004

1980s to around 80 in the 2000s) as well as all the necessary administrative offices and staff in smaller Italian cities.

Analysis of the Italian Research Sector (1991–2001 Period)

If we consider the total personnel of PRBs and universities in Italy, results show that the researchers dropped from 45,661 units (in 1991) to 40,152 (in 2001); whereas the technicians and administrative staff increased by around 16,000 units over 1991–2001. Figure 3 shows that there is an average increase in technicians and administrative staff equal to +23.2%; whereas researchers decrease over time by -5.5% (arithmetic mean). These data are confirmed by the ratio researchers divided by technicians and administrative staff, which changed from 1.40 to 0.83 over 1991–2001. Figure 3 also shows that there are three periods in which technicians and administrative staff increased considerably:

- 1 1993–1994, from 3.62 to 33.00%
- 2 1996–1998, from 0.52 to 44.13%
- 3 1999–2001, from 35.90 to 49.18%

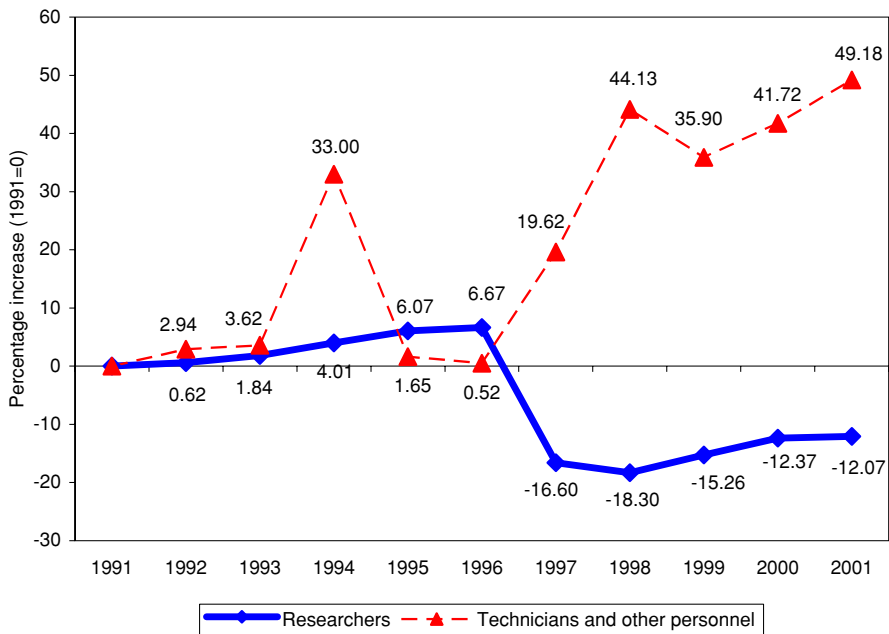


Fig. 3 Percent growth of total personnel in the Italian research sector in 1991–2001 (the number of technicians and other staff in 1997 is an estimate, since a precise number is not available). *Source* Istat 1991–2004

Italian National Research Council: 1997–2002 Period

It is interesting to analyse trends in the largest public research body in Italy, the Italian National Research Council (CNR). CNR (a body similar to the French *Centre National de la Recherche Scientifique*, to the German *Max-Planck Gesellschaft* and to the Spanish *Consejo Superior de Investigaciones Cientificas*) promotes, coordinates, and regulates Italian scientific research with the aim of advancing the country's scientific and technological progress. Its research institutes are mainly publicly funded to produce scientific research according to general guidelines set by the Italian Government and the European Union. Until the end of the Nineties, the National Research Council (CNR) had a research organization based on *research institutes* with their own payroll employees, and *research centres* located in universities and staffed by a mix of personnel belonging both to the CNR and to universities. In the 1990s and early 2000s the restructuring of the CNR has been carried out to increase the efficiency of this structure. As a matter of fact, the modernization of the public sector, as a means of solving financial problems due to the shrinking of public research lab budgets, is a trend in most Western countries (Metcalf and Richards 1993). Therefore, successive Italian governments have changed the universe of the CNR research units by consolidating them from 310 (in 2000) to around 100 institutes. Because of the laws governing public bodies (CNR personnel have the status of civil servants), and because of low mobility and constraints by the Italian labour union, it is impossible to accommodate the personnel physically all in the new institutes, with a consequent scattering in more than 200 locations. Consequently, the institutes have their main headquarters (or institute), plus one or more decentralized research units. In fact, only the name of these new CNR research units has changed; in other words, with this restructuring they are simply relabelled as institutes and decentralized units. A second reform of the Italian CNR (2003) has shifted from line and staff organization to project based organization set up to manage the portfolio of scientific research projects. This new reform has created 11 scientific departments and other hierarchy levels, such as Department Directors, Project Managers and Work Package Managers.

