Science and Higher Education

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Abstract: Science and higher education in Germany have undergone profound changes over the last 20 years. Here one might think of New Public Management reforms, the Bologna Process, or the Excellence Initiative. At the same time, basic tenets of the German system, such as the strong role of the professoriate, the absence of tuition fees, and the diversified structure of public research institutions have remained unchanged. This makes Germany an intriguing case for sociological research. Following a macro–meso–micro logic, we present the major findings of that research, highlighting theoretical contributions, empirical findings, and methodological innovations, as well as future perspectives on the study of change and continuity of science and higher education in Germany.

Keywords: Higher-education system, science system, knowledge production, governance, political reform

1 Introduction

Research on higher-education and science topics typically follows cycles of social discourse and public debate, for example, periods of major reforms and rapid transformations or times of perceived crises. The past 20 years have been one such period of perceived crises and far-reaching reforms. Roughly two decades ago, the institutional role of the university, the organization of higher-education institutions, as well as their knowledge production no longer seemed to suit the knowledge society of the post-industrial age. In Germany, such crisis diagnostics became visible, for example, in a special issue of the sociological journal *Leviathan* in 2001 titled *Die Krise der Universitäten* (*The Crisis of the Universities*). Its editors argued that, although the problems of contemporary universities consist of many small crises (e.g., too much responsibility, insufficient funding, and a growing gap between disciplines as well as the quality of institutions), these were not unconnected but rather amassed into one large crisis that called existing university structures into question (Stölting and Schimank, 2001). As a result, at the end of the 20th century, the German system was seen as having fallen behind international higher-education and science-policy discourse. In response to these crisis diagnostics and after years of delay, the German higher-education system was swamped with diverse programs for simultaneous reforms at the end of the 1990s (Schimank and Lange, 2009). As in many other European countries, the public university model in Germany was revised, and the universities' governance regimes pushed toward a much more competition-driven and managerial framework. Simultaneously, the Bologna reform greatly affected the German system, which contributed to the ongoing internationalization of German higher education. Partly owing

to these reforms, but also to pertinent historical features, one could witness an increasing international interest in science and higher education in Germany in recent years. The so-called Excellence Initiative (known today as the Excellence Strategy) in research, the absence of tuition fees despite the rapid rise in the student population, the diversified structure of public research institutions, and the priority given to internationalization across all levels of the system have once again made the German system relevant and fascinating to an international audience. At the same time, unintended consequences, such as the bureaucratization brought about by the Bologna Process in Germany or the critical effects of the increasing stratification as a consequence of the Excellence Initiative, continue to be widely discussed (for an extensive overview of the main characteristics of the German system, see Hüther and Krücken, 2018).

Both crisis diagnostics and the supposed cure in the form of managerial reform spurred the sociological study of developments and phenomena in higher education and science. The interplay of change and continuity as well as their specifics is the common ground among the sociological studies that we discuss in the following. But the studies also have another analytical perspective in common. Albeit to different degrees, they all focus on the relationship between the production of scientific knowledge and its production sites. As universities are (still) the most important loci of science production in Germany (Powell and Dusdal, 2017), they are of particular interest in this context. We see this dual focus on the production of science and on higher-education and research institutions, in which knowledge production takes place, as a particular strength of German sociological research on science and higher education. In the international research context, the two perspectives are typically treated separately (Krücken, 2012; Hamann et al., 2018). Recent initiatives, such as the establishment of the “Working Group ‘Science and Higher Education Studies’”¹ or joint funding initiatives for higher-education and science research of the *Bundesministerium für Bildung und Forschung* (BMBF; Federal Ministry of Education and Research),² give reason to hope that this unique characteristic of sociological science and higher-education research in Germany will be further institutionalized.

