In the context of the ongoing Russian war against Ukraine and the growing tensions with China, the question of transnational scientific cooperation has returned to the center of the debates about the future of East-West diplomacy and international relations. The last year saw many panels organised in prominent forums, where academics, experts, and diplomats explored the benefits and pitfalls of knowledge exchange with non-democratic and aggressive regimes. Can any useful lessons be learned from the East and West confrontation during the Cold War? Or has the current global political economy of knowledge evolved so far as to render the Cold War models of soft power and neutrality of scientific and cultural exchanges completely obsolete? In addition to the renewed confrontation, domestic political shifts in government began to disrupt the established forms of bilateral cooperation between the global North and South: for instance, in Sweden in the summer 2023, the right-wing Sweden Democrats Party cancelled governmental funding for research projects that are anchored to the implementation of the UN Sustainable Development Goals as well as those projects which are categorised as developmental and aid research.1 As Western societies are facing the cost of living crisis and the challenges of national security, self-centered and autarkic nationalisms appear to return to mainstream politics.

Many historians of science and technology would argue that such nationalist politics end up being toothless and destined to fail because they ignore just how deeply complex societies are entangled in transnational flows. Furthermore, the development of empires and nation-states entailed a co-evolution of regulation, bordering, and transfers and exchanges. The recent collection, *Knowledge Flows in a Global Age: A Transnational Approach*, edited by John Krige, adds further arguments and cases that deepen our understanding of the constitutive role of the national regulatory regimes in the shaping of late modern scientific knowledge. Krige doubts that the intensifying transnational and international transfers have diminished the power of the nation-state. The knowledge flows, according to Krige, rather co-evolved with the regulatory nationalisms and, in many ways, even depended on the obstacles and boundaries that they encountered.

Explaining the rationale for this volume in the introduction, Krige presents an extensive overview of the research on knowledge circulation during the Cold War, when the regulation of knowledge transfer was

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probably at its most explicit. Krige suggests that much previous work sought to demonstrate the ways in which the epistemological demands of modern science required the opening up of the borders of the political regimes. However, according to Krige, it would be a mistake to consider that knowledge flows can become completely independent from the political system, and, in effect, undo the nation-state regime: “There is no transnational knowledge without friction at national borders” (2). Here “friction” is defined as the effect of different structures, such as inequalities, economic and material affordance, political agendas, and institutional rules, all of which impact on the production and transfer of knowledge. As Krige put it, “knowledge” is defined as science and technology, knowing that and knowing how. Knowledge can be both propositional and tacit. Knowledge hardly ever moves transnationally as a whole. It travels as an assemblage, in bits and bobs. Borders are defined as institutions “that impede or facilitate the movement of knowledge across them” (14).

Krige engages with actor network theory terms, such as stabilization and inscription, which help historians identify the forms that enable the knowledge to travel. The key interest in this volume is more on the process of the flows and less on the social, political and economic impacts of the circulation of knowledge: “the movement of knowledge embodied in people, ideas, institutions, and things across national borders is itself the object of transnational analysis” (3).

The book contains many interesting case studies of different knowledge mobilities and immobilities, which are drawn from the global North and South. Focusing on the points of transfer, passage, and frictions, the chapters detail the highly complex institutional, social, and technical landscape of knowledge mobilities that can traverse the nation-state boundaries. Krige explains that representing this diversity is important: “the accounts of how knowledge and skills are produced locally and disseminated transnationally are so heterogeneous, and each case is so specific, that no single analytic framework can adequately explain how knowledge moves transnationally, and the changes in meaning that such knowledge and skills assume as their context change” (10). However, this makes me wonder if the volume would have been made even more impactful by engaging with more specific arguments about decolonial, authoritarian, liberal, and capitalist knowledge regimes. It would be interesting, for instance, to explore how the shifts of particular regimes and practices of control of the knowledge flows can help us to understand the wider shifts of the forms of government, the economy, and society. This said, I am sure that the book will be very useful for scholars who explore these wider questions that extend beyond the history of science and technology.

The book is divided into two parts. Part 1 explores military and semi-military forms of highly regulated knowledge transfers. Part 2 focuses on agricultural knowledge, which is particularly useful to discern the South-South knowledge transfers and show the ways in which Western modernization has been entangled with de-colonial politics and competing globalizations.