Data, concerning the period between 1997 and 2002 are from the CNR Reports. The figures do not display a high increase in administrative personnel; as a matter of fact, the ratio researchers divided by administrative staff increased from 3.3 to 3.9 over 1997–2002.

Figure 4 shows a staggering increase in research personnel between 2000 and 2001, from 3,650 to 4,313 units, due to a large wave of recruitment of personnel carried out during this period; whereas administrative personnel has a lower growth than researchers (3.1 versus 19.0% in 2002); while technicians have a decreasing trend over time.

International Comparisons

The results concerning the research sector in Italy are compared to the studies carried out by Gornitzka et al. (1998) in Norway and by Gumpert and Pusser (1995) in California.

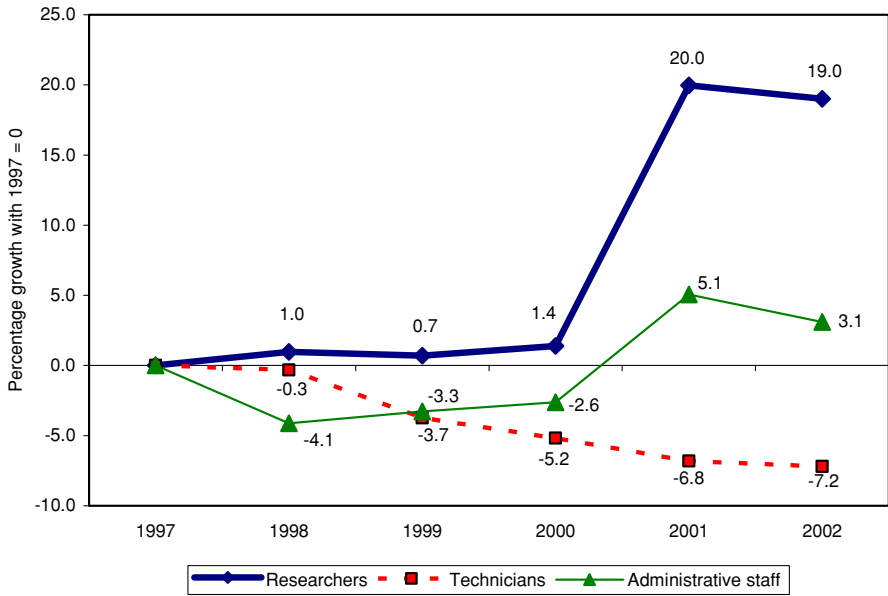


Fig. 4 Percent personnel growth in the CNR with 1997 = 0. *Source* CNR Report 1999–2002

Table 1 Average personnel growth per year in percentages: comparison between states

	University		Italy		
	California	Norway	University	Public research bodies	National Research Council
Researchers (%)	4.35	4.25	-1.8	0.28	3.80
Administrative staff (%)	10.70	6.25	15.2	-1.60	0.62

Table 1 shows a comparison between researchers and administrative staff in the following periods:

- *Italy*: 1991–2001 for universities and PRBs, and 1997–2002 for CNR
- *Norway*: 1966–1991 for university
- *California*: 1987–1995 for university

The values are standardized using the formula:

$$\frac{\Delta \text{Total in the period}}{\text{Number of years}}$$

The comparisons in Table 1 show that the average yearly growth of administrative personnel in Italian universities is higher than in Californian and Norwegian

institutions (respectively 15.20% in Italy versus 10.70% in California and 6.25% in Norway); whereas the number of researchers in Italy drops by -1.8% , versus an increase of $+4.35\%$ in California and $+4.25\%$ in Norway. In the case of PRBs and the CNR, there is a different situation: the increase of researchers is greater (3.8%) than that of administrative staff (0.62%). The main results are summarized in Table 1.

