European Review, Vol. 32, No. 4, 335–342

doi:10.1017/S1062798724000206

Organized Capitalism and Organized Science

JÜRGEN KOCKA

Wissenschaftszentrum Berlin für Sozialforschung, 10785 Berlin, Germany. Email: kocka@wzb.eu

This article compares two different ways in which German industries, during the half century before 1914, managed to integrate useful results from scientific research: At the time, on the one hand there was single-firm-based industrial research, and on the other the cooperation of science, business, and government in the Emperor William Society for the Advancement of Sciences (1911) out of which, after the Second World War, the Max Planck Society emerged. On this basis, the article discusses similarities and tensions between capitalism and the sciences which, in spite of some structural similarities, follow different logics.

The Problem

This article is particularly interested in capitalism's strong inclination to move beyond its original sphere, the economy, and permeate – some would say, colonize – other spheres of life, such as election campaigns, the arts, sports, very personal relations, education and perhaps also the world of science. Are there limits to this powerful capitalist drive to expand? Are there abutments of resilience? Do we need them?

It is with such questions in the background that this article deals with some aspects of the changing relationship between capitalism and scientific knowledge. It deals with industrial capitalism in Germany in the late nineteenth and early twentieth centuries, when the needs of industrial production and the results of scientific research were integrated in a new way. The combination of organized capitalism and organized science that was established then has basically survived until today.

In conclusion, the article offers some general comments on similarities and differences between capitalism and science.

In this article, the term 'capitalism' means an economic practice or an economic system with decentralization, commodification and accumulation as basic characteristics. It is essential that individual or collective actors, on the basis of property rights, are able to make economic decisions in a relatively autonomous and decentralized way. Markets serve as the main mechanisms of allocation and coordination – the price system and competition are central, and commodification permeates capitalism in many ways. Capital, profit and accumulation are defining elements, i.e., using resources for investments now in expectation of higher gains in the future. It also involves dealing with uncertainty and risk (Kocka 2016: 21). There are different types of capitalism. This article is mainly interested in industrial capitalism and its relation to scientific knowledge.

Organized Capitalism

Since the last quarter of the nineteenth century, with the increasing importance of new branches such as electrical manufacturing and chemicals, and with important technological changes in the production of steel and other raw materials, we observe (a) the rise of large manager-directed corporations with complex and systematic managerial structures; (b) new forms of organized cooperation between those large enterprises, e.g., cartels, trusts, mergers and a close interdependence between production firms and banks; and (c) an increasing intensity of state interventions in the economy and society, after some decades of free-trade liberalism and deregulation. Cases in point are, on one hand, the nationalization of railways and the introduction of protective tariffs, and, on the other hand, labour and social welfare legislation, among many other examples. While state authorities intervened with greater intensity in the economy and society, economic and social interests became organized and exerted a growing influence on political decisions and public policies through their lobbies and interest groups.

The rise of large managerial enterprises, the new strength of cooperative self-organization between them and the increasing interdependence between market and state – these were three interrelated developments that did not damage or replace decentralized decision making, market mechanisms, competition, risk and other elements of capitalism, quite to the contrary. But they led to a new mixture between market and organization, to a new pattern, which historians have analysed as 'coordinated', 'corporate', or 'organized capitalism' (Winkler 1974; Puhle 1984; Wehler 1995: 662–680; Tilly and Kopsidis 2020: 165–250).

It was within the large managerial enterprises that the need emerged to increasingly integrate scientific knowledge, first into production, then later into management and marketing. Science could be used to increase productivity and competitiveness, particularly in those branches in which essential parts of the productive programme were matched with relevant progress in closely related fields

of scientific research or technical skills. This was especially the case in chemicals, electrical manufacturing, steel, nonferrous metallurgies, machine building and optical industries. In these branches, economies of scale offered the necessary financial margins, and there were qualified staff with the ability to open up and sustain cooperation with scientists and academic institutions. Inter-firm cooperation could be helpful if sources of scientific knowledge were to be tapped from institutions outside the single firms. And it was only under conditions of close interdependence between state and market that governments could function as intermediators in building coalitions between business, science, and administrations. Such coalitions were helpful for continuously mobilizing scientific input into industrial structures. Considering these factors, one understands the intrinsic nexus between 'organized capitalism' and the road towards growth and success of science-based industries in the late nineteenth and twentieth centuries.

Single-firm-based Industrial Research

Firms had different ways of obtaining scientific knowledge that would serve their business goals. Personal contacts and individual contracts with scientists from neighbouring research institutions or schools was one possibility; purchasing patents or licences another. But in both cases, further detailed research and technical operations inside the firms were needed to translate an inspiring idea or a patent-registered proposal from outside into a practicable production method inside the firm. Such transition steps were hard to perform without highly qualified and specialized staff. Qualified personnel were also needed for surveying the field and observing, as much as possible, what competitors did; for gradually improving established procedures and making them more efficient; and for piecemeal innovations which would supplement and further develop the production programme in order to maintain and improve, in a dynamic market and challenged by competitors, the competitive position of the firm.