The chapters presented in part 1 proceed in a mainly chronological way. The first chapter by Jessica Wang outlines the invention of international science to demonstrate a wide range of frictions encountered by the internationalizers in the last three centuries. Wang reviews a plethora of examples of the attempts to limit and stop the movement of scientific knowledge, such as early modern censorship, state control, governmental and commercial secrecy, as well as plunder of knowledge. Wang argues that the movement of knowledge was enabled by the emergent modern sociability, which was expressed in seventeenth and eighteenth century “republics of letters,” cosmopolitanism, and the value of reciprocity. However, the internationalization of science was institutionalized beginning in the 1850s, when the advancing means of transport enabled the embodied exchange of ideas and the rise of a new form of the scientific social that was forged through face-to-face encounters.

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to-face meetings at international congresses. Wang proposes a set of interesting arguments, for instance, that the intra-European national conflicts were moderated and softened through inter-imperial diplomacy dividing overseas colonies among European empires. The nineteenth century, starting in the 1820s, saw the rise of inter-imperial diplomacy, expeditions, and sharing geophysical data on the oceans in the context of reduced inter-state violence. In this way, Wang traces the colonial roots of the European administrative and political internationalism.

Wang’s chapter speaks to Krige’s argument that “Knowledge that crosses borders is saturated with power by the very fact that it is set in motion to serve a transformative goal” (10), where actors are seen as having power when they are able to overcome obstacles, to move strategically, and achieve transformation. In the eighteenth and nineteenth centuries the European colonial regimes emerged as precisely such actors, but the question is how this power can be democratised, shared, and emerge in alternative spaces.

The following chapters provide further cases showing the ways in which governmental institutions exerted their power by initiating and limiting knowledge transfers. Katherine Epstein explores the approaches to innovation developed at the British Admiralty in the early twentieth century and the origins of the secret patent act, which was passed to incentivize private inventors. Epstein contrasts the British approach with the US nuclear regime that emerged as a paradigmatic example of wide-ranging state-sponsored secrecy. Epstein shows clearly that the regimes of knowledge secrecy were developed not only in line with national security requirements, but also in line with the norms of the contract-bounded liberal society. Indeed, the history of patents is a significant area of research where scholars such as Emma Hemmungs Wirtén have explored the ways in which the uses and refusals of patents intertwined with material and symbolic cultures of science.

The importance of economic logic and particularly contractual law is explored by Michael Falcone who details the transatlantic development of penicillin. The pioneering antibiotic, as Falcone shows, was developed and made widely available thanks to the UK-US cultural diplomacy. This is a fascinating case study that reveals the way in which corporations navigated nationalistic frameworks of knowledge ownership and distribution. The case of penicillin entailed the transfer from military to civilian use, where both the British and US governments played an important role in initiating the transfer. However, US corporations appropriated what was in fact a public, state sponsored invention by twisting their narrative to present their adoption of the technique of the production of penicillin as patriotic innovation, which in turn legitimized the corporate reaping of the profits from what initially were free patents on further commercial development. Falcone argues that the mobilization of World War II constituted a case where the British and US governments both aimed and were able to regulate knowledge transfers for the first time. However, the governments had to give in to commercial interests which, after the war, boosted the US pharma industry as their commercial interests were more “protected,” i.e. more autonomous of the state secrecy regulation. In this way, writes Falcone, “Transnational penicillin development mutated into multinational corporate empire” (141).

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Krige has written widely on the history of Cold War science, but this very volume largely leaves aside both the Cold War and the Soviet and Communist forms of knowledge transfers. The exception is an interesting chapter by Mario Daniels, who analyses the East-West transfer of high performance computing (HPC), the highly strategic technology that was controlled even more tightly than the sale of nuclear reactors during the Cold War. Daniels shows that although the Coordinating Committee for Multilateral Export Controls (CoCom) banned the export of Western strategic technology to the Communist bloc, there was a special regulatory environment created that opened limited opportunities for the export some of Western HPC components to the Soviet Union. This export possibility, as Daniels shows, came with strings attached: the HPC components were supplied subject to monitoring of their use. This meant that should the Soviets want to buy those components, they had to supply the sellers with the information of the use of the technology. This was expected to limit the use of the Western HPC parts for military purposes. Somewhat surprisingly, the Soviets agreed to the monitoring, which testified to their high interest in obtaining those components. To illustrate this, Daniels describes the building of the Serpukhov particle accelerator, where two International Computers Ltd (ICL) computers were installed in 1973.