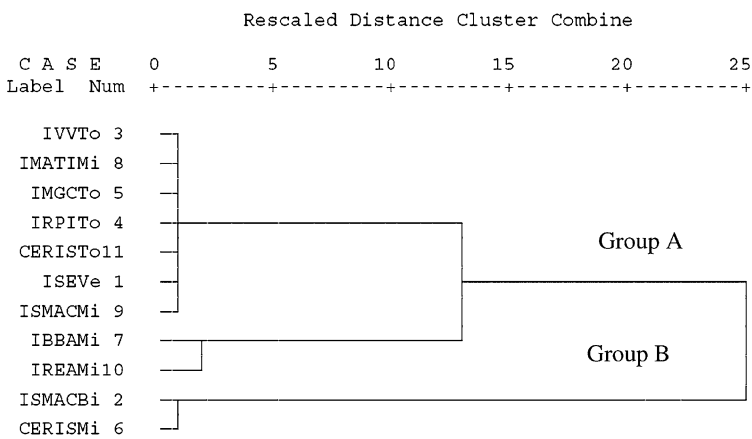
Does Bureaucratization Affect the Research Performance of Public Research Organizations?

The cluster analysis assembles 11 research units belonging to the CNR into two clusters of 9 and 2 units respectively (Fig. 5). Descriptive statistics of these groups display their organizational behaviour (Table 2).

The key to the cluster analysis is that, on the one hand, group B (Table 2) displays an average scientific production that is higher than group A; on the other hand, group B displays also lower average values for all the manifest variables that are bureaucratization indicators. In a nutshell, *in PRBs when the time spent on administrative activities increases (more academic bureaucratization), scientific production of the research institutes decreases over time.*

Lessons Learned and Causality Arguments about the Bureaucratization in Public Research Institutions

Bureaucratization is a complex and dynamic phenomenon that has aspects that are important for increasing the efficiency of research organizations as well as of the whole economy of modern countries. In fact, the Better Regulation Task Force (BRTF) in the United Kingdom asserts that bureaucracy reforms could potentially



Labels of Provinces: TO = Turin; MI = Milan; VE = Verbania; BI = Biella

Fig. 5 Dendrogram of CNR research institutes, using Ward’s method

Table 2 Descriptive statistics of groups A and B generated by cluster analysis of CNR institutes

	Arithmetic mean ^a group A	Arithmetic mean ^a group B	Standard deviation group A	Standard deviation group B
Scientific production	3.069	3.458	1.279	1.708
T ₁ : Contract-staff recruitment	0.402	0.338	0.076	0.012
T ₂ : Organization of events	0.486	0.213	0.125	0.243
T ₃ : Activities in 1 month	0.069	0.013	0.062	0.007
T ₄ : Drawing up final balance sheets and budgets	0.069	0.012	0.072	0.002
T ₅ : Approval by the headquarters	0.872	0.628	0.279	0.039
T ₆ : Financial activities	0.143	0.133	0.032	0.003
T ₇ : Purchases	0.098	0.090	0.026	0.008
N: Documentation (number)	6.264	4.577	1.837	0.322
Number of institutes	9	2	9	2

^a Some figures are low since they are standardized in annual value

T₁ = average time needed to recruit fixed-term contract personnel

T₂ = time needed to organize events such as meetings, seminars, and projects

T₃ = time needed to participate in meetings and to draw up projects

T₄ = time needed to compile budgets and to draw up final balance sheets of research projects

T₅ = time elapsing from the project application or joint agreement/collaboration to the moment when it starts

T₆ = time needed to approve budgets and to make changes to the expenditure capacity of the research unit

T₇ = time needed to purchase scientific material, books, journals, etc.

N = number of documents filled in

deliver an increase in Gross Domestic Product by about £ 16 billion—that is an increase higher than 1% (Better Regulation Task Force (BRTF) 2005). As a matter of fact, a lower level of bureaucratization can be a significant source of competitive advantage for a country. The first aspect analysed by this paper is the nature of bureaucratization in public research bodies.

One of the most interesting results is that academia, i.e., Italian universities (Il Sole 24 Ore Newspaper 2007, 11 marzo, p. 1), have a high level of administrative bureaucratization: a disproportionate growth of administration staff in comparison with researchers and faculty—by contrast, Public Research Bodies (PRBs) have academic bureaucratization. Figure 6 summarizes the results:

More Specifically:

- Firstly, the organizational behaviour of Italian universities is similar to that of Californian and Norwegian universities: i.e., the increase in administrative staff is greater than the increase in researchers (*Administrative Bureaucratization*). The nature of this bureaucratization within Italian universities is due to new universities created by government in several minor cities (from 48 in the 1980s

In Italian Universities, Bureaucratization **depends** on the growth of administrative staff in comparison with researchers (*Administrative Bureaucratization*)



This **confirms** the studies conducted in the universities of Norway and California (Gornitzka *et al.*, 1998; Gumpert and Pusser, 1995)

Bureaucratization within Italian PRBs **depends** on the administrative burden which is due to organizational change, market activity and adaptation to complexity (*Academic Bureaucratization*)



This **confirms** the results of researches carried out in US research labs, showing that public labs are the most bureaucratized structures (Crow and Bozeman, 1989)

Fig. 6 Typology of bureaucratization in Public Research Organizations

to around 80 in 2009), which have led to the growth of the administrative apparatus. This supply-driven growth generates new demands from education, which contributes to the growth of the administrative burden (e.g., students and professors generally need administrative services in the university). As a matter of fact, the administrative staff within universities are in a position that allows them to maximize their own activities.