It was between the 1860s and the 1910s that firm-based industrial research was established within the larger companies in the branches mentioned above. First, single persons with some academic training were hired who would then, if requested, build up firm-based laboratories. In case of further growth and demand, they might grow and diversify, be grouped around central main laboratories and be further developed into fully-fledged firm-based research departments.

These labs and departments were staffed by academically trained chemists, physicists, other scientists and engineers, but also by persons with practical training and by helpers trained on the job. Usually they were employed by the firm and situated in its hierarchical and functionally diversified system of positions. The work they did can be described as teamwork with an interdisciplinary reach. It was strictly application-oriented, and clearly within the scope of the firm's production programme, under the guidance of superiors, although not controlled by them in detail (Meyer-Thurow 1982; Reinhardt 1997: 3–13, 319–329; Marsch 2000: 13-27).[a]

https://doi.org/10.1017/S1062798724000206 Published online by Cambridge University Press

The assessment of this type of research by historians differs – from 'industrialization of invention' (Meyer-Thurow) to 'basically routine' (Marsch). There is no question that this type of industrial research was regarded as very important by the industrialists, who maintained and expanded it in spite of high costs. It was a type of scientific research clearly different from scientific research in the universities, and this basic difference between industrial research and university research became even more pronounced with time. It was characterized by certain limits: relatively narrow specialization, although sometimes across disciplinary boundaries; orientation towards reaching results in relatively short time spans; some kind of censorship, in relation to competing firms; restricted discourse with peers; restrictions of freedom of research. Both strengths and weaknesses were consequences of the fact that industrial research of this sort was practised within and under the rules of capitalist firms.

Science, Business and the State: The Kaiser-Wilhelm-Gesellschaft in 1911

Sensitive to the built-in limits of single-firm-based industrial research, some major and influential industrialists, such as Werner von Siemens, supported by leading scientists from prestigious universities, such as Hermann von Helmholtz, argued for an alternative way of making scientific knowledge available for the increasingly science-dependent industries. At least since the 1880s, they stressed the huge importance of basic research – *Grundlagenforschung* – for the long-time success of German industries, and also with respect to increasing international competition. They argued that basic research of the kind they needed could not be sufficiently pursued in market-dependent industrial labs, which necessarily concentrated on direct and fast application. They pointed out that it could take many years to find out whether a new scientific discovery would pay off or not, in market terms. They emphatically argued in favour of *Forschungsfreiheit*, freedom of research, which, as they implied, could not be fully practised within firms, i.e., institutions that legitimately pursued economic interests first. They depicted scientific progress as absolutely central both to long-term economic success, but also to the national prestige and power – including military – of the newly founded German Empire. It should not be left to the influence of 'material interests' (they argued), rather it was something for which governments, the state, should shoulder responsibility, including financial responsibility (Szöllösi-Janze 1996: 1193–1198).

Within the semi-authoritarian German *Kaiserreich*, very much under the influence of Prussia and its administrative, aristocratic and bourgeois elites, this argument was remarkably successful. Several multi-functional research institutions were founded in which scientists and economic actors worked together in close alliance with state representatives, who played intermediating roles and were very influential in shaping the scientific landscape, both in the single states and the Empire. The most important of these new creations was the *Kaiser Wilhelm*

Gesellschaft zur Förderung der Wissenschaften (KWG), literally: the Emperor William Association for the Promotion of Science, which was founded in 1911.

It was an alliance of three groups that successfully promoted and later controlled the KWG. On the one hand, there were leading scholars such as Adolf von Harnack, the theologian, church historian and president of the Prussian Academy of Sciences, and Emil Fischer, chemist and Nobel laureate, who held influential positions in the academic world. They were convinced that, in the twentieth century, scientific progress required new forms of large-scale research with interdisciplinary elements, organized outside the rigid disciplinary structure of universities, and carried on by full-time researchers without teaching obligations. They envisioned a new type of institute under the leadership of very powerful directors, since they firmly believed that even large-scale research enterprises could only flourish if directed by strong individuals. These research institutes would have to find access to non-government financial resources. After all, modern research in the natural sciences was expensive. Demands were often greater than what publicly financed Universities, Technical High Schools or Academies could marshal. These academic advocates of large-scale science – science in the broad sense of *Wissenschaft* – were not afraid of close cooperation with capitalists, quite the contrary, but they emphasized the autonomy of research and researchers as indispensable, in contrast to industrial research within private firms.

