

### Science policy in imperial Germany: a progress report

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## SCIENCE POLICY IN IMPERIAL GERMANY

A Progress Report

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The report presents the results of an on-going project on science policy in Germany, particularly in Prussia during 1870 and 1914. During these decades patterns of cooperation between government, the scientific community, and private entrepreneurs were developed which tremendously increased the importance of private industry in matters of science policy and put an end to the monopoly which so far the state had enjoyed in this field. The plans for using quantitative methods in the forthcoming research are outlined.

### I.

Economic growth depends, among other factors, on the regular supply of technological innovations. Whereas much is known about this relationship in today's world, it has, so far, not been researched very thoroughly for the decades starting about 1850. Murray Brown's work on the effects of technological progress in the USA since 1890 contains only preliminary results but gives us at least an idea of the importance of technological change in the industrial age (1). We know less about the causes of technological progress. Mc Clelland, Lundgreen, and others have contributed some work in that field (2), but much remains to be done.

Our project deals only with one aspect of this larger problem, with science policy. Its chronological limits are, roughly speaking, the years 1870 and 1914, but these limits are, of course, more of a symbolical nature. Geographically, the project concentrates on Germany, particularly on Prussia. Germany experienced rapid economic, scientific, and technological change in the decades after about 1850, and this process centered on Prussia. Most relevant material being kept in the GDR, research on Prussia always poses some technical problems, but, thanks to the Staatliche Archivverwaltung der DDR, these have so far been overcome successfully.

For the purposes of the project, the term science policy should not be construed to include governmental activities only: During the decades covered by the project, patterns of cooperation between government, the scientific community, and private entrepreneurs were developed which tremendously increased the importance of private industry in matters of science policy and put an end to the monopoly which, so far, the state had enjoyed in this field. In other words: the project from the first had to take into consideration not only governmental activities but also private attempts to gain influence and had to analyze the motives behind such attempts. It also had to appraise the effects of this science

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policy on the scientific community, on the development of German research facilities, and on the relations between government and private economy.

Source materials available to the project include not only numerous statistical works and a host of contemporary printed sources, but also much unpublished material. Five groups stand out in particular:

1. The files of the Prussian Kultusministerium contain much material concerning the founding and running of various research institutions, personnel management, and the political background of certain science policy activities. There are also many documents covering cooperation between the state and private economy in science policy affairs.
2. These records are supplemented by documents from other government agencies. To give but two examples: The files of the Prussian Ministry of Trade provide many insights and have become more easily accessible by the publication of H. Buck's extensive special inventory (3). The files of the Prussian Geheimes Zivilkabinett contain valuable information on everything that was brought to the attention of the Kaiser, including very many science policy matters.
3. The papers of various scholars and administrators have proved indispensable to the project. This holds true in particular for the papers of Friedrich Althoff who for more than two decades was one of the driving forces behind Prussian science policy. The same might be said for the papers of his close collaborator and, in later years, successor Friedrich Schmidt-Ott which are kept partly at the Zentrales Staatsarchiv Merseburg, partly at Berlin-Dahlem. From the large number of scientists who left valuable papers, Emil Fischer deserves special mentioning because his importance as a science policy organizer and as one of the foremost collaborators with private industry can hardly be overrated. His papers are in the possession of the Bancroft Library.
4. The files of various industrial pressure groups active at the time provided much valuable information. Particularly the larger federations of the chemical industry were very active in science policy matters (4).
5. Finally, the Archives of the Kaiser-Wilhelm-Gesellschaft zur Förderung der Wissenschaften (today's Max-Planck-Gesellschaft) must be mentioned. They contain interesting documents not only concerning the KWG itself, but also on the history of science and the cooperation between governmental agencies and businessmen in the field of science policy.

Most of the materials mentioned above have been used in the course of the project, as they have been used by authors treating similar topics (5), but they can hardly be said to have been evaluated thoroughly.

