Science and Public Policy, 2025, **52**, 491–502
DOI: https://doi.org/10.1093/scipol/scae095
Advance Access Publication Date: 15 February 2025
Article

Scientizing the world: on mechanisms and outcomes of the institutionalization of science

Marcelo Marques[1,*], Bea Treena Macasaet[1], Justin J.W. Powell[1], Jennifer Dusdal[1], David P. Baker[1,2]

[1]Department of Social Sciences, University of Luxembourg, 11 Porte des Sciences, Esch-sur-Alzette 4366, Luxembourg
[2]Department of Sociology and Criminology, Pennsylvania State University, 647 Welch Building, University Park, PA 16802, United States

*Corresponding author. Department of Social Sciences, University of Luxembourg, 11 Porte des Sciences, Esch-sur-Alzette 4366, Luxembourg.
E-mail: marcelo.marques@uni.lu

Scientific reasoning has emerged as a powerful social force, particularly due to the institutionalization of science, a process that has significantly accelerated since the late 20th century. This phenomenon, known as scientization in the social sciences, encapsulates how scientific reasoning has become the dominant medium for shaping science-society relationships. Despite its growing prominence, the mechanisms and outcomes of scientization remain less well understood. A systematic search of Elsevier's Scopus database reveals a sharp increase in references to scientization since the late 1970s, with 296 publications doing so by 2020. This study examines how mechanisms such as rationalization, professionalization, technologization, commercialization, and actorhood have driven the institutionalization of science, impacting culture, academic disciplines, and policy-making. Our findings highlight the critical need for more nuanced understandings of how scientization influences modern societies, particularly within the policy sphere, where the interplay between science and policy has substantial and far-reaching consequences.

Keywords: scientization; institutional theory; rationalization; standardization; actorhood; policy.

1. Introduction: roots of and views on scientization

In his famous lecture, *Science as Vocation*, Max Weber ([1919] 1946) discussed how the modern world was becoming "disenchanted" ("*entzaubert*," borrowing from Schiller, see Raphael 1996). This new world has fewer mysterious, incalculable forces; all things may be understood by scientific, technical means. Measurements, calculations, and rational experiments have left less and less space for such enchantment. Weber attributes this process of social change to the growing use of intellect and rationality in solving social problems, which has progressively supplanted mystical or religious beliefs in our unending human quest to deal with myriad human challenges and to more deeply understand our world and the mysterious universe beyond. This notion of disenchantment also highlighted the limits of scientific rationality in addressing human values and ethics, a critique echoed in later theoretical discussions on the role of science in society and further consequences. Critical theorists have seen in formalized science a tool for domination (Horkheimer and Adorno 2002), a tool that can be instrumentalized because it lacks neutrality (Marcuse 1964), or the depoliticization of public discourse and consequent concentration of decision-making power in the hands of technocratic experts (Habermas 1968).

The establishment of universities (Shils 1973), the continuous rise in educational attainment (Baker 2014), and the proliferation of knowledge-producing organizations (Drori et al. 2003) are both the backbone and the driving force behind the broadening and deepening of scientific reasoning in society. These institutions foster the growth of a knowledge-based society (Frank and Meyer 2007, 2020), continually fueling the expansion of what we know as *modern science*. To analyze this extraordinary expansion, especially since World War II, multiple (sub)fields, such as sociology of science (Merton 1962; Ben-David and Sullivan 1975), sociology of scientific knowledge (Collins 1983; Shapin 1995), and science of science (Fortunato et al. 2018; Wang and Barabási 2021) developed. Incontrovertibly demonstrated by "pure exponential growth" in scientific publications (Price 1963; Ben-David 1990)—now more than four million articles across the disciplines per annum—knowledge production has jumped from small-scale to "global mega-science" based on networked universities, their researchers, and shared infrastructures (Powell, Baker, and Fernandez 2017; Baker and Powell 2024). Demonstrating the worldwide spread of scientific networks, the growth of international collaboration in science across disciplines exhibits the same exponential trend (Wagner and Leydesdorff 2005; Dusdal and Powell 2021; Fu et al. 2022). Greatly facilitating these networks are instantaneous communication, data sharing platforms, and the steadily increasing number of scientific conferences dedicated to dissemination of cutting-edge scientific knowledge (Zapp, Marques, and Brant 2024).

The transformation of modern society via such broad and diverse institutionalization of science has been termed *scientization* (Beck 1992; Murakami 1993, 1997; Drori et al. 2003; Drori and Meyer 2006a). Scientization refers to the process through which scientific reasoning—scientific methods and principles—have evolved, becoming a pervasive social and cultural force deeply embedded in all aspects of society, with significant, far-reaching consequences. Importantly too, scientization also implies a deepening institutionalization of science itself: the emerging autonomy of science's internal organization and the strategic actions of thousands of universities, other organizations, and contemporary scientists working globally to expand this institution (Baker and Powell, 2024). *Modern science* is the social institution that has contributed the most to this process of *scientization*. While a considerable body of scholarly work shows the expansion and dynamics of modern science, there remains a significant lack of clarity regarding how "scientization" is applied and how this multidisciplinary body of literature contributes to our understanding of the mechanisms that explain the instutitonalization of science—and its outcomes. Thus, we carry out a systematic literature review of scholarship on the topic over four-and-a-half decades to answer the following research questions: How has the concept of scientization been applied within different disciplines and fields? What are the mechanisms driving the institutionalization of science, and what are the outcomes of this process?

Our goal is to provide insights into the mechanisms and outcomes of scientization in post-industrial societies. To do so, we survey patterns of expansion and diffusion of the term across the sciences via systematic literature review of a corpus of 296 publications published from 1978 to 2022 that refer to "scientization" either in the title, keywords, or abstract. With these data, we analyze the mechanisms of *rationalization, professionalization, technologization, commercialization*, and *actorhood* to explain how scientization unfolds and the outcomes in the domains of *culture, disciplines*, and *policy* are described in scientific literature. This comprehensive analysis enables a fuller, more in-depth understanding of the institutionalization of science—within science—and beyond its boundaries (consequences in other institutions).

2. The mechanisms and outcomes of scientization: an analytical framework

To better understand the mechanisms and outcomes of scientization, we base our arguments on theoretical paradigms explaining the relationship between science and society. This helps us explore both the mechanisms driving the institutionalization of science in modern societies and the consequences of this on-going expansion.

Within social science theories, the concept of scientization has been used to describe how scientific principles have become more institutionalized in society. Murakami (1993, 1997) describes how secularization, the reorganization of knowledge into disciplines, and the recognition of scientists as a professional category all contributed to the maturation of science as a social institution, or "the scientization of science."

In turn, new institutional theory has contributed to understanding the process of the institutionalization of science, both within the development of science as an institution, and its impact on other social sectors (Drori et al. 2003; Drori and Meyer 2006a, 2006b). In this context, institutionalization refers to the process by which (scientific) practices, norms, or structures become established and so widely accepted that they are taken for granted. It involves embedding these elements into formalized, enduring systems resistant to change. As defined by Meyer and Rowan (1977), institutionalization is the process by which social practices acquire a rule-like status in thought and action, gaining legitimacy through their adoption and adherence by organizations within a broader institutional environment. As the authors elaborate, research and development can be considered institutionalized categories of organizational activity that have meaning and value in many sectors of society. Studies have charted the growing number of science associations (Schofer 1999), national science ministries and international organizations producing science (Drori et al. 2003; Zapp 2017), supranational governments investing in regional networks and scientific collaboration, such as in Europe (Marques 2018, 2023; Zapp, Marques, and Powell 2018), and discussed how scientific knowledge has become a source of legitimacy across societal sectors (Gauchat 2011), despite recent populist attacks on its authority (Schofer, Lerch, and Meyer 2022; Gauchat 2023).