- Secondly, the bureaucratization of public research bodies has a different nature. The Italian National Research Council and other PRBs do not have a disproportionate growth of administrative staff in comparison to that of researchers (i.e., administrative bureaucratization); on the contrary, they are permeated by academic bureaucratization due to other causes such as the hasty, poorly designed and incomplete restructuring that generates structural deficiencies. To investigate the causes of this academic bureaucratization, it is important to analyse in greater depth the restructuring that had the objectives of reducing general costs and increasing the technology transfer and overall efficiency of Italian research structures. In particular, the first restructuring (2001) was a consolidation among research units in order to create scientific institutes of larger size, similar to the Max Planck Institute in Germany, thinking that large labs = efficient labs. This consolidation has been carried out only from an administrative and not from a scientific point of view. Although nowadays there are about 100 institutes (in the past there were around 310 research units), these often have several decentralized units (2–6) scattered around the territory and far from the institute headquarters. It is significant that the consolidation has been creating *diseconomies of scale* as a consequence of coordination problems among research units (Coccia and Rolfo 2007, pp. 215–233). In fact, the horizontal, vertical and geographical differentiations of large organizations need extra administrative resources to keep the institutions together. Mintzberg (1983) argues that the different activities of an organization must be coordinated and controlled, and the larger the organization, the more emphasis will be put on these tasks. In sum, the first restructuring creates diseconomies of scale, due to the higher costs of co-ordination generated by the administrative burden of all the decentralized research units (academic bureaucratization). In addition, the

administrative burden is also due to the duplication of work, resulting from internal processes in headquarters and decentralized units. In fact, different decision-making principles operating side by side encourage administrative growth; but it also appears that a large kernel of this growth lies in the duplication along a vertical and horizontal dimension in the organizational structure. The cost of this bureaucratization is invisible in the short run. In addition to this reform, in 2003 the government decided to launch a new restructuring based on project management, with the explicit aim of transforming the CNR into a consulting body operating to support firms. This restructuring is based on result-oriented planning and cash limit budgeting that affect the governance of this public research institution. This situation will deserve a much closer examination in order to find other causes of bureaucratization. Actually, this second reform has been causing other co-ordination problems as a consequence of a badly designed matrix-structure. The CNR has never really implemented project management rules; rather, the whole institution hybridizes project management rules with the old organization to cope with uncertainty and restructuring gaps. Common features of these two reforms are decreasing public funds, which are no longer sufficient to cover the current expenses of research units. In the past, public funding enabled Italian scientists to carry out normal scientific activities and to apply for external projects to receive additional funding. Nowadays, because of decreasing funds, it is impossible to conduct research solely with public funds and they are not sufficient to support the structure, which means research equipment cannot be maintained, repaired, or renewed. Research institutes are forced to apply for market funds to conduct normal scientific activities and the market (external) funding is not just an additional but also a main source of funding for Italian public research units. This strategic change is functional to cope with environmental threats due to low public funds (Gioia and Chittipeddi 1991, pp. 433–448).⁴ Through these reforms, the government means to promote multidisciplinary research for the market and co-operation with the private sector: public research units should be market-oriented institutions. Basically, I think that this demand-driven effect generated by external subjects is the second cause of bureaucratization. In fact, research institutes have a high administrative burden, which is due to the vast portfolio of research projects for market activity. To support this argument, there is the *resource-dependence* theory. PRBs need more time to administer externally funded activities. Actually, interaction with external subjects involves drawing up written contracts, filling out forms and writing reports. More specifically, the search for and maintenance of external funding has led to administrative burden at the central, institute and department level. In short, if the institutes are providers of technological services to the market, the administrative burden is a consequence of these activities, since research units and their staff are not apt for market activity. Furthermore, internationalization

⁴ In general terms, change involves an attempt to alter the current way of thinking and acting by an organization's membership. More specifically, *strategic change* involves an attempt to change current modes of cognition and action to enable the organization to take advantage of important opportunities or to cope with consequential environmental threats have investigated this topic in depth.