## II.

Beside a number of lectures etc., the project so far has produced one monograph and a dozen articles. (There also exists a large working paper, publication of which is not intended.) They can be divided into three groups:

1. Papers evaluating the contemporary public discussion of science policy matters: As this discussion was conducted with some vehemence, the number of relevant publications is immense. When work on the project started, a preliminary quantitative survey of this literature was conducted. It led to two publications which at the same time were designed to give some basic information on the field covered by the project (6).

2. Papers treating the utilization of science policy for political purposes: Work on the project soon showed that at least some governmental activities in science policy were less designed to promote science than to further certain political plans entertained by the governments of Prussia and/or the Reich. Two of these goals deserve special mentioning,  
- the containment of Social Democrats and other "enemies of the realm" and  
- winning over the Center Party for certain political undertakings in non-scientific fields.

Containment of Social Democracy within the scientific community was to be facilitated by passing legislation like the Lex Arons which - contrary to German academic tradition - established governmental discipline over the Privatdozenten, who received no salaries and had therefore hitherto been independent of government supervision. The short term purpose of the new law was elimination of the Privatdozent Arons, a Social Democrat, from the staff of Berlin University; in the long run, it was designed to give the state a legal instrument in dealing with Social Democratic views within the scientific community in general.

A second target group of containment measures were those Alsatians and Poles who had not reconciled themselves to being subjects of the German Reich. In order to impress on the inhabitants of Alsace the permanence of German presence in their country and to strengthen the German element within the population, Straßburg University was founded in 1872; for the same reasons, it was aided and encouraged very generously during the following decades. Posen on the other hand, although chronically underprivileged in cultural affairs, was denied its university: The Prussian government was of the opinion that a university at Posen with its strong Polish population element would aid the Poles more than the Germans and was therefore out of the question (7). Danzig, where German "Volkstum" was embattled as well but stood a much better chance, was given a Technische Hochschule as a "bulwark of Germanism".

As the catholic Center Party occupied a political key position since the parliamentary elections of 1898, the Reich government needed it in order to secure passage of various projects in the fields of military and economic policy. In return, the Reich and the Prussian government were ready to appease the Center Party in other fields, among them that of science policy. Thus, around the turn of the century, the catholic academy at Münster was upgraded to full university status; at Straßburg University, a catholic chair of history was founded and filled with the son of a prominent Center Party politician, against the vehement protest of the department concerned; when the director of Prussia's historical institute at Rome, himself a Catholic, ran into historical documents which Berlin considered harmful to their courtship of the Center

Party, he was forbidden to publish them by no less an official than the Reich Chancellor himself (8).

3. Particular attention was paid to cooperation between the state and private business in science policy matters. Both sides cooperated for different reasons: The Prussian Government appreciated the danger of Germany losing her leading position in international science with the government being unable (or at least: unwilling) to supply more money to the scientific community. Those branches of industry, on the other hand, which were increasingly interested in the supply of scientific inventions by the universities, were ready to supply the money - provided they were given a share of the responsibility. They also became more and more engaged in questions of scientific university training: Recruiting university graduates in ever growing numbers, they wanted these men to be trained in accordance with the standards and needs of their firms.

Since the 1880's, the chemical industry in particular became active in both fields. They succeeded to a certain extent in forcing their ideas concerning the training of future chemists on the universities, thus supplying an early example of what is known in German sociology as "Berufskonstruktion": the creation of new professions with qualifications which exactly fit the specifications of a particular industry (9).

The chemical industry succeeded to a similar degree in establishing additional research facilities. Since the Reich government in cooperation with Werner Siemens had founded the Imperial College for Science and Technology (Physikalisch-Technische Reichsanstalt) (10), leaders of the chemical industry had pushed for the establishment of a similar institution in the field of chemistry. Prominent professors of chemistry supported them because they, like the government, feared for Germany's position in international science.

This constellation finally led to the founding of a committee which was charged with planning such an institute. The necessary funds were raised by interested chemical firms which in turn were promised representation on the institute's board of supervisors (11). Before, however, these plans could be implemented, they became part of a much more ambitious project: Not chemistry alone, but German science as a whole now was to be advanced by the founding of new research facilities. The Kaiser-Wilhelm-Gesellschaft zur Förderung der Wissenschaften was set up as their organizational base (12). The funds, again, were raised within business and industry; the donors were in turn allowed to participate in determining their use.