Our overview of prolific sociological perspectives on science and higher education follows the macro–meso–micro logic. We begin with macrosociological perspectives on change and continuity in the configuration of the higher-education and science system, move on to studies on change and continuity in the organization and governance of higher education, then follow this with studies on change and continuity in the practice of scientific knowledge production. The contributions that we consider are based on empirical research, except for one primarily conceptual con-

¹ The working group is part of the “Sociology of Science and Technology” section of the *Deutsche Gesellschaft für Soziologie* (DGS; German Sociological Association;), see: <https://akwiho.wordpress.com/for-english-readers/>

² The funding initiatives and their results can be found on the corresponding web portal launched by the BMBF. See: <https://www.wihoforschung.de/en/index.php>

tribution, which we discuss at the end of our review. This latter text merits particular attention as it makes an important contribution to the theoretical foundation of future empirical research on change and continuity in higher education and science.

2 Change and Continuity in the Configuration of the Higher-Education and Science System

Die Stunde der Wahrheit? Vom Verhältnis der Wissenschaft zu Politik, Wirtschaft und Medien in der Wissensgesellschaft (2001; *The Moment of Truth? On the Relationship of Science to Politics, the Economy, and Media in the Knowledge Society*) by Peter Weingart sheds light on the waning distance and closer coupling between science and politics, the economy, and the media, and analyzes their interdependencies as the core characteristic of scientific knowledge production in the knowledge society. In his fundamental view of society, Weingart applies differentiation theory (an undogmatic use of Luhmann's systems theory) and, accordingly, views science as well as the other societal spheres (politics, the economy, and the media) as functionally differentiated but interdependent systems. In international discourse, such a theoretical and macrosociological perspective that stems from a general theory of society is both rare and fruitful. Empirically, this plays out as follows. While institutional and operational interdependence between science and politics, the economy, and the media have led many scholars to diagnose a "hybridization" of science and the other spheres or a "blurring of boundaries" between them (as diagnosed, e.g., in the triple-helix model by Leydesdorff and Etzkowitz, 1996; the mode-2 type of research by Gibbons et al., 1994; or the penetration of societal spheres by Nowotny et al., 2001), two simultaneous and paradoxical processes form the nucleus of Weingart's diagnosis: the "politicization," "commercialization," and "mediatization" of science and a scientification of politics, the economy, and the media. The result of these paradoxical developments is an increasing loss of distance between science, politics, the economy, and the media, though not a full blurring of system boundaries. Whereas the latter offers hope that these systems might be able to rebalance their proximity–distance relationship, the waning distance and closer coupling of the systems first and foremost entails some destructive side-effects. For one, the increased use of scientific expertise by policymakers for solving problems or legitimizing decisions does not increase the degree of certainty but in fact erodes political legitimacy. Similarly, the more application-oriented and thus the more useful science is to industry and economic exploitation, the less autonomy science has, resulting in a decreasing number of groundbreaking discoveries and, ultimately, a decreasing usefulness of science overall. The more science is oriented toward the media in order to receive public attention, the more it is subject to the communicative selection criteria of the media system, thereby decreasing its exceptional status as a knowledge-producing enterprise and thus its public appreciation. This in turn leads to another set of paradoxical developments.

Despite the loss of authority of scientific expertise, policymakers do not concede their reliance on existing advisory arrangements, and the manifold new communication channels of the digital world popularize scientific results and scientists themselves more than ever before. Notwithstanding a potential loss of innovative capacity, industry favors mode-2 research over mode-1 forms of knowledge production.

Although published in 2001, Weingart's analysis has not lost any of its timeliness and its explanatory richness. The strength of this book is that it simultaneously illuminates the social macro structures of the modern knowledge society and, drawing on numerous studies and original research, also focuses on the motives and strategies of the actors who work across the boundaries between science, business, politics, and the media and thus help foster the mutual dependencies and interactions between these spheres. At the same time, these actors have a vested interest in a well-functioning science system to which they can refer and that they can use to legitimize their own tasks and achievements. In contrast to diagnoses based on mode 2, triple helix, and other models, it helps to explain why the boundaries of science do not merely dissolve, even though its edges may become fuzzy. Only the chapter on mediatization would need some updating. More recent developments such as digitalization, the power of (academic) social networks, and the alternative measures of scientific outputs that they provide were not yet covered at that time. It is a pity that the book has not been translated into English to make it available to an international audience—though different parts of Weingart's analysis have been published in the form of international articles (e.g., Weingart, 1998; 1999; 2002).