Indeed, as Daniels shows, the original deal involving the more powerful Control Data Corporation (CDC) supercomputer fell through. However, the Soviet Union was given remote access to CDC 6600 through Vienna Technical University’s CYBER 74 and, as early as in 1973, had an input-output unit which gave Soviet scientists remote access to the CDC 6600 supercomputer that was located in Frankfurt. Experimental real-time data connections with Moscow were launched in 1974, when the East-West institute, the International Institute of Applied Systems Analysis (IIASA) established a data link to the Moscow Institute of Control Sciences (IPU). The IPU also managed to obtain the British ICL 4/70. It is interesting that Soviet leaders accepted proposed safeguards as a condition of the importing of computers, while at the same time they did not accept nuclear testing inspections in the 1970s. The Western partners were surprised by the willingness of Soviet leaders to submit the core data reports, although they observed that this was done “not cheerfully” (167). It remains to be seen if this can be explained by their ability to manipulate the data. Although this led to a further relaxation of the East-West computer trade, this did not result in high economic value exports for western companies. As Daniels did not use Soviet sources, it would be interesting to find out about the Soviet side of the story, particularly how the strategic revealing was managed.

Finally, in his chapter John Krige explores an accidental transfer of sensitive know-how knowledge of satellite technology from the US to the Chinese in the 1990s. Drawing on the documents detailing the legal dispute, Krige outlines the controversy that followed a suspicion that the Chinese were using open deliberative seminars, as opposed to restrictive technical discussions, to steal the US “know how.” Krige uses this controversy to demonstrate the fragility of technoscientific cooperation between the regimes that are not parts of trusted alliances and the continued importance of the politicization and securitization of technical cooperation. While the materials analyzed, due to their nature, offer a very strategic framing of practices, it would be interesting to explore such cases by using oral history and memoirs that could cast additional light on the process, particularly on how the scientists themselves perceived the exchange.

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The chapters presented in part 2 are empirically rich and will interest those readers who seek to learn about the agricultural modernization in the global South. The focus on this geographical area and the agriculture sector is particularly important in the context of the history of late modern science and technology where the main focus often is on what were perceived as more complex military, informational, and electronic technologies. However, the environmental turn in the history of the Cold War science and technology has begun to erode the distinction between high tech and agriculture. These chapters demonstrate the complexity of the development of the biological and agricultural sciences and detail their central role in the struggle for global domination.  

Focusing on seed transfer between Mexico and India, Gabriela Soto Laveaga explores the developmental politics of technology transfer, where the source and origin of the transferred technology is discursively framed to bolster foreign policy orientation. Laveaga critiques the political economy of the international transfers that privilege the enterprises that operate in line with the large-scale, intensive agricultural economy, such as large and highly developed farms in India. The seed technology, as Laveaga shows, was not transferred alone but with the associated infrastructures of irrigation and fertilizing, which were costly and could not benefit small farmers. In contrast, the case of Angolan coffee, which is analyzed by Maria Gago, demonstrates that national and international standardization of coffee actually benefitted the Angolan small producers. Gago applies a Latourian lens that focuses on different devices of stabilization of the identity of the object, in this case, coffee beans, to historicize standardization as a state driven regulation process in Angola. The argument is continued in the chapter by Tiago Saraiva, who tracks the way in which agricultural statistics were developed through the US New Deal and the UN development programs, and details the political intertwining of the soil erosion index as an index of colonization on the example of New Guinea Bissau. Courtney Fullilove presents an interesting case of arid agriculture and seed banks, detailing the many obstacles to knowledge-based development in the context of acute military conflict in Palestine. The final chapter by Sabina Leonelli focuses on the digital infrastructures that enabled agricultural data to cross borders. Leonelli describes the design of the Crop Ontology platform, which offers the possibility of creating genuinely transnational data versus the nationalization of data movement.

As Krige puts it in the introduction, “scientific internationalism is an ideology, and a practice, that promotes transnational cooperation between researchers who share new knowledge, regardless of national affiliation, in the name of scientific progress” (5). As such, scientific internationalism faces a continuous crisis: the cases presented in the volume show just how limited the contexts in which the ideology of scientific internationalism can be adopted and practiced are. The volume shows clearly that the very idea of “progress” is wrought with tension, where some actors are constricted by the liberal contractual framework and are expected to generate profits, while others seek to establish asymmetric relations in the contest for the military and technoscientific superiority. Knowledge Flows in a Global Age reads as a compendium of the complexities of

transnational knowledge transfer questioning the notion of effortless globalization. It does important work that will certainly be useful for a wide range of scholarship.

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