as well as marketization of research have administrative consequences on research institutions: the participation in the European Union's programmes and research grants generate an increasing amount of administrative burden. Gornitzka et al. (1998) show that this has contributed to both academic and administrative bureaucratization. In addition, the national rules for reducing public debt have produced *laws and regulations* concerning the governance of public administration, to which universities and PRBs must automatically adapt. This generates internal bureaucratization by means of significant administrative side-effects—an aspect that has been largely overlooked in public policy-making. Public research institutions have handled this *environmental complexity* through bureaucratization based on an increase in administrative burden in order to manage decentralized research units and the portfolio of market research projects (academic bureaucratization). Moreover, the strengthening of the administrative apparatus may channel resources to administrative positions and not directly to academic and scientific activities.

To sum up, the main causes of this academic bureaucratization tendency in PRBs are due to: (a) diseconomies of scale, generated by coordination problems in decentralized units, increase the administrative burden at the headquarters; (b) resource-dependence generates the search and maintenance of market funding and as a consequence the administrative burden to manage the vast portfolio of external research projects; (c) environmental complexity, which is due to administrative regulations to reduce national public debt as well as organizational changes, has generated internal procedures with increasing administrative burden (i.e., academic bureaucratization).

- Thirdly, it has been interesting to understand *how bureaucratization affects the research performance of public research units*. As a matter of fact, the institutional theory by Chubb and Moe (1990) claims that bureaucracy leads to poor performance in some public schools. Meir et al. (2000, pp. 590–603) suggest that poor performance results in a growing bureaucracy and not vice versa. This research shows that bureaucratization reduces scientific performance; and this is a major problem for public research units, since scientific production is more and more important in gaining financial support, in hiring and promoting research staff, and in building a good academic reputation. However, the cause of this reduction in scientific production (and efficiency) in the CNR cannot be ascribed to administrative bureaucratization, but rather to academic bureaucratization. In fact, spending time on administrative activities for external projects is a poor investment for academics, since career rewards and personal satisfaction are primarily associated with publications. What this means is that the resource dependence generates low scientific production in terms of scientific publications, since researchers dedicate an increasing part of their time dealing with administrative matters, such as preparing grant and/or project applications, managing grants and/or projects, and so on, that are necessary in order to obtain market funds (Academic bureaucratization, Musselin 2007). Goldfarb (2008) supports these results by confirming that researchers who maintain relationships with external subjects experience a decrease in publications in leading international journals, implying [the danger]

that the careers of academics may be a function of the funding gathered rather than of talent. This leads to a strong distortion in the efficiency of these PRBs.

Concluding Remarks

I have shown that the hasty and uncertain Italian restructuring as well as the massification of academic research⁵ have been generating higher academic bureaucratization and lower efficiency and research production within public research organizations. The origin of this situation is the lack of a long-term national research strategy and of a consistent research policy (shared by Italian governments of different political coalitions). Associated with the marketization of scientific research (Schuetze 2007, pp. 435–443) this situation has been causing the negative performance of the whole Italian national system of innovation (Coccia 2005, pp. 377–412). It is reasonable to view the bureaucratization of PRBs not as a process planned and regulated at a high level in these institutions but as the result of several small decisions taken at different levels and in various forms, as well as a natural adaptation of these structures to environmental changes and complexity. Although this analysis of bureaucratization in public research organizations, focused on the Italian case study, cannot be transferred directly to other countries, the global tendencies in this field seem to run parallel. We have seen that the administrative bureaucratization of academia tends to be present in some other states, such as Norway and California, whereas academic bureaucratization also transpires in some US labs. I believe that these results are fundamental for the support of strategic change in public research units in modern turbulent economies. In fact, governments need to be aware of the negative relationship between the bureaucratization generated by hasty restructuring and the scientific production of research units. Although this paper does not provide exhaustive findings about all the contending causes and effects of bureaucratization in public research institutions, the results can support better decisions to improve the efficiency of PRBs. No doubt further research about bureaucratization within public research institutions is needed to strengthen this important research topic in modern economic and managerial literature.

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⁵ Because of market-oriented trends of research units -due to low public funds- they are focused on massive increase in technological services rather than fundamental research, therefore there is depersonalisation of researchers and emptying of the scientific research activity of its main contents, i.e. less discovery-based research around longer term needs centred on public welfare; in other words, business and commercial interests are influencing research units and universities in an unsavoury manner.

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