Hardly any change in German higher education has aroused as much interest at the international level as Germany's Excellence Strategy. As far back as 2000, the German federal government considered establishing "elite" universities. This was implemented in particular by launching the Excellence Initiative, which identifies high-performing universities and aims to raise their performance even further by supplying considerable additional funding. The initial idea of elite universities was eventually dropped, however.

The German Excellence Strategy is an ambitious program that began in 2006 and lasted in its present form until the end of 2018. In the summer of 2016, it was decided to extend the program until at least 2032. From 2006 through 2017, a total of 4.6 billion euros were invested in high-quality research to strengthen the international visibility and competitiveness of German universities and the German higher-education system as a whole. For the German higher-education system, the Excellence Initiative has been particularly important for two reasons. First, by identifying high performers at the institutional level, it marks a considerable departure from the hitherto underlying idea that all German universities are equal. Second, the Excellence Initiative has certainly contributed to the increased international visibility of the German system and corresponding reform initiatives. Since the 1990s, the German higher-education system could mainly be seen as a "recipient" of reform initiatives that emerged from other national higher-education systems. As a "sender," the German Excellence Ini-

tiative has influenced a range of European and Asian nations and triggered a broad international wave of comparable reforms.

Still, the Excellence Initiative remains highly controversial in Germany. For instance, a memorandum from 2016 that sharply criticizes the initiative for fostering managerial strategies in universities, externally inducing research competition, and giving rise to inequalities, was signed by about 2,000 academics within a few days. The internationally well-known sociologist Richard Münch became its most outspoken critic in Germany. In his book *Die akademische Elite. Zur sozialen Konstruktion wissenschaftlicher Exzellenz* (*The Academic Elite. On the Social Construction of Scientific Excellence*) from 2007 as well as in a number of articles and in a subsequent book in English (Münch, 2014), he criticizes what he—following in particular Pierre Bourdieu's work on the academic field—calls the creation of a new academic elite, both among academics and, more importantly, among universities. According to Münch, despite the rhetoric around excellence and the academic peer review underlying funding decisions, a self-reinforcing power cartel has emerged that favors larger universities over smaller ones, technical universities over non-technical ones, and natural sciences over the humanities. This is partly due to the selection criteria: third-party funding through the *Deutsche Forschungsgemeinschaft* (DFG; German Research Foundation) is of central importance, hence triggering the well-known Matthew effect in science, where, according to Robert K. Merton, reputation becomes self-reinforcing. As Münch shows with detailed statistical analyses, the same effect holds true for resources for conducting research. As a consequence, he views the entire process as flawed and contrary to the “*illusio*” (Bourdieu) of those who see strictly meritocratic principles at work here. The skewed distribution of resources in the Excellence Initiative is rather the result of past merits, debatable selection criteria, and arbitrary decisions. In addition, a highly problematic dynamic of large-scale and path-dependent research is set off, in which individual and small-group research are similarly downplayed as risky and uncertain endeavors.