New institutional theory has produced important contributions to enhance our understanding of the mechanisms that explain how science, as an institution, matures or gets institutionalized in modern societies. From this perspective, the main mechanisms driving scientization are *rationalization, professionalization*, and actorhood (see Drori et al. 2003; Drori and Meyer 2006a).

Rationalization refers to the long-term process by which religious beliefs and societal traditions are gradually transformed or replaced by rationality. According to Weber, science is the main driver behind rationalization, due to the gradual, wider spread of intellectual life as well as the elevation of the rational experiment as a principle of research since the Renaissance (Weber 1919). Science and scientific methods, reinforced by well-established and elaborated rules of regularity and standards, generate refined and continually improving scientific scripts that acquire increasing authority through the assumption of the principle of universality (Drori et al. 2003; Drori and Meyer 2006a). By gaining authority-supported universality, scientific scripts appear as stateless and decentralized, such that scientific knowledge becomes ubiquitous and (to some extent) independent of the context(s) in which it was originally produced. Increasingly taken-for-granted, science continuously (re)shapes world culture. The role of science and/or professional scientific associations (Schofer 1999), ministries of science and technology (Sukjang 2003), the exponential rise of scientific knowledge produced in numerous of universities worldwide and in diverse field-based networks (Fu et al. 2022) demonstrate how the institutionalization of scientific scripts, disciplinary concepts, and research findings are organized, evaluated, and continuously diffused globally. These self-reinforcing processes of rationalization and scientization are coupled, affected by a surge of global standardization of policies, programs, and practices that unify nations, sec-

tors, and organizations, captured in Jepperson's definition of rationalization as:

> continuing efforts to systematize social life around standardized rules and schemes that explicitly differentiate and then seek to link means and ends; (2) the ongoing reconstruction of all social organization—both social activities and social actors— … as means for the pursuit of collective purposes, these purposes themselves subject to increasing systematization (Jepperson 2002: 257).

In turn, the term *professionalization* refers to the process through which an occupation or a group of individuals seeking recognition and legitimacy adopt specific characteristics and principles that align with prevailing institutional norms and values. As a mechanism, professionalization encompasses a myriad of specific roles and programs that overlay new rules and norms onto pre-existing ones (Drori and Meyer 2006b). This mechanism not only introduces novel standards but also consolidates and reinforces established professional identities within the scientific community and beyond. This involves setting standards for education, certification, ethical guidelines, and professional conduct, all of which help to formalize certain fields and enhance their credibility. As a mechanism of scientization, professionalization produces layers of new roles and responsibilities onto the traditional work of scientists, such as creating new peer-reviewed journals or establishing professional associations. Moreover, the role of scientists in influencing global and national policies with evidence-based recommendations, for instance in the case of the Intergovernmental Panel on Climate Change (IPCC), or participating in industry consultancy, further highlights how professionalization continually reshapes the trajectory of science, connecting with other institutions in society and lending them authority.

Finally, the term *actorhood* can be understood as a cultural script that establishes acceptable behavior and shapes the permitted roles that individuals and organizations may legitimately pursue within a specific social framework (Meyer 2010). Within the institution of science, the key role of a scientist as an objective, independent researcher is an example of actorhood. This cultural script legitimizes their authority to conduct experiments and produce knowledge as it shapes expectations regarding their behavior, such as adhering to ethical standards in research and contributing to the advancement of science (Meyer and Jepperson 2000). Similarly, organizations, such as universities or research instituts, are expected to function as legitimate actors in the production and dissemination of knowledge. These organizations adopt specific roles, like providing education, conducting research, and shaping public policy, all part of their socially accepted and expected actorhood (Drori, Meyer, and Hwang 2006).

Moreover, by defining boundaries and providing classifications and categories, science not only empowers but also limits human actorhood. Such expansion is visible in the establishment of new categories of social actors, supported and substantiated by evidence in the modern world, such as students, or minorities of diverse gender, sexuality, and ability. For instance, the category refugee has been gradually institutionalized through international legal frameworks since the 1950s, informed by demographic and sociological studies (Zetter 1991). Empowerment is facilitated by increasing educational participation and attainment (Baker 2014) and granted by the legitimacy of scientific and rational explanations and tools that justify and confer meaning to the social action of empowered human actors (Drori et al. 2003; Drori and Meyer 2006a).

The institutionalization of science has not only been charted by empirical evidence but also criticized as it is entrenched in other fields like politics or ethics subordinating moral values to instrumental reason. This facilitates technocratic power that (potentially) marginalizes indigenous or alternative forms of knowledge and decision-making. In fact, Weber's notion of disenchantment also captures the limits of scientific rationality, particularly its inability to address questions of human values and ethics ([1919] 1946).

This original scepticism vis-à-vis science is later echoed in further discussions on the *instrumentalization of science*, which emphasizes efficiency, control, and predictability, leading to the domination of both nature and human beings (Horkheimer and Adorno, 2002). In the same vein, the gradual expansion of scientific rationality detached from neutrality makes science an instrument that can be used and manipulated (Marcuse, 1964). The scientization of politics, as discussed by Habermas (1968), aligns with this critique, suggesting that science is employed to depoliticize and control public discourse, shifting decision-making power away from democratic processes and concentrating it in the hand of a select group of experts. This technocratic dominance, where scientific claims and expertise are used to legitimize decisions and exclude broader societal input, narrows public participation in dialogue and democratic decision-making.

To understand both the mechanisms and outcomes of the institutionalization of science, we now turn to our methodology and the corpus of publications that variously construct and utilize conceptions of "scientization" revealing both mechanisms and outcomes of the institutionalization of science in the domains of *culture*, *disciplines*, and *policy*.

3. Data and methods for systematic literature review

To provide a comprehensive understanding of the term "scientization" and its application in the scholarly literature, we conducted a two-stage systematic literature review of academic publications that reference the term. The initial stage involved selecting the relevant records, adhering to guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al. 2009; Page et al. 2021). This approach consists of three steps: *identification, screening*, and *inclusion*. To identify academic publications on the topic, records were retrieved from Elsevier's Scopus database, searching for the terms "scientization"/"scientisation" or "scientiz*"/"scientis*" in article titles, keywords, and abstracts. (Throughout this analysis, we searched for variants in spelling of both American (e.g. "scientization") and British English (e.g. "scientisation").) A total of 348 documents published between 1978 and 2022 were identified. For the selected contributions, we then retrieved document-level metadata: (1) author name(s), (2) publication year, (3) document title, (4) keywords, (5) abstract text, and (6) name of journal or book. To retrieve the document's field classification, we used the Scopus All Science Journal Classification (ASJC) codes that sort journals within three nested levels of field classification: the first level (L1) comprises five

general categories (1) social sciences, (2) physical sciences, (3) life sciences, (4) health sciences, and (5) multidisciplinary; the second level (L2) has 27 more specific categories; and the third, most specific level (L3) has 334 subject areas (Scopus 2023). A journal may have more than one field classification, and being interested in portraying the reach of the term "scientization" across subject areas, we counted multidisciplinary journals once for each field. Sources including books, conference proceedings, and other nonjournal publication types left unclassified by Scopus were manually classified according to the ASJC.

We initiated the process by gathering the documents referred to in the individual records. Prior to proceeding with the screening phase, we excluded 31 inaccessible publications (mainly titles related to unavailable conference proceedings). In our subsequent screening, we included all articles in English, French, German, Russian, and Spanish. Finally, we included documents for review based on whether they reflect an attempt to conceptualize the term (as opposed to merely mentioning the term without context or using "scientized" as an adjective), finally resulting in a database of 296 publications.

The second stage involved a thematic content analysis of the corpus. This analysis allowed us to delve into the content of each publication and examine the emergent themes and patterns related to scientization. Through this four-step procedure (Vaismoradi et al. 2016): *initialization, construction, rectification*, and *finalization*, we gained insights into various disciplinary perspectives, conceptual nuances, and thematic developments surrounding scientization. Three research team members individually read the records and identified recurring themes. This initial interpretation involved searching for patterns and abstractions while taking reflective notes, and cataloging the range of meanings ascribed to scientization.

