



Research infrastructures: the European way to Big Science

Katharina C. Cramer, and Olof Hallonsten, (Eds.), *Big Science and Research Infrastructures in Europe*, Northampton, Edward Elgar Publishing, 2020, 288 pp., \$145, ISBN: 9781839100000

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When introducing the history of science in the second half of the Twentieth Century, talking of Big Science has become a commonplace. Bolstered by an unprecedented stream of public investment and the Cold War competition between the superpowers for world supremacy, science grew big in a number of respects: number of researchers, output of publications, magnitude of the scientific organizations, and, most notably, size of the scientific equipment involved in scientific projects. The Manhattan project leading to the first atomic bomb, the construction of large-scale particle accelerators, and the space race are among the most vivid images of the “bigness” of Big Science. On the other hand, the term “research infrastructures,” with its bureaucratic flavor, does not frequently pop up in the scholarly literature on science. It has become, however, a buzzword in current science policy discourse, especially in Europe. Defined as “facilities, resources and related services that are used by the scientific community to conduct top-level research in their respective fields” (European Council 2009), research infrastructures and related initiatives were funded in Horizon 2020, the current framework program of the European Union, with €2.5 billion. And they should receive the same amount in the next EU program.

Thus, “Big Science” and “research infrastructures” belong to different discursive universes: the former to the scholarly study of science, the latter to the world of science policy and administration. The volume edited by Katharina Cramer and Olof Hallonsten is a valuable attempt to put the two concepts in dialogue, focusing in particular on Europe, the context where the term “research infrastructures” has