3 Change and Continuity in the Organization and Governance of Higher Education and Science

Changes in the organization and governance of higher-education institutions is another related topic that has received a great deal of attention within the sociological research community studying science and higher education. The topic has become important because we are currently witnessing the transformation of the university into an organizational actor (i.e., an integrated, goal-oriented, and competitive entity) in the context of which academic missions are carried out by means of increased reliance on the organization itself and not solely by the academic community and its members. By referring to the international research literature on higher education, organization, and science studies in different national systems, we can observe the

shift from a loosely coupled, decentralized expert organization to a strategically acting, managed organization (see, e.g., Paradeise and Thoenig, 2013; Berman and Paradeise, 2016; Bleiklie, Enders, and Lepori, 2017; Musselin, 2017; Hütter and Krücken, 2018). Most of these and related accounts draw on more recent developments in higher education, whereas a careful analysis of recent decades is hard to find. This is where Frank Meier's book *Die Universität als Akteur* (2009; *The University as Actor*) comes in. In this theoretically ambitious piece of work, Meier draws on a variety of sociological resources, most importantly on the neo-institutional work by John Meyer and colleagues on actorhood, but also on Niklas Luhmann's sociological systems theory, governmentality studies by Michel Foucault and those inspired by him, as well as sociological theories of action. Such a broad conceptual framing that draws on different American and European strands of sociological theorizing is of great value and highly inspiring. Building on these concepts, Meier asks whether or not universities can be perceived as actors. Empirically, he broadly analyzes higher-education discourse in Germany from 1945 until the early 2000s. According to Meier, there is no simple shift from understanding the university as a loosely coupled expert system to the concept of the university as an integrated, strategically acting entity. Clark Kerr, the former president of the University of California system, has anecdotally described the struggle for parking lots on campus as the only commonality of university professors within their institution. Instead, Meier delineates four concepts of the university in German higher-education discourse that, despite their overlap, can be observed in a temporal order. It starts with the university as an institution, that is, a broad and encompassing concept of *Die deutsche Universität* (the German university), the identity of which dates back to the early ideas of Wilhelm von Humboldt and which can equally be applied to all German universities. Two other powerful concepts emerged in the 1960s and 1970s: first, the university as a bureaucratic corporation and, second, the university as a work organization whose structure resembles that of a business firm. However, while the latter especially is an important predecessor for the current understanding of the university as an actor, that concept only emerged in the 1980s with the rise of the fourth model, the competitive university. Here institutional autonomy, self-control, and responsibility are salient features that were lacking in the previous three models. Consequently, the model of the competitive university has been influential throughout the ensuing decades until today. More recent trends such as the increasing societal embeddedness through diversity, service learning, and academic outreach have not resulted in a new model but are instead carried out by the university as a strategically acting, managed organization, for which its self-perception as being embedded in multiple competitions is of key importance. The process of turning the university into an organizational actor has been briefly reconstructed in English in Krücken and Meier (2006).

Against the backdrop of the increasing actorhood of German universities, Otto Hütter's book *Von der Kollegialität zur Hierarchie? Eine Analyse des New Managerialism in den Landeshochschulgesetzen* (2009; *From Collegiality to Hierarchy? An Analysis of New Managerialism in State Laws on Higher Education*) is equally relevant

for understanding changes in the German higher-education and science system (for some important results in English, see Hüther and Krücken, 2018: chapter 4). The book's focus is on German higher-education laws and how they changed between 1998 and 2008 after the 1998 national *Hochschulrahmengesetz* (Framework Act for Higher Education) allowed the sixteen federal states to pursue their own paths with regard to formal organizational structures of their respective public universities. Dealing with higher-education laws from a sociological perspective is highly illuminating for current international research and discourse. By focusing on legal regulations, Hüther examines a missing link, so to speak, as many sociological analyses by and large either focus on broader societal discourses or concrete practices at the organizational level of universities. This allows one to further embed the German case in international debates on university governance. Comparative analyses have shown that universities in Europe have gained increasing formal autonomy in decision-making vis-à-vis the state as well as the academic community, thus following a trend towards deregulation and converting higher-education governance into a form of "steering from a distance." Although Germany is considered to be a latecomer with regard to New Public Management (NPM) reforms in higher education, NPM reforms were nevertheless adopted as well.