Three domains—*culture, disciplines*, and *policy*—emerged from this iterative process. The articles' themes were reviewed, refined, and discussed by the team. These domains reflect the primary contexts in which the importance, roles, and effects of science have most frequently been analyzed. They correspond to broader societal sectors: *culture* represents society at large, *disciplines* capture scientific communities, and *policy* focuses on regulatory settings and governance.

Each team member then independently classified all records to assess fit between the categories and records. The resulting classifications were compared, resulting in initial intercoder reliability (see O'Connor and Joffe 2020) of approximately 70 per cent. The discordant 30 per cent of publications were then re-analyzed and recoded collectively to refine and validate the identified themes to avoid arbitrary classification. Finally, *culture* comprises 37 records; *disciplines* 155; and *policy* 104.

The *culture* category includes publications that analyze science as a significant social force; they focus on understanding science's broader impacts in cultural terms, such as influence on societal values, beliefs, and practices. The *disciplinary* publications mainly employ the term "scientization" to describe processes in which specific (multi)disciplinary fields undergo increasing levels of scientization, manifest in applications of scientific knowledge, addressing scientific principles, or the exploration of specific subjects. The *policy* publications explicate science's conferment of legitimacy and authority to various fields of policymaking or the use of scientific expertise in governance.

Thematically analyzing the applications of the concept of scientization, we grouped themes according to the mechanisms of *rationalization* (and *standardization*), *professionalization*, and *actorhood* via a deductive process. Also guided by inductive reasoning, we were open to other mechanisms that we could observe in the data. Three others emerged that have received less attention in scholarship thus far: *academicization, commercialization*, and *technologization*. Further, we found cases that indicate "*over-scientization*". We then coded the outcomes associated to each mechanism for each domain (*culture, disciplines*, and *policy*). We later discuss their relevance for complementing and advancing theoretical perspectives in scientization.

Methodologically, this study has some limitations. Although we included documents in five languages in the dataset, relying on bibliometric data from Elsevier's Scopus database introduces a language bias, as most publications indexed in recent decades were written in English, with representation of other languages varying—and declining—over time. The database indexes the world's leading journals, with an overrepresentation of Western journals (varying by discipline), which may result in a skewed perspective. The analysis focused mainly on peer-reviewed articles (70 per cent). The rest of our sample comprises reviews (13 per cent), book chapters (9 per cent), conference papers (7 per cent), and negligible percentages of books, editorials, short surveys, and notes (1 per cent). Due to this sampling, we cannot capture the complete spectrum of usage and perspectives on the concept of scientization, as other publication formats, such as books, might offer further insights and diverse perspectives that enrich the understanding of the science–society nexus. Furthermore, the records explicitly using the term "scientization" merely comprise a portion of all published research examining the institutionalization of science and its societal implications. Many studies explore similar processes, yet do not explicitly invoke the term.

By considering these aspects, future research can expand the horizons of our investigation of scientization. Next, we present our results.

4. Results: unpacking scientization—emergence, diffusion, mechanisms, and outcomes

4.1 Overview of the term's cross-disciplinary diffusion

Before presenting core results of this paper—mechanisms and outcomes of scientization—we provide an overview of the term's cross-disciplinary diffusion to show its rising scholarly importance. The concept of scientization gradually emerged, then diffused considerably over the past quarter century, evident in the increasing number of publications that explicitly refer to the term (see Fig. 1) in myriad fields (see Table 1).

The first explicit reference to scientization in our dataset can be traced back to a publication that explored the influence of scientization in developing operational research in health services planning (Rosenhead 1978). During the 1980s, the concept was hardly used, with two publications explicitly mentioning it. Then, in the 1990s, scientization started gaining traction, as evidenced by twenty publications referencing

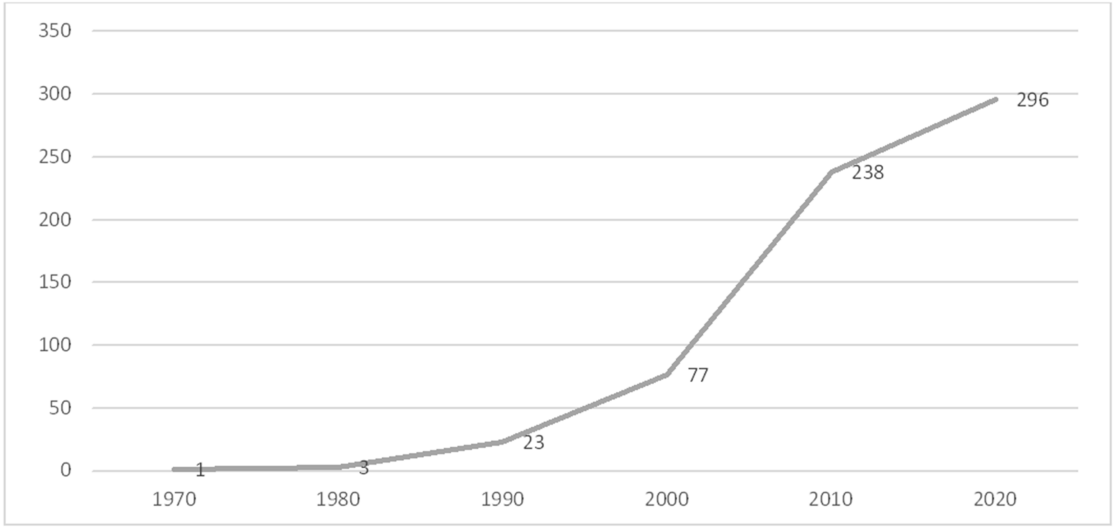

Figure 1. Emergence and diffusion of 'scientization' in publications, 1970–2020.
Source: Scientization database, based on Elsevier's Scopus.

the concept. This momentum continued into the 2000s, with fifty-four publications. In the 2010s, the concept experienced a significant surge, as 161 publications mentioned scientization. This upward trend continued into the 2020s. In fact, fifty-eight records (roughly 20 per cent of the entire corpus) referenced scientization between 2010 and 2022 alone. These dynamics underscore the growing presence of the concept, suggesting its enduring and growing relevance. Diversity in (multi)disciplinary subject areas reveals the extent of the term's use (see Table 1). Among L1 fields, the largest number of publications is found in the Social Sciences (67 per cent), with some representation in the Physical Sciences (18 per cent) and Health Sciences (10 per cent), and minor representation in Life Sciences (4 per cent) and Multidisciplinary fields (1 per cent).

Along with general diffusion across fields, the concept of scientization is, unsurprisingly, most prevalent in the social sciences, especially Sociology, Political Science, and History. Other leading disciplinary contributions explicitly mentioning scientization include Management, Monitoring, Policy and Law in Physical Sciences, General Medicine in Health Sciences, and Biotechnology in Life Sciences. Subject areas with one mention each are Marketing and Urban Studies in Social Sciences, Information Systems in Physical Sciences, Dermatology in Health Sciences, and Aquatic Science in Life Sciences. Meanwhile, five publications that mention scientization were published in journals explicitly classified as multidisciplinary. The above field and subject area breakdowns underscore the growing diffusion of the term scientization, with its presence observed and explored across a wide multitude of academic disciplines, providing a strong indication that the consequences of science in society are far-reaching across many sectors, which we present next.

4.2 Scientization mechanisms and outcomes

Table 2 shows the mechanisms of scientization grouped by domain—*culture, disciplines*, and *policy: rationalization* (and *standardization*), *professionalization, actorhood* as well as the smaller categories emerging from the analysis of data—*academicization, technologization*, and *commercialization*. We show the effect of each mechanism in cultural, disciplinary, and policy-related arenas, also providing references to outcomes of scientization as we cite select works from the corpus, alongside the main theoretical perspectives that frame the authors' uptakes on the processes and effects of scientization.