As the records of the special account set up for the purpose of handling the donations have survived (13), it became possible to analyze the chronology of the recruiting drive as well as the sectoral and regional distribution of the donors. Also, the largesse of groups or individuals could be compared to various socio-economic indicators. Letters accompanying the donations (or, occasionally, refusals) and a variety of supporting documents facilitated the examination of the givers' motives and the deeper reasons behind them. By joining the results obtained thus with those gained from analyzing the special account, it became possible

to reconstruct the cooperation taking place between the state and prominent businessmen in some detail. The patterns which were developed on this occasion were followed time and again in later decades.

### III.

In closing, some words shall be said about the future of the project. Some areas have been covered sufficiently well to receive only slight attention in the future. This holds true for the contemporary science policy literature which simply cannot be treated as extensively as perhaps it should be within a small project. The cooperation between the state and private enterprise has been analyzed in various case studies. It will receive more attention when the beginnings of German business schools are being researched; otherwise, this field will decrease in importance.

Utilization of science policy for day-to-day politics will be looked into more closely. Particular attention will be given to Berlin University's so-called Oriental Seminary, the foremost training establishment for those among Imperial Germany's young diplomats, officers, and businessmen who were assigned to duty in Africa or Asia.

Some attention will have to be devoted to the question whether the Prussian ministry of education did follow any tangible concept in science policy which went beyond mere administration without being induced by outside pressure.

Within the universities there occurred a number of notable changes which deserve being studied more closely: "Irregular" staff members (i.e. members who did not hold full professorships with tenure) became more and more important for maintaining the teaching schedules and as the leaders of a process of scientific diversification which produced a large number of new disciplines. At the same time, the assistants working in the scientific laboratories and in university clinics grew in number and status: Around the middle of the 19th century, they had been an amorphous group of individuals without rights, without prestige and often without pay. Sixty years later, their number had increased vastly, their status was more clearly defined, and their pay was better. They also had come to look upon themselves as a group with joint problems and interests rather than as an accidental grouping of individuals. This process was initiated and kept going in part by necessities arising within the universities, in part by governmental wishes, in part by the development of German industry which offered more and more alternatives to disgruntled and underpaid university assistants (14). So far, little is known about all this.

Finally, particular attention will be given to the development of student numbers in Germany. Although some work has been initiated in this field (15), we still know little about the relations between economic conditions, the growth of science and population and the development of student numbers. This holds true in particular for the connections evidently existing between economic development and the number of university students. We can, of

course, construct an econometric model which gives us the development trend of student numbers if supplied with data on the development of the net national product. This solution, however, is not quite satisfactory: It makes no allowance for the fact that there exists no simple dependency of student numbers on the national product but rather a feedback relationship. Even if we had to deal only with a unilinear dependency, we should have to determine the lag with which student numbers followed economic development. For the sum total, the best fit is obtained by assuming a lag of 1.5 to 2 years, but development in the various faculties does not run true to this pattern at all. As interchangeability between various branches of the German school system was close to zero, a case might even be made for a lag of twelve years: Children who enrolled in the "Volksschule" (grade school) instead of in a "Vorschule" (preparatory school which was part of a Gymnasium) had almost no chance of ever obtaining the Abitur and thus an opportunity to study at a university. The decision to attend or not to attend a secondary school thus had to be made at an early date and at least in a number of borderline cases certainly depended on the economic situation at the time. It remains, of course, somewhat doubtful whether this complex question can be cleared up in the course of work on a small project like the one presented in this paper.

The same holds true for the question whether the project will succeed in measuring the scientific and economic effects of Prussian science policy. Gauging its scientific effects will be less of a problem: We can certainly show that steps like A.W. Hofmann's call to Berlin in 1865, the founding of the College of Science and Technology, or the setting up of the Kaiser-Wilhelm-Gesellschaft induced certain scientific inventions and/or educational improvements. On the other hand, though, it will be difficult indeed to measure the effects of such practices as the maintaining of the traditional "Ordinarienuniversität": Contemporary experts insisted that it guaranteed Germany's scientific supremacy, and it will not be easy to prove or disprove their point.