Hüther's examination of the sixteen state laws over one decade is based on a meticulous empirical analysis of the power and influence of ministries of education and science, boards of governors, higher-education leadership (presidents or deans), and academic bodies in which professors hold the majority. The influence of these actors and entities on formal decision-making was measured by focusing on the responsibility for key structural and personnel decisions in universities. Structural decisions include, for example, target and performance agreements, structure and development plans, and budget allocation processes; personnel decisions involve, among other things, the election of members to the board of governors and university leadership positions. As a result, one can see that higher-education institutions have by and large been gaining formal autonomy since the end of the 1990s. In part, this includes rights that they had not enjoyed for centuries. A number of states now allow higher-education institutions to appoint professors themselves, whereas traditionally the respective ministries for education and research of the states made these appointments. The strengthening of managerial self-governance is closely connected to the reduction in formal regulation by state authorities. The new competencies and freedoms for universities have not been transferred to academic decision-making bodies but have been achieved instead by shifting decision-making rights from the state and academic bodies to presidents and deans. However, the shifts have not come uniformly. There is still a huge variance among states, the autonomy of higher-education institutions can also be narrowed through state guidance and related new instruments (e.g., target agreements between the state and universities), and—particularly when compared to other countries—academic decision-making bodies still play an important role in German higher-education governance. It will be very interesting to observe the trends depicted by Hüther in the coming years and from an interna-

tional comparative perspective. With his book, Hüther has developed the analytical tools to do this. In addition, one could go a step further by also including changes in actual decision-making processes at universities and, following the seminal paper in organizational sociology by Meyer and Rowan (1977), focus on the supposedly loose coupling between formal and activity structures in university organizations.

Given Münch's critical appraisal of the Excellence Initiative discussed above, one can assume that those who traditionally are not at the center of the science system and its institutional structures are not only in a disadvantaged position but will lose further ground owing to the self-reinforcing mechanism of the allocation of resources and reputation. Women in academia are an interesting case in point as they have traditionally been in a disadvantaged position on the one hand, while, on the other, the German higher-education and science system has also been subject to numerous initiatives to foster the participation of women in academia, in particular in higher-level positions where the number remains remarkably small, even by international standards. The Excellence Initiative also aims to create equal opportunities for men and women, which makes this a highly relevant subject for sociological analysis. The monograph by Anita Engels et al., *Bestenauswahl und Ungleichheit. Eine soziologische Analyse zu Wissenschaftlerinnen und Wissenschaftlern in der Exzellenzinitiative* (2015; *Meritocracy and Inequality. A Sociological Analysis on Female and Male Scientists in the Excellence Initiative*), sheds light on this subject. Their book employs a variety of qualitative and quantitative research methods and gives particular importance to organizational case studies. It thus complements the empirical focus on discourses (Meier) and laws (Hüther) in a very important way, as this book enables us to see whether discursive and formal changes are accompanied by changes at the actual level of organizational practices. The particular value of the book lies in combining the analysis of broader societal changes concerning gender with related organizational responses and individual career trajectories. The diligent analysis shows the reformulation of gender issues that came with the Excellence Initiative. For instance, a documented concept to promote gender equality is a necessary requirement for any application to the Excellence Strategy. In its wake, gender equality is no longer framed in terms of equality of opportunity, justice, or fairness but rather in terms of competition, namely, the competitive advantage for the individual university and the overall university system if all talents can be mobilized. Previously, responsibility for gender issues in universities lay in the hands of equal opportunity or women's commissioners, who were by and large rather detached from university leadership. With the Excellence Initiative, equal opportunities have become a strategic and competitive issue for the entire university, including its leadership and management, and have hence become part of broader human resources and organizational development (for a similar argument on the trajectory of equal opportunity in American corporations, see Dobbin, 2009). Of particular interest is that a variety of measures, such as flexible time arrangements, provision of childcare, and dual-career options, were developed at the organizational level in order to take the private lives of (future) members into account. This indicates a huge cultural shift as German universities are historically

shaped by the ethos of “science as a vocation” (Max Weber), which is at odds with extra-academic orientations of its members. Following the case studies by Engels et al., the changes, including those in the number of women among the professoriate, are visible and certainly more than mere window dressing for the funding environment. Nevertheless, the entire issue requires further critical monitoring, and it seems like only a matter of time before other dimensions of equal opportunities—such as social background and migration status in particular—will complement the current focus on establishing gender equality in the German higher-education system.