Rationalization, as the long-term process by which religious beliefs and societal traditions are gradually transformed or replaced by rationality supported by the maturation of science, is spotted as a mechanism that fuels the rise and institutionalization of other modern institutions as in the case of modern states (Merl 2020), schooling and higher education (Schofer and Meyer 2005; Smith 2022), and continuously shapes cultural norms and values as in the secularization of society (Park 2013). Here, studies are largely supported by the world society framework, alongside Raphael's (1996) theorization of the "scientization of the social," that argues for five main pathways of academic scholarship into society: (1) social-scientific concepts and discourses introduce new categorizations in social and political spheres; (2) experts transfer social–scientific knowledge within and outside of academia; (3) politicians negotiate what constitutes legitimate knowledge; (4) techniques employed to acquire knowledge; and (5) how institutions play an important role in producing and processing social-scientific knowledge).

Within the boundaries of academia, rationalization operates via the standardization of theory and methods that cuts across academic disciplines, as for instance in economics (Fourcade-Gourinchas 2001). To make a discipline "more scientized" is to modernize it in the form of advanced methods, grant authority to its epistemic claims through research, and align it with other established bodies of knowledge. In arguing for structural advancements in methods and processes, authors view scientization as a goal, for example, in improving image simulation of the human body in sports science (Dai 2022), applying e-commerce technology to improve logistics distribution (Zeng 2022), and enhancing hydrologic modelling in agriculture (Cheng et al. 2021).

Table 1. Distribution of 'scientization' in publications across subject areas.

Subject area (L3) by L1 field	Publication count
Social Sciences (67% of total share of L1 fields)	
Sociology and Political Science	70
Education; History	37
General Social Sciences	25
Cultural Studies	24
Geography, Planning and Development	22
Social Sciences (miscellaneous)	20
History and Philosophy of Science; Philosophy	18
Health (Social Science)	13
Anthropology; Law; Strategy and Management	11
Arts and Humanities (miscellaneous); Development	10
Economics and Econometrics	9
Linguistics and Language; Literature and Literary Theory; Public Administration	8
Communication; Organizational Behavior and Human Resource Management; Political Science and International Relations; Religious studies; Social Psychology	7
Management of Technology and Innovation (5); Business and International Management; Gender Studies; General Psychology; Language and Linguistics (4); Applied Psychology; Clinical Psychology; Health (Social Science); Library and Information Sciences; Tourism, Leisure and Hospitality Management; Visual Arts and Performing Arts (3); Business, Management and Accounting (miscellaneous); Demography; General Arts and Humanities; General Business; Management and Accounting; Information Systems and Management; Management Science and Operations Research (2); Accounting; Economics, Econometrics and Finance (miscellaneous); Experimental and Cognitive Psychology; General Economics, Econometrics and Finance; Management Information Systems; Marketing; Museology; Safety Research; Statistics, Probability and Uncertainty; Transportation; Urban Studies (1)	≤5
Physical Sciences (18% of total share of L1 fields)	
Management, Monitoring, Policy and Law	13
General Engineering	8
Environmental Science (miscellaneous); Geotechnical Engineering and Engineering Geology; Safety, Risk, Reliability and Quality	6
Biomedical Engineering; Ecology; Electrical and Electronic Engineering; General Computer Science; Human–Computer Interaction; Mechanical Engineering (5); Building and Construction; Energy Engineering and Power Technology; General Environmental Science; General Mathematics; Global and Planetary Change; Industrial and Manufacturing Engineering; Water Science Technology (4); Earth and Planetary Sciences (miscellaneous); Fuel Technology (3); Architecture; Civil and Structural Engineering; Computer Science Applications; Geology; Nature and Landscape Conservation (2); Analytical Chemistry; Applied Mathematics; Artificial Intelligence; Atmospheric Science; Bioengineering; Computer Networks and Communications; Computer Vision and Pattern Recognition; Earth-Surface Processes; Engineering (miscellaneous); Fluid Flow and Transfer Processes; General Energy; Information Systems; Media Technology; Modelling and Simulation; Renewable Energy, Sustainability and the Environment; Software (1)	≤5
Health Sciences (10% of total share of L1 fields)	
General Medicine	18
Complementary and Alternative Medicine	8
Health Policy; Pharmacology (medical); Physical Therapy, Sports Therapy and Rehabilitation (5); Medicine (miscellaneous); Public Health, Environmental and Occupational Health (4); Orthopedics and Sports Medicine; Psychiatry and Mental Health (3); General Nursing; Issues, ethics and legal aspects (2); Anatomy; Dentistry (miscellaneous); Dermatology; Epidemiology; Infectious Diseases; Nutrition and Dietetics; Physiology (medical); Small Animals; Urology (1)	≤5
Life Sciences (4% of total share of L1 fields)	
Biotechnology (4); Agronomy and Crop Science; Food Science; General Pharmacology, Toxicology and Pharmaceutics; Pharmaceutical Science (3); Drug Discovery; General Neuroscience (2); Aquatic Science; Biochemistry; Ecology, Evolution, Behavior and Systematics; General Biochemistry, Genetics and Molecular Biology; Genetics; Pharmacology (1)	≤4
Multidisciplinary (1% of total share of L1 fields)	5

Source: Scientization database based on Elsevier's Scopus.

Within the policy realm, rationalization has contributed to the *scientization of politics* (Weingart 1999) to describe a process in which policy decision-making is gradually supplanted by purposive rational or instrumental knowledge subordinated to scientific logics and terms instead of democratic or political deliberations. Habermasian approaches appear as a cornerstone in the analysis of the relationship between science and politics. Habermas traces the emergence of the scientization of politics back to the mid-18th century, triggered by a concurrent process of the death of the classical doctrine of politics and the rise of specialized social sciences that implement methodologies of the natural sciences (Habermas, 1968).

Here, abundant examples show that science contributes to the rationalization of public decision-making, as in the cases of COVID-19 crisis management (Christensen and Lægreid 2022) or genetically modified crops (Harsh 2014). Others provide accounts of the rationalization of policy sectors, such as the environment (Mulberg 1996) or healthcare (Gideon,

Table 2. Mechanisms and outcomes of scientization by domain.

Mechanisms	Outcomes on		
	Culture	**Disciplines**	**Policy**
Rationalization	*contributing to the rise of…* Childcare outside the home; scientific activity in world polity; schooling (state); secularization of religious/contemplation and spirituality practices *Scientization of the social*: Chinese culture; modern societies (via humanities and social sciences); illness; miscarriage; nation-states (modern)	*Standardization of theory and methods in 26 disciplines:* (Accounting; Art-design Education; Biomedicine; Bioethics; Biowarfare; Climate Change; Educational Research (and Teacher Education); Epigraphy; History; Humanities; Information Management; Literary Studies; Nutrition Science; Food Chemistry; International Relations; Linguistics; Medicine; Traditional Medicine (Chinese, Korean, Slovak, Tibetan); Nurse Education; Military; Mining; Physical Education; Policing; Political Science; Psychology and Psychoanalysis; Qualitative Research; Sociology; Tourism; Waste Management and Recycling)	*Public decision-making*: on biodiversity policies, crisis management (COVID-19), New Public Management, public administration; genetically modified crops; dams, conservation, risk management of food safety, planning; provision of services; *of policy sectors*: education, healthcare/medicine, environment, legal policy, tourism; *of policy advice*: global and national governance; *of international organizations*: European Central Bank, European Commission, OECD; *of political representation*
Academicization of…	Religious Studies	Business Education; Literary Studies; Management Studies; Physical Education; Teacher Education; Tourism Studies; Veterinary Education	
Professionalization		Bureaucratic scientization as a new form of professionalism in teaching profession Sports scientists as 'performance technocrats'	Role of scientists in policymaking Expertocracy Boundary work: science and politics
Actorhood…	*shaping gendered scripts*: Women as medical and medicalized subjects; women as high-risk population; gender norms in Mexican-American families and Chinese culture; parental practices; mother identity; household/ domestic work	*shaping academic and professional work-related scripts*: researchers and scientists; organizations	*shaping actors scripts via policy*: on motherhood and breastfeeding (via policy expertise); on citizen participation in the governance processes
Technologization in…		humanities; physical training and sports science and management; logistics; warfare and military; art-design teaching; crop grey breeding; information/library science; policing practices	decision-making processes
Commercialization of…	*of mindfulness;* illness	*traditional medicine* (Chinese, Indian, Korean, Slovak, and Tibetan)	*and privatization of research; Neoliberalism and science*

Source: Authors' presentation.