On the other hand, there were the initiatives and contributions by policymakers, mainly by highly qualified civil servants from inside the administration of Prussia, the largest state in Imperial Germany. Among them were the highly experienced ministerial director Friedrich Althoff, who promoted these plans, motivated by state politics and considerations of military defence. Wilhelm II agreed to become the protector (Schirmherr) of the KWG. That his name appeared in the title of this organization was indicative of the visible support that the Imperial court was giving and that documented the national significance of the new Association. This support very considerably improved the chances of gaining private patrons and thus to mobilize financial resources from industry and civil society.

And there were, thirdly, leading representatives of 'big business', the powerful and wealthy rulers of empires in electrical manufacturing, chemicals, coal, iron and steel, but also bankers, the industrialist Gustav Krupp von Bohlen und Halbach and the banker Ludwig Delbrück among them. They all promised to support the new KWG, which would be financed mainly from private donations and not from public money.

The emerging organization – at first a rather loose umbrella organization with a quickly growing number of relatively autonomous institutes mainly in the natural sciences – acquired, after some discussion, the legal status of an association under civil law (*Verein des bürgerlichen Rechts*) with individual persons as co-opted members.

No question, there was much state influence. In fact, leading academic members invited and explicitly welcomed state influence as an effective protection against too much influence by capitalists and their firms. But in spite of all outspoken proximity to the governing authorities, the KWG was not organized as a government agency,

and it has defended its autonomy against political encroachments from above, again and again, with varying success. Corporate influences have certainly been powerful, and there was very close cooperation between single institutes and specific firms. But neither the KWG nor most of its institutes were organized as profit-oriented enterprises. Some of its academic members were not free of anti-capitalist resentments.

Up to 1914, five specialized institutes had been established within the KWG, of which four were located in Dahlem to the southwest of Berlin, with Althoff hoping that Dahlem would become a 'German Oxford'. The four institutes worked in physical chemistry, electro-chemistry, chemistry, experimental therapy and labour physiology and finally biology. All of them succeeded in recruiting prominent directors and scholars, among them Fritz Haber and Albert Einstein. The directors had ample financial resources and plenty of freedom and scope for their research. They all had their own priorities in their projects, geared to basic research. They were not obliged to conduct applied research on projects in which the government or the powerful donors had a political or economic interest.

The KWG did not cost the state of Prussia or the Reich government much. By 1914, it received no less than 14 million marks in private donations. These were not only raised by the representatives of industry and finance who had accepted membership in the KWG, but were also given by other sectors of the bourgeoisie. Some 140 millionaires (billionaires, by today's standards) were among the 175 donors from Prussia. Jewish patrons were particularly strongly represented among them, as they were in their giving to other large scientific and cultural projects. As the science historian Jon Agar concluded with respect to the next decades, the KWG institutes became 'power houses of twentieth-century German science' (Agar 2012: 101–104; Wehler 1995: 1228–1232; vom Brocke 1990).

Discredited under National Socialism, the KWG re-emerged as the Max-Planck-Gesellschaft (MPG) in 1948. Now that it was largely financed with public money and it became a much more integrated organization, it changed in many respects. It has grown: now there are more than 80 institutes with in the MPG. But its institutes have retained their former position as self-determined organizations of basic research (*Grundlagenforschung*) led by very independent and institutionally strong directors. The MPG has remained close to governments, but never became part of the public bureaucracy. It has continued to cooperate closely with capitalist industry and finance without being a profit-oriented enterprise. It knows how to protect its autonomy. In these respects, the MPG is still organized along the lines of the 1911 model which has survived for more than a century (Renn *et al*. 2024).

Similarities and Differences between Capitalism and Science

Maybe it is not fully convincing to speak of 'organized science', since one can argue that science is always organized in one way or another. In this article, 'organized science' means science embedded in relatively stable, formal, differentiated structures

that are intended to continuously relate science to non-scientific contexts, in this case to economic – more specifically, capitalist – contexts (Willke 1998).

I have analysed two forms of organized science – one within firms in capitalist markets, the other outside such firms, but with close relation to them. Both patterns show a high degree of compatibility and mutual reinforcement between capitalism and scientific knowledge. But it also became clear that a full integration of scientific research into capitalist contexts requires a price – a certain truncation that limits and narrows the possibilities of scientific research. In contrast, the second form of organized science is based on both proximity to and distance from capitalist practices, a pattern that allows a fuller realization of the strengths of scientific research.

One should neither be surprised about the high degree of compatibility and mutual reinforcement between capitalism and scientific knowledge nor about the severe tensions between them. On the one hand, there are striking structural similarities between modern science and modern capitalism. Both are committed to growth, basically without limits. Both in capitalism and in science, innovations are highly valued, and in both cases innovation not only augments the existing status quo, but also invalidates previous solutions and practices. Creative destruction (Joseph Schumpeter) plays a role in both. Both are future-oriented. Dealing with unclear futures, with uncertainties and risks, defines the efforts of both entrepreneurs and scientists. Both capitalism and science have led, and can lead, to highly beneficial consequences for humankind, but also to damage and harm.