4 Change and Continuity of Research Practices

Two books by Marc Torka and Cristina Besio add to the discussion about scientific knowledge production with a perspective on changes in research practice and a focus on a phenomenon that is central to today’s organization of research: the rise of research projects. Conducting research today means to design, launch, and carry out research projects. Whether it is a PhD thesis, an article, a book, a project proper based on third-party funding, or even a large-scale collaborative research consortium, we think about scientific knowledge production in terms of projects as a specific organizational and social form with defined goals and tasks, a limited duration, and short-term planning and resources. Besio and Torka both show that, today, projects are a central form of organizing research; research in project form has become the standard model of research, institutionalized across all disciplines, research objects, and types of research.

Besio’s book *Forschungsprojekte. Zum Organisationswandel in der Wissenschaft* (2009; *Research Projects. On Organizational Change in Science*) places special emphasis on the relationship between projects and organizations—that is, universities and research institutes—and analyzes the extent to which research projects are changing scientific knowledge production. Her analysis is conceptually based on Luhmann’s organization theory. Torka’s book *Die Projektförmigkeit der Forschung* (2009; *Research as Projects*) analyzes the mode of operation of projects in everyday research practice, and his approach is based on a combination of Luhmann’s semantic analysis and Overmann’s interpretation pattern analysis. The theoretical perspectives of both authors allow them to focus on the nature of research projects and distinguish them from much of the international literature. There are plenty of studies on the growing size of research projects and their characteristics, their increasingly internationally oriented and collaborative character, as well as the growing competition for funding. However, not much has been written on the impact of the project form on scientific knowledge production and the organizations that produce scientific knowledge.

Both books examine the significance and development of research projects from a historical perspective and trace their roots back to the industrial laboratories of the 19th century. For the 20th century, they emphasize the interrelatedness of the spread of

research projects and research funding. The emergence of national research-funding organizations is particularly important for the institutionalization of project-based research. Both authors investigate the German case using the example of the DFG's creation in the 1920s. Project-based funding brought about a shift in the assessment and evaluation of research—from an assessment of a researcher's past achievements to the evaluation of project proposals. Such proposals need to point out the relevance as well as the feasibility of the research in advance to be granted funding. Also, the emergence of "Big Science" in the 1960s (historical examples include major space projects and the Manhattan Project in which science, industry, and politics were closely interrelated) further facilitated the institutionalization of the project form, beginning in the natural sciences and engineering, and spreading to the social sciences and humanities. Torka goes back even further in time and shows that the semantic precursors of the project form date back to the figure of the "project maker" and the activity of "project making" in the 15th century but disappeared with the emergence of modern sciences in the 19th century.

In their empirical parts, the books are complementary. Besio focuses in her empirical analysis (based on interviews) on the functions, opportunities, and risks of research projects. Projects have advantages at the level of the organization of research because they provide a structure that can have an "unburdening effect" on the research process by defining a fixed duration, allocating a specified amount of resources, and clearly distributing responsibilities. Moreover, they have the further advantage that they facilitate risk-taking in research because of having a foreseeable end and therefore temporally limiting that risk. But they can also create pressure with regard to success and time. Another potential downside is that projects might lead to a fragmentation of the research. Besio's conclusion is that benefits and drawbacks of the project form are strongly dependent on the characteristics of the individual projects and those of the organizations in which they are embedded. Different forms have different advantages and disadvantages. In his empirical analysis (based on interviews and participant observation), Torka depicts the project form as a paradoxical treatment of the structural openness of research. While it aims at the creation of factual, temporal, and social expectability, research itself is characterized by its openness, inconclusiveness, and its preference for the failure of initial expectations (i.e., trial and error as a means of generating knowledge). Research and the project form are thus subject to different expectations, which are in tension with each other. Nevertheless, the project form has developed into a generalized and autonomous structure of the research practice that makes scientific knowledge production both more controllable and more flexible.