Hunter, and Murray 2017); policy advice in national and global governance (Christensen 2018; Rautalin, Syväterä, and Vento 2021); and scientific work in international organizations (Mudge and Vauchez 2018).

Within the rationalization of knowledge systems lies the force of *academicization*. This phenomenon delineates the transformation wherein knowledge, initially conceived for practical application, undergoes a gradual detachment from its real-world utility as it becomes increasingly assimilated into the realm of specialized scientific discourse (Harwood 2010). This process, often overshadowed in new institutional scholarship, has garnered attention within diverse academic disciplines, including but not limited to business education (Amdam 2020), management studies (Kaufman 2022), and veterinary education (Rollin 2020).

The institutionalization of science is also propelled by the mechanism of *professionalization*: the process through which an occupation or a group of individuals seeks recognition and legitimacy by adopting characteristics and principles that align with institutional norms and values—as recognized in how scientization has shaped the practices associated with teachers (Pupala, Kascak, and Tesar 2016) and sports scientists (Whitson and Macintosh 1990), and has developed the enterprise of expertocracy or expertization and boundary work between science and politics (Brückweh et al. 2012; Hoppe, Wesselink, and Cairns 2013; Christensen and Holst 2017). Following an Habermasian approach, this standpoint is leveraged in the publications to discuss the evolving relationship between academic disciplines and the "profession" of policymaking highlighting the subversion of democratic consensus to technical discussions restricted to a minority of experts that gradually depoliticizes, manipulates, and ultimately, controls the population via technical and bureaucratic elites. In the same vein, Beck's conceptualization of primary scientization—positivistic science and the enlightened priesthood of scientific experts¸ and reflexive scientization with scientific decision-making on (environmental) risks opened up for social rationality and wider participation (Beck 1992)—is

Table 3. Over-scientization.

	Culture	Disciplines	Policy
Over-scientization	Science as a tool of colonial power; Science contributes to isolation by enhancing loss (scientization of death); Science produces apolitical categories (e.g. of women, youth)	*and the development of disciplines, science*: stifles the present and future of educational research; distorts subjectivity (in literary texts); marginalizes humanistic features (on kinesiology); dehumanizes teacher education; exclusion of social and human related theories (on psychology); produces dominant discourses (sociology) *On the effects on actors, science*: removes 'humanity' and oversimplifies complex mental problems; psychological damage (on veterinary practice)	Scientific communities dictating legitimate and illegitimate knowledge. Science as a tool for political advantage (politicization of science). Science enhances global inequalities (in decision-making processes). Science destabilizes consultative processes. Science narrows chances to explore other pathways. Science as a gatekeeper of regulations/ legislation.

Source: Authors' account.

largely used in the policy category to analyze the relationship between science and democracy and citizen participation in decision-making processes informed by scientific evidence.

Two driving mechanisms propelling and accompanying scientization emerged inductively from our analysis: (1) *technologization*: the process of integrating technology in a given societal sector, and (2) *commercialization*: the marketing and monetization of knowledge, policy or practices using science. The role of technology is noticeable in the incorporation of technological tools in scientific fields, as in the case of biowarfare (Schillinger 2023), sport science (Dong 2020), and in policy decision-making processes (Harsh 2014). In turn, commercialization is explained by how science transforms and legitimizes the commercialization of contemplation practices, as in the case of mindfulness in corporate settings (Karjalainen, Islam, and Holm 2021) or Chinese and Korean traditional medicinal knowledge (Kim 2009; Zhan 2014), among others. In the policy realm, the results indicate how science has become a commercial activity via privatization and commercially driven research (see Pinto 2017).

The impact of science on *actorhood*—as the process that establishes acceptable behavior and shapes the permitted roles that individuals and organizations may legitimately pursue within a social framework (Meyer 2010)—is highlighted in scripts related to gender norms (Roesch 2015) and parental practices (Faircloth 2010); in academic and professional work-related scripts in scientific organizations (Whitson and Macintosh 1990); and even in actor scripts changed via policy and legitimized by science, as in the case of motherhood (Lee 2011) or citizen participation in governance (McCauley 2017).

All these mechanisms that drive and are reinforced by scientization are related to the extent of legitimacy that science has achieved throughout its maturation process. Science is used as a tool to legitimize certain discourses, practices, and political forces, while simultaneously having the cultural and cognitive authority to drive the rationalization, academicization, and formalization or organization of disciplinary and scientific fields. In the policy domain, legitimacy is often connected to what Weingart (1999) has termed the *politicization of science*. Here, legitimation refers to the process of establishing certain scientific information sources as authoritative in the public domain. Using various tactics to gain public trust and support for their claims or stance, different political actors may attempt to portray scientific interpretations as more legitimate than those of their opponents. This process is observed not only in how disciplinary fields lend legitimacy to policymaking, but also in how science legitimizes policy advantage (Tangney 2015) or legitimizes other political actors in the case of social movements (McCormick 2006).

Some ideas that convey excess, overreach or domination of science's role and authority in society observed in the dataset, are classified as *over-scientization*. This term implies that science has extended beyond its optimal or intended scope, leading to overreach and overextended influence (see Table 3).

Within these studies, we used *over-scientization* to capture how scientific authority can undermine local and traditional knowledge systems as historically served as a tool for colonial power (Lattas 1992), advancing Western ideologies, and an imposition of a dominant scientific worldview. Furthermore, by creating seemingly neutral categories for identity, such as "women" or "youth," science may inadvertently foster apolitical classifications that overlook the complex, intersectional nature of identities, thereby reinforcing stereotypes and oversimplifying the lived realities of individuals (Abugideiri 2004). In the realm of academic disciplines, over-scientization often results in the prioritization of scientific methods and frameworks at the expense of more interpretive or humanistic approaches (Anderson 2002).

But the most pronounced impact of *over-scientization* may be observed within policy, where science wields significant influence over legislative and regulatory processes (Doremus 2005). While scientific evidence can inform decision-making, an overreliance on science risks politicizing its authority and framing policy debates in ways that may ignore broader societal needs. For instance, scientific authority is frequently leveraged selectively by policymakers to legitimize or illegitimize certain political agendas, potentially distorting, or oversimplifying scientific findings to fit desired narratives (Quark and Lienesch 2017). This undermines science's objectivity and limits the space for democratic debate, as "scientific facts" are presented as non-negotiable in public discussions, often sidelining alternative viewpoints. Moreover, science-driven policy frameworks tend to amplify global inequalities (Gideon and Porter 2016), as countries with robust scientific infrastructures set standards that may not accommodate the voices or needs of less scientifically developed regions. This deepens global disparities, marginalizing perspectives and knowledge systems that might otherwise inform more equitable policies.

5. Discussion and conclusion

By analyzing the mechanisms and outcomes of the institutionalization of science through publications that apply the concept of *scientization*, we highlighted the evolution of science–society relationships and contributed to a deeper understanding of their dynamics. We explored and systematically analyzed the use and application of the term scientization that has matured significantly over the past quarter century. Its emergence and continuous diffusion across many scientific fields, especially over the past 15 years, highlights its growing relevance. The concept of scientization has been explicitly leveraged and integrated into areas of cultural, social, academic, and political life. We measured this by analyzing scientific literature, classified into categories of *culture, disciplines*, and *policy*. This proxy helps to understand the large-scale mechanisms and outcomes of the institutionalization of science.