The second question poses even greater problems. There can, of course, be no serious doubt that connections between science policy and economic growth did indeed exist. In some cases, as e.g. in the field of organic chemistry, it can easily be shown (in a qualitative way) to have existed. Quantifying this relationship will prove more difficult. Much will depend on finding suitable indicators, and, again, it remains doubtful whether this can be done within a small project. Thus, the project cannot hope to come to a definite answer to the question posed above. It will, however, be able to supply some tentative results of a qualitative nature which might contribute towards solving that problem in the long run.

#### FOOTNOTES

- 1 M. Brown, On the Theory and Measurement of Technological Change. London 1966.
- 2 D. McClelland, "Does Education Accelerate Economic Growth?" In: Economic Development And Cultural Change 14, 1966,

- pp.257 sq.; P. Lundgreen, *Bildung und Wirtschaftswachstum*. Berlin 1973.
- 3 H. Buck, ed., *Zur Geschichte der Produktivkräfte und Produktionsverhältnisse in Preußen 1810-1933*. 3 vols. Berlin and Weimar 1960 sqq.
  - 4 A brief summary of these activities is given by: L. Burchardt, "Die Zusammenarbeit zwischen Hochschulchemie und chemischen Verbänden im Wilhelminischen Deutschland". In: *Technikgeschichte* 1979.
  - 5 K.H. Manegold, Universität, Technische Hochschule und Industrie. Berlin 1970; K. Düwell in: H.M. Klinkenberg, ed., *Rheinisch-Westfälische Technische Hochschule Aachen 1870-1970*. Stuttgart 1970; P. Borscheid, *Naturwissenschaft, Staat und Industrie in Baden (1848-1914)*. Stuttgart 1976; R. Riese, *Die Hochschule auf dem Weg zum wissenschaftlichen Großbetrieb*. Stuttgart 1977.
  - 6 L. Burchardt, "Wissenschaftspolitik und Reformdiskussion im Wilhelminischen Deutschland". In: *Konstanzer Blätter für Hochschulfragen* 27, 1970, pp.71-84; id., *Die wissenschaftspolitische Reformdiskussion im Wilhelminischen Deutschland*. Ms. Konstanz 1972.
  - 7 A paper dealing with the fate of the Posen projects will be published shortly.
  - 8 A paper describing the crisis of the institute during these years and its background will appear shortly.
  - 9 Cf. L. Burchardt, "Die Ausbildung des Chemikers im Wilhelminischen Deutschland". In: *Zeitschrift für Unternehmensgeschichte* 1978, pp.31-53.
  - 10 Cf. L. Burchardt, "Die Projektierung und Gründung hochschulferner physikalischer Forschungsstätten im Wilhelminischen Deutschland". In: *Physikalische Blätter* 1976, pp.289-297; F.R. Pfetsch, *Zur Entwicklung der Wissenschaftspolitik in Deutschland*, Berlin 1974, pp.109-123.
  - 11 Cf. L. Burchardt, "Wissenschaft und Wirtschaftswachstum..." In: U. Engelhardt et al., eds., *Festschrift für Werner Conze*. Stuttgart 1976, pp.770-797.
  - 12 The prehistory of the Kaiser-Wilhelm-Gesellschaft and its early years are exhaustively treated in: L. Burchardt, *Wissenschaftspolitik im Kaiserreich. Vorgeschichte, Gründung und Aufbau der Kaiser-Wilhelm-Gesellschaft zur Förderung der Wissenschaften*. Göttingen 1975.
  - 13 This material is kept at the Zentrales Staatsarchiv Merseburg, 2.2.1. Nr. 21281-21283.
  - 14 A paper looking into this process in the field of chemistry will appear shortly.
  - 15 Riese, op.cit., pp.19-61, gives much valuable information and insights concerning this point, and his results are more convincing than those arrived at by C. Quetsch, *Die zahlenmäßige Entwicklung des Hochschulbesuchs in den letzten fünfzig Jahren*. Berlin 1960 and by the older works of Conrad's and Eulenburg's.