With academic freedom under siege in even the most unexpected countries, German academia may well consider itself lucky that the principle is enshrined in the national constitution. The first 20 articles of that document are regarded as inviolable and are subject to a so-called "eternity clause," which implies that the underlying principles may never be changed. Article five states that "[a]rts and sciences, research and teaching shall be free" (article 5.3 *Grundgesetz* [Basic Law]). This was a response to

the traumatic experience of Nazi Germany. After World War II, this autonomy was exclusively defined as an individual right, to be protected against the state and the university as an organization. The managerial higher-education reforms of the past 20 years, however, have put this notion of autonomy within academia and science into question. The new organizational autonomy of higher-education and research institutions has the potential to influence the individual autonomy of academics. Thus, we would like to mention a special issue of the journal *Theoretische Soziologie* (*Journal for Theoretical Sociology*) edited by Franzen et al. that moves the autonomy of science into the limelight of sociological debate. The issue is titled *Autonomie revisited. Beiträge zu einem umstrittenen Grundbegriff in Wissenschaft, Kunst und Politik* (*Autonomy Revisited. Contributions to a Controversial Basic Concept in Science, Art, and Politics*), and the extensive thought it gives to the autonomy of science with reference to the autonomy of arts and politics is particularly valuable. It contains a variety of contributions on autonomy in the three societal spheres of science, art, and politics, which unfortunately cannot all be addressed here individually. Instead we will highlight the volume's structuring arguments.

The editors of the volume emphasize an important difference in how we conceive of autonomy itself. They distinguish between the use of the concept of autonomy in sociological theories (autonomy as a concept) and the discursive and normative use of autonomy in social practice (autonomy as a value) and posit that the way autonomy is employed and how it is conceptually defined remains unclear in many debates. They point out that autonomy is not a static concept but is subject to change and also serves to describe change, which, as the editors argue, explains the lasting popularity of the concept as well as the fact that autonomy often becomes the battlefield of normative convictions. On this basis, the aim of the contributions collected in the anthology is, first, to reopen the discussion of autonomy and, second, to ask whether sociology needs the concept of autonomy, and if so, what it might look like. From the editors' sociological perspective, autonomy can be seen as a "hinge" between the social micro, meso, and macro levels that connects interactions and mutual conditions between the different levels. The contributions on autonomy in arts and politics note that there are great similarities in all three societal spheres, namely, the assumption that activities in all three must be autonomous in order to be truly socially relevant. At the same time, the contributions show that autonomy is not simply a synonym for independence and self-referentiality, nor is the loss of autonomy a synonym for the further differentiation of social spheres. Rather, paradoxical dynamics and autonomy conflicts are present in all three societal spheres. Such paradoxical dynamics in science and higher education permeate the managerial higher-education reforms. The attempt to shift control from state authorities to higher-education institutions and to establish more organizational autonomy has at the same time brought about a greater demand for accountability and evaluation on the organizational as well as on the individual level, which might have an impact on the autonomy of universities and their members. The special issue offers numerous conceptual suggestions for the analysis of this tension, but research on its empirical impact and consequences is still largely lacking.