Our results show the persistent, expanding forces of *rationalization* (and *standardization*), *academicization, professionalization, technologization, commercialization*, and *actorhood*—across the three domains of *culture, disciplines*, and *policy* as potent mechanisms that have been driving the institutionalization of science—with far-reaching consequences for society. *Rationalization* traverses cultural dynamics and shows how science became not only a pervasive force to provide legitimacy for modern institutions, as in the case of state schools and universities, but also to question the rationality of long-lasting social institutions, as in the case of religion (Aukland 2016), often marked by inter-institutional conflicts. The policymaking landscape has undergone a profound shift as policymakers actively frame issues using scientific assertions, cited to lend authority and validation to their decision-making. Unsurprisingly, the mention of scientization is most prominent in the disciplinary domain, across the boundaries of academic disciplines through structural developments and the continuous application (and *standardization*) of scientific principles, data, and methods within various bodies of knowledge. Here, the emergence of *academicization* in this analysis facilitates better understanding of rationalization processes in the internal dynamics of science, heavily supported by the omnipresent university and its globe-spanning networks (Baker and Powell, 2024), and it has contributed to the scientization of science (internal development of science) (Murakami 1993, 1997). However, critical theory provides a cautionary lens through which to view this institutional maturity. The processes of *rationalization* and *standardization*, while enhancing the legitimacy of science, also impose rigid frameworks on societal sectors, potentially leading to technocratic governance in which decisions are increasingly framed by scientific expertise, at the expense of broader social engagement perhaps, contributing to Marcuse's understanding of a unidimensional world (1964).

Conversely, *professionalization* is particularly conspicuous within the domain of policy. The emergence and expansion of expertocracy stands as a testament to the enduring impact of professionalization in occupational domains (Christensen and Holst 2017) that, as argued by Habermas (1968), contribute to the depoliticization of public discourse. This influence is manifested in the realm of science-based governance, serving both as a conduit to offer solutions grounded in scientific principles and as a means to confer legitimacy upon particular political choices. The intertwining of professionalization with policy underscores the nuanced ways in which scientific expertise has become integral to decision-making processes—on multiple levels of governance.

Technologization and *commercialization*, mechanisms that have remained largely overlooked by theoretical discussions on the institutionalization of science, appear as significant forces that deserve further attention by scholars engaged in studying the science/society relationship. Technology has not only transformed the scientific enterprise (as evidenced by the 2024 AI-related Nobel Prizes awarded in diverse STEM fields), enabling advancements in research methodologies, data analysis, and communication of findings in many disciplines, but has also shaped the role of science in the knowledge economy, as a device for innovation and economic development (Moore et al. 2011). In turn, science as a powerful legitimized modern script has rationalized contemplative practices and further provided the legitimacy to commodify them as marketable products and services. This refers to the increasing influence of market forces and commercial interests in scientific research, innovation, and applications. Universities, research institutes, and private companies are increasingly engaged in commercializing scientific discoveries through patents, licensing agreements, and spin-off companies. This neoliberal reconceptualization of knowledge (Pinto 2017) has implications for research priorities, funding, and intellectual property rights, often leading to tensions between academic norms and commercial imperatives that deserve further attention. Incorporating technologies and commercial interests into discussions on scientization enriches our understanding of how scientific knowledge is produced, circulated, and utilized in all societies. Thus, mechanisms of *professionalization, technologization*, and *commercialization* and the consequences discussed here evidence how science can be instrumentalized. In ever more highly educated societies, with more R&D personnel (Zapp 2022), science has enormous capacity to shape actor scripts, as in the case of gendered norms, scientific work, or conceptions of citizenship, via science-based policymaking. This is manifest in the mechanism of *actorhood*. Such developments are only possible considering the degree of legitimacy that science enjoys as a forceful modern institution conferring and granting authority (Gauchat 2011), expanding its scope and maturity as an institution.

The emergence of the policy domain as central to this analysis underscores the intricate nexus of science–policy relations within the broader science–society framework. It exemplifies the dynamic interplay between two powerful modern institutions—science and politics—and how each institution increasingly serves and influences the other, captured effectively by the terms of *the scientization of policy* and *the politicization of science*. The scientization of policy occurs when scientific principles, methodologies, and data are prioritized in shaping policy decisions (Habermas [1968] 1972; Weingart 1999). This reliance often grants science an authoritative role in policymaking, guiding policy agendas based on scientific criteria such as evidence-based outcomes, quantifiable data, and predictive modeling. On the one hand, this approach seeks to ensure that policies are grounded in 'objective' knowledge, enhancing their credibility and, theoretically, their effectiveness. However, this heavy reliance on science

can sometimes overshadow social, ethical, and cultural considerations that are equally important in addressing complex societal issues.

Conversely, the *politicization of science* (Weingart 1999; Pinto 2017) highlights how political interests and agendas shape scientific discourse, research priorities, and even the interpretation of scientific findings. When political actors influence science, it can lead to selective funding, skewed data interpretation, or suppression of findings that contradict desired outcomes. This manipulation of science can have far-reaching consequences, affecting public trust in scientific institutions and leading to policies that may reflect political priorities over scientific accuracy, showing the moldable character that modern science carries, alluding to Marcuse's idea that science is detached from neutrality and can be manipulated (1964).

Moreover, we termed *over-scientization* to reflect a process whereby scientific influence becomes excessive, potentially detrimental by marginalizing other forms of knowledge, human experience, and political and policymaking developments. This overreach emphasizes the risks of equating scientific authority with objectivity, potentially leading to imbalances in societal values and priorities. This nuanced exploration of mechanisms and outcomes can support a richer discussion on the implications of scientific authority in contemporary societies.

This dynamic science–society relationship not only highlights scenarios of expansion that bolster scientific authority but also reveals instances where it is challenged, particularly through processes of de-scientization. In such cases, the authority of science is questioned, often in policy and political contexts where over-scientization is perceived. This nuanced understanding of over-scientization and its implications sheds light on the broader ramifications of embedding scientific authority across various domains. Building on this analysis, we invite readers to critically reflect on the complexities of a scientized world—acknowledging both its empowering potential and unintended consequences of scientific authority in shaping culture, academic disciplines, and policy development.

Acknowledgements

The authors express their gratitude to Oksana Stolietnia and Yunus Yusuf, students at the University of Luxembourg, for their assistance in creating the scientization database.

Conflict of interest. None declared.

Funding

The authors acknowledge financial support of the Institute for Advanced Studies of the University of Luxembourg through a BRAINSTORM grant (Brainstorm-01-2022) for *Scientization Events and Expansion across Disciplines in Society (SEEDS)*.

References

Abugideiri, H. (2004) 'The Scientisation of Culture: Colonial Medicine's Construction of Egyptian Womanhood, 1893-1929', *Gender & History*, 16: 83–98.

Amdam, J. (2020) 'Creating the New Executive: Postwar Executive Education and Socialization into the Managerial Elite', *Management and Organizational History*, 15: 106–22.

Anderson, D. R. (2002) 'The Humanity of Movement or "It's Not Just a Gym Class"', *Quest*, 54: 87–96.

Aukland, K. (2016) 'The Scientization and Academization of Jainism', *Journal of the American Academy of Religion*, 84: 192–233.

Baker, D. P. (2014) *The Schooled Society*. Stanford, CA: Stanford University Press.

Baker, D. P. and Powell, J. J. W. (2024) *Global Mega-Science: Universities, Research Collaborations, and Knowledge Production*. Stanford, CA: Stanford University Press.

Beck, U. (1992) *Risk Society. Towards a New Modernity*. London: SAGE.

Ben-David, J. (1990) *Scientific Growth*. Berkeley: University of California Press.

Ben-David, J. and Sullivan, T. A. (1975) 'Sociology of Science', *Annual Review of Sociology*, 1: 203–22.