On the other hand, there are striking differences between modern capitalism and modern science. It is much more difficult to define scientific knowledge as private property, while private property of capital, material and products is normal in capitalism. Inclusion and exclusion work differently and on the basis of different criteria in science and capitalism. Universalist inclinations and energies are stronger in science than in capitalism. Searching for truth, however defined, is something different from striving for gains, profit and accumulation.

Along these lines, one can understand why science and capitalism are not only mutually reinforcing twins, but also counterparts. Science – in the broad sense of *Wissenschaft* – contains elements of resilience against being fully organized according to capitalist principles. Capitalism and science follow different logics, and this difference should be respected.

Note

a. In an influential debate, scholars have distinguished between two modes of knowledge production. According to Michael Gibbons and colleagues (1994), 'Mode 1' mainly refers to basic research organized into separate disciplines and is not primarily motivated by the goal of applying its findings to the solution of practical problems. In 'Mode 2', multidisciplinary teams are brought together for limited periods of time to work on specific problems, with the aim of applying the results to the solution of economic, social or political problems. The authors assumed that 'Mode 2' only emerged in the mid-twentieth century. The debate has continued, criticism has been raised, and an additional mode has been suggested later. Here it should only be noted that knowledge production in the form of 'Mode 2' seems to have already existed in the nineteenth century.

References

Agar J (2012) *Science in the Twentieth Century and Beyond*. Cambridge: Polity.

Gibbons M, Limoges C, Nowotny H, Schwartzmann S, Scott P and Trow M (1994) *The New Production of Knowledge*. Thousand Oaks: Sage Publications.

Kocka J (2016) *Capitalism. A Short History*. Princeton and Oxford: Princeton University Press.

Marsch U (2000) *Zwischen Wissenschaft und Wirtschaft. Industrieforschung in Deutschland und Großbritannien 1880–1936*. Paderborn: Ferdinand Schoeningh.

Meyer-Thurow G (1982) Industrialization of Innovation. *Isis* **73**, 363–381.

Puhle H-J (1984) Historische Konzepte des entwickelten Industriekapitalismus. 'Organisierter Kapitalismus' und 'Korporatismus'. *Geschichte und Gesellschaft* **10**(2), 165–184.

Reinhardt C (1997) *Forschung in der chemischen Industrie. Die Entwicklung synthetischer Farbstoffe bei BASF und Hoechst, 1863-1914*. Freiberg: Technische Universität Bergakademie.

Renn J, Reinhardt C and Kocka J (eds) (2024) *Die Max-Planck-Gesellschaft. Wissenschafts- und Zeitgeschichte 1945-2005*. Göttingen: Vandenhoeck & Ruprecht.

Szöllösi-Janze M (1996) Geschichte der außeruniversitären Forschung in Deutschland. In: Flämig Ch. *et al.* (eds), *Handbuch des Wissenschaftsrechts, vol. 2*. 2nd edn. Berlin: Springer.

Tilly R and Kopsidis M (2020) *From Old Regime to Industrial State. A History of German Industrialization from the Eighteenth Century to World War I*. Chicago: The University of Chicago Press.

vom Brocke B (1990) Die Kaiser-Wilhelm-Gesellschaft im Kaiserreich. In Vierhaus R and vom Brocke B (eds), *Forschung im Spannungsfeld von Politik und Gesellschaft. Geschichte und Struktur der Kaiser-Wilhelm-/Max-Planck-Gesellschaft*. Stuttgart: Deutsche Verlags-Anstalt, pp. 17–162.

Wehler H-U (1995) *Deutsche Gesellschaftsgeschichte III. Von der 'Deutschen Doppelrevolution' bis zum Beginn des Ersten Weltkrieges 1849-1914*. München: Verlag C.H. Beck.

Willke H (1998) Organisierte Wissenschaft. *Zeitschrift für Soziologie* **27**, 161–177.

Winkler HA (ed) (1974) *Organisierter Kapitalismus: Voraussetzungen und Anfänge*. Göttingen: Vandenhoeck & Ruprecht.

About the Author

Jürgen Kocka taught modern history at the University of Bielefeld, the Free University of Berlin and at UCLA. He was a Permanent Fellow of the Wissenschaftskolleg zu Berlin and President of the Social Science Research Center Berlin (WZB). He sees himself as a social historian in a broad sense of the word. He is interested in syntheses and broad comparisons. He has published on the history of social classes, war and society, firms and capitalism, particularly in Germany, in the nineteenth and twentieth centuries. Among his English language publications are: *Capitalism. A Short History* (2016); *Historians and the Future* (2020); *Germany's Struggle for Modernity. Society, Economy, Culture and Politics, 1789–1918* (forthcoming).