5 A Conceptual Contribution on Scientific Production Communities

Finally, we would like to discuss the book *Wissenschaftliche Produktionsgemeinschaften. Die soziale Ordnung der Forschung* (2006; *Scientific Production Communities: The Social Order of Research*) by Jochen Gläser, which is a conceptual contribution to the field. It raises two fundamental questions that have been addressed by the sociology of science from its beginnings and have been answered in various ways in distinct traditions of thought (for example, by Merton, Fleck, Polanyi, and Latour): “How does social order in scientific communities emerge, and how is it maintained? What kinds of social mechanisms allow scientists, who are only imperfectly informed about each other’s work, to produce scientific knowledge together?” (ibid.: 11). Gläser traces the functionalist, institutionalist, and constructivist classics and argues that the established models failed because they neither provided satisfactory answers nor established a program for research. Accordingly, Gläser develops an integrative concept and explanatory model for collective scientific knowledge production that answers both questions, which he calls “scientific production communities.” The model builds on the concept of norm-based communities as a means of creating social order and on Mayntz and Scharpf’s actor-centered institutionalism research. Specifically, Gläser focuses on the concept of collective production systems, which are “social orders that solve a specific problem: they order the actions of a collective in such a way that its members can produce goods together” (ibid.: 56–57).³ Throughout the book, he draws on these conceptual resources by analyzing how scientific production communities emerge and operate. He identifies the conditions for their emergence and operation as the existence of a common object of investigation, a collective identity and corresponding individual identities, established and legitimized practices, related standards and systems of regulation, and a corresponding public communication (ibid.: 259). On the basis of these conditions, Gläser describes the functioning of scientific production communities as follows: “Production is based on *autonomous decisions by producers* about which necessary contributions they can make and how to go about producing them. These decisions are *based on the community’s common knowledge base*, which is simultaneously the object of investigation, a means of work, and a collective product. New contributions to the community’s knowledge base are *offered publicly* and included in the knowledge base by being used in further knowledge production. This *use in subsequent production processes* is also the most important form of *quality control* for produced knowledge. *Rules and standards* for local knowledge production practices increase the contributions’ reliability and compatibility. *Peer review harmonizes individual perspectives with the mainstream community* and thus improves individual contributions’ usability. Membership in such

3 All translations from German sources are our own.

a collective production system is facilitated by the *orientation of the individual production to the community's knowledge base*" (ibid.: 263, emphasis in the original). Gläser's conceptual elaboration is quite valuable for future empirical research on change and continuity (and beyond) in higher education and science. Without explicitly referring to his book, these considerations form a conceptual building block in the authority-relations research program that Gläser has developed with his colleagues (see, e.g., Whitley and Gläser, 2007).

6 Conclusion

To conclude our review, we would like to stress that both the German science and higher-education system as well as the sociological thinking about it have adapted and changed considerably over the last two decades while pertinent historical features are still of paramount importance. This has, on the one hand, led to the combination of new and international trends (e.g., New Public Management), in a rather incremental fashion, with the more traditional features of "the" German university. On the other hand, the strong and assertive role of sociology as a discipline in the analysis of such processes has been retained, too, whereas more inter- or transdisciplinary research seems to be dominant in the international sphere. We have presented some of the results of these efforts above in an attempt to shed light on recent systemic trends and their sociological analysis.

Beyond the achievements of sociological research on the German science and higher-education system, we would like to highlight three systemic changes that deserve further attention. First, more analyses are needed of the interplay between globalization trends in science and higher education and their relationship vis-à-vis the national and organizational levels. From a sociological perspective, these levels and their related processes are closely connected but at the same time display their own logics and specificities. Second, the increasing competition within science and higher education needs closer scrutiny. Again, different levels of analysis and related processes have to be taken into account, which might reinforce or contradict each other. In this context, sociology has a lot to offer, in particular when bridging the gap between studies on science and higher education and economic sociology and the sociology of valuation. Third, digitalization as a pervasive societal feature, which is increasingly shaping science and higher education, requires further sociological reflection. For example, what will university teaching look like in the era of digitalization, and how will this affect research and related collaborations? Processes and developments like these are creating a demand for new methods as well as opportunities for methodological innovation. Big data and machine learning still play too small a role in current sociological research. Combining new methods for the analysis of big data with qualitative interpretative methods could open new and exciting avenues for the sociology of higher education and science in the 21st century.

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