Brückweh, K. et al. (2012) *Engineering Society: The Role of the Human and Social Sciences in Modern Societies, 1880–1980*. London: Palgrave Macmillan.

Cheng, G. et al. (2021) 'Stochastic Rainwater Harvesting System Modeling under Random Rainfall Features and Variable Water Demands', *Water Resources Research*, 57: 1–21.

Christensen, J. (2018) 'Economic Knowledge and the Scientization of Policy Advice', *Policy Sciences*, 51: 291–311.

Christensen, J. and Holst, C. (2017) 'Advisory Commissions, Academic Expertise and Democratic Legitimacy: The Case of Norway', *Science and Public Policy*, 44: 821–33.

Christensen, T. and Lægreid, P. (2022) 'Special Issue on the Scientization of Public Decision-making Processes–the Relevance for the Handling of the COVID-19 Pandemic', *Public Organization Review*, 22: 215–21.

Collins, H. M. (1983) 'The Sociology of Scientific Knowledge: Studies of Contemporary Science', *Annual Review of Sociology*, 9: 265–85.

Dai, J. (2022) 'Physical Education Teaching Based on Human Model Design and Computer Simulation of Human Two-Dimensional Moving Image', *Mathematical Problems in Engineering*, 20: 1–8.

Dong, J. (2020) 'The Theoretical Construction and Application System Development Study of Sports Information Management', *2020 IEEE International Conference on Power, Intelligent Computing and Systems (ICPICS)*, Shenyang, China, pp. 526–9.

Doremus, H. (2005) 'Science Plays Defense: Natural Resource Management in the Bush Administration', *Ecology Law Quarterly*, 32: 249–305.

Drori, G. S., Meyer, J. W., Ramirez, F. O., and Schofer, E (2003) *Science in the Modern World Polity: Institutionalization and Globalization*. Stanford: Stanford University Press.

Drori, G. S., Meyer, J. W. and Hwang, H. (eds.) (2006) *Globalization and organization: World society and change*. Oxford: OUP.

Drori, G. S. and Meyer, J. W. (2006a) 'Scientization: Making a World Safe for Organization', in M. Djelic and K. Sahlin-Andersson (eds) *Transnational Governance*, pp. 31–52. Oxford: OUP.

Drori, G. S. and Meyer, J. W. (2006b) 'Global Scientization: An Environment for Expanded Organization', in G. S. Drori, J. W. Meyer and H. Hwang (eds) *World Society and Organizational Change*, pp. 50–68. Oxford: Oxford University Press.

Dusdal, J. and Powell, J. J. W. (2021) 'Benefits, Motivations, and Challenges of International Collaborative Research: A Sociology of Science Case Study', *Science and Public Policy*, 48: 235–45.

Faircloth, C. (2010) 'What Science Says Is Best': Pareting Practices, Scientific Authority and Maternal Identity', *Sociological Research Online*, 15: 85–98.

Fortunato, S., Bergstrom, C. T., Börner, K., Evans, J. A., Helbing, D., Milojević, S., Petersen, A. M., Radicchi, F., Sinatra, R., Uzzi, B., Vespignani, A., Waltman, L., Wang, D., and Barabási, A.-L. (2018) 'Science of Science', *Science*, **359**.

Fourcade-Gourinchas, M. (2001) 'Politics, Institutional Structures, and the Rise of Economics: A Comparative Study', *Theory and Society*, 30: 397–447.

Frank, D. J. and Meyer, J. W. (2007) 'University Expansion and the Knowledge Society', *Theory and Society*, 36: 287–311.

Frank, D. J. and Meyer, J. W. (2020) *The University and the Global Knowledge Society*. Princeton: Princeton University Press.

Fu, Y. C., Marques M., Tseng Y.-H., Powell J. J. W., and Baker D. P. (2022) 'An Evolving International Research Collaboration Network: Spatial and Thematic Developments in Co-authored Higher Education Research, 1998–2018', *Scientometrics*, **127**: 1403–29.

Gauchat, G. W. (2011) 'The Cultural Authority of Science: Public Trust and Acceptance of Organized Science', *Public Understanding of Science*, 20: 751–70.

Gauchat, G. W. (2023) 'The Legitimacy of Science', *Annual Review of Sociology*, 49: 263–79.

Gideon, J., Hunter, B. M., and Murray, S. F. (2017) 'Public-private Partnerships in Sexual and Reproductive Healthcare Provision', *Journal of International and Comparative Social Policy*, 33: 166–80.

Gideon, J. and Porter, F. (2016) 'Challenging Gendered Inequalities in Global Health: Dilemmas for NGOs', *Development and Change*, 47: 782–97.

Habermas, J. ([1968] 1972) *Knowledge and Human Interests*. Boston: Beacon Press.

Harsh, M. (2014) 'Nongovernmental Organizations and Genetically Modified Crops in Kenya: Understanding Influence within a Techno-civil Society', *Geoforum*, 53: 172–83.

Harwood, J. (2010) 'Understanding Academic Drift: On the Institutional Dynamics of Higher Technical and Professional Education', *Minerva*, 48: 413–27.

Hoppe, R., Wesselink, A., and Cairns, R. (2013) 'Lost in the Problem: The Role of Boundary Organisations in the Governance of Climate Change', *Wiley Interdisciplinary Reviews: Climate Change*, 4: 283–300.

Horkheimer, M. and Adorno, T. W. (2002) *Dialectic of Enlightenment: Philosophical Fragments (E. Jephcott, Trans.)*, Stanford, CA: SUP.

Jepperson, R. L. (2002) 'Political Modernities: Disentangling Two Underlying Dimensions of Institutional Differentiation', *Sociological Theory*, 20: 61–78.

Karjalainen, M., Islam, G., and Holm, M. (2021) 'Scientization, Instrumentalization, and Commodification of Mindfulness in a Professional Services Firm', *Organization*, 28: 483–509.

Kaufman, B. E. (2022) 'The Academic-practitioner Gap: Past Time to Bring in the Practitioner Perspective', *Human Resource Management Review*, 32: 100895.

Kim, J. (2009) 'Transcultural Medicine: A Multi-Sited Ethnography on the Scientific-Industrial Networking of Korean Medicine', *Medical Anthropology*, 28: 31–64.

Lattas, A. (1992) 'Hysteria, Anthropological Disclosure and the Concept of the Unconscious: Cargo Cults and the Scientisation of Race and Colonial Power', *Oceania*, 63: 1–14.

Lee, E. (2011) 'Infant Feeding and the Problems of Policy', in P. Liamputtong (ed.) *Infant Feeding Practices*, pp. 77–91. Dordrecht: Springer.

Marcuse, H. (1964/1965) *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society*. Boston: Beacon Press.

Marques, M. (2018) *Research Governance through Public Funding Instruments: Institutional Change of Educational Research in the European Union and England, 1984–2014*. Luxembourg: University of Luxembourg.

Marques, M. (2023) 'Governing European Educational Research through Ideas? Incremental Ideational Change in the European Union's Framework Programme (1994–2020)', *European Journal of Education*, 51: e12579.

McCauley, J. (2017) '"We Can Help the People Who Can Make a Difference": Motivations, Goals, and Outcomes in Volunteer Water Quality Monitoring', *Sociological Focus*, 50: 125–37.

McCormick, S. (2006) 'The Brazilian Anti-Dam Movement. Knowledge Contestation as Communicative Action', *Organization & Environment*, 19: 321–46.

Merl, S. (2020) 'Modernity and the Failure to Maintain the Peace (1918-1938): Comparing the Cases of the Soviet Union and the German Reich', Мир России. Социология. Этнология *[World of Russia. Sociology. Ethnology]*, 29: 103–31.

Merton, R. K. (1962) *The Sociology of Science. Theoretical and Empirical Investigations*. Chicago: University of Chicago Press.

Meyer, J. W. (2010) 'World Society, Institutional Theories, and the Actor', *Annual Review of Sociology*, 36: 1–20.

Meyer, J. W. and Jepperson, R. L. (2000) 'The "Actors"of Modern Society: The Cultural Construction of Social Agency', *Sociological Theory*, 18: 100–20.

Meyer, J. W. and Rowan, B. (1977) 'Institutionalized Organizations: Formal Structure as Myth and Ceremony', *American Journal of Sociology*, 83: 340–63.

Moher, D. et al. (2009) 'PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-analyses', *Annals of Internal Medicine*, 151: 264–9.

Moore, K., Kleinman, D. L., Hess, D., and Frickel, S (2011) 'Science and Neoliberal Globalization: A Political Sociological Approach', *Theory and Society*, 40: 505–32.

Mudge, S. L. and Vauchez, A. (2018) 'Too Embedded to Fail: The ECB and the Necessity of Calculating Europe', *Historical Social Research/Historische Sozialforschung*, 43: 248–73.

Mulberg, J. (1996) 'Environmental Planning, Economic Planning and Political Economy', *International Sociology*, 11: 441–56.

Murakami, Y. P. (1993) 'Scientization of Science', *Annals of the Japan Association for Philosophy of Science*, 8: 175–85.

Murakami, Y. P. (1997) 'Transformation of Science', *Annals of the Japan Association for Philosophy of Science*, 9: 79–85.

O'Connor, C. and Joffe, H. (2020) 'Intercoder Reliability in Qualitative Research', *International Journal of Qualitative Methods*, 19: 1609406919899220.

Page, M. J. et al. (2021) 'The PRISMA 2020 Statement. An Updated Guideline for Reporting Systematic Reviews', *BMJ*, 71: 372.

Park, R. S. (2013) 'Fragmented Knowledge Structures: Secularization as Scientization', *The Heythrop Journal*, 54: 563–73.

Pinto, M. F. (2017) 'Agnotology and the New Politicization of Science and Scientization of Politics', in D. Tyfield, R. Lave, S. Randalls, et al. (eds) *The Routledge Handbook of the Political Economy of Science*, pp. 341–50. London: Routledge.

Powell, J. J. W., Baker, D. P., and Fernandez, F. (eds.) (2017) *The Century of Science: The Global Triumph of the Research University*. Bingley: Emerald.

Price, D. J. de Solla (1963) *Little Science, Big Science*. New York: Columbia University Press.

Pupala, B., Kascak, O., and Tesar, M. (2016) 'Learning How to Do up Buttons: Professionalism, Teacher Identity and Bureaucratic Subjectivities in Early Years Settings', *Policy Futures in Education*, 14: 1–11.

Quark, A. A. and Lienesch, R. (2017) 'Scientific Boundary Wor and Food Regime Transitions: The Double Movement and the Science of Food Safety Regulation', *Agriculture & Human Values*, 34: 645–61.

Raphael, L. (1996) 'Die Verwissenschaftlichung des Sozialen als methodische und konzeptionelle Herausforderung für eine Sozialgeschichte des 20. Jahrhunderts', *Geschichte und Gesellschaft*, 22: 165–93.

Rautalin, M., Syväterä, J., and Vento, E. (2021) 'International Organizations Establishing their Scientific Authority', *International Sociology*, 36: 3–24.
Roesch, C. (2015) *Macho Men and Modern Women*. Berlin: de Gruyter.
Rollin, B. E. (2020) 'Integrating Science and Well-being', *Veterinary Clinics: Small Animal Practice*, 50: 899–904.
Rosenhead, J. (1978) 'Operational Research in Health Services Planning', *European Journal of Operational Research*, 2: 75–85.
Schillinger, N. (2023) 'Microbic Mass Destruction-Biological Warfare and Epidemic Prevention in Republican China', *East Asian Science, Technology and Society*, 17: 148–69.
Schofer, E. (1999) 'Science Associations in the International Sphere, 1875–1990: The Rationalization of Science and the Scientization of Society', in J. Boli and G. M. Thomas (eds) *Constructing World Culture. International Nongovernmental Organizations since 1875*, pp. 249–66. Stanford: Stanford University Press.
Schofer, E., Lerch, J. C., and Meyer, J. W. (2022) 'Illiberal Reactions to Higher Education', *Minerva*, 60: 509–34.
Schofer, E. and Meyer, J. W. (2005) 'The Worldwide Expansion of Higher Education in the Twentieth Century', *American Sociological Review*, 70: 898–920.
Scopus (2023) *Content Coverage Guide*. https://www.elsevier.com/?a=69451, accessed 10 Dec. 2023
Shapin, S. (1995) 'Here and Everywhere: Sociology of Scientific Knowledge', *Annual Review of Sociology*, 21: 289–321.
Shils, E. (1973) *Max Weber on Universities: The Power of the State and the Dignity of the Academic Calling in Imperial Germany*. Chicago: University of Chicago Press.
Smith, D. S. (2022) 'Social Scientization and the Schooling State in UK Parliamentary Discourse, 1803–1909', *Social Science History*, 46: 223–54.
Sukjang, Y. (2003) 'The Global Diffusion of Ministries of Science and Technology', in G. S. Drori, J. W. Meyer and F. O. Ramirez, et al. (eds) *Science in the Modern World Polity: Institutionalization and Globalization*, pp. 120–35. Stanford: Stanford University Press.
Tangney, P. (2015) 'Brisbane City Council's Q100 Assessment: How Climate Risk Management Becomes Scientised', *International Journal of Disaster Risk Reduction*, 14: 496–503.
Vaismoradi, M. et al. (2016) 'Theme Development in Qualitative Content Analysis and Thematic Analysis', *Journal of Nursing Education and Practice*, 6: 100–10.
Wagner, C. and Leydesdorff, L. (2005) 'Network Structure, Self-organization, and the Growth of International Collaboration in Science', *Research Policy*, 34: 1608–18.
Wang, D. and Barabási, A. (2021) *The Science of Science*. Cambridge: CUP.
Weber, M. ([1919] 1946) 'Science as a Vocation', in H. H. Gerth and C. W. Mills (eds) *From Max Weber*. New York: The Free Press 129–156.
Weingart, P. (1999) 'Scientific Expertise and Political Accountability', *Science and Public Policy*, 26: 151–61.
Whitson, D. J. and Macintosh, D. (1990) 'The Scientization of Physical Education: Discourses of Performance', *Quest*, 42: 40–51.
Zapp, M. (2017) 'The Scientization of the World Polity. International Organizations and the Production of Scientific Knowledge, 1950–2015', *International Sociology*, **33**: 3–26.
Zapp, M. (2022) 'Revisiting the Global Knowledge Economy: The Worldwide Expansion of Research and Development Personnel, 1980–2015', *Minerva*, **60**: 181–208.
Zapp, M., Marques, M., and Brant, T. (2024) 'The Structures of World Society: Geography, Discourse, and Interorganizational Networks in Global Education, 1900–2018', *Comparative Education Review*, 68: 286–311.
Zapp, M., Marques, M., and Powell, J. J. W. (2018) *European Educational Research (Re)constructed: Institutional Change in Germany, the United Kingdom, Norway, and the European Union*. Oxford: Symposium Books.
Zeng, Q. (2022) 'Characteristic Analysis and Route Optimization of Heterogenous Neural Network in Logistics Allocation System', *Computational Intelligence and Neuroscience*, 2022: 1713183.
Zetter, R. (1991) 'Labelling Refugees: Forming and Transforming a Bureaucratice Identity', *Journal of Refugee Studies*, 4: 39–62.
Zhan, M. (2014) 'The Empirical as Conceptual: Transdisciplinary Engagements with an "Experiential Medicine"', *Science, Technology, & Human Values*, 39: 236–63.

Science and Public Policy, 2025, 52, 491–502, DOI: https://doi.org/10.1093/scipol/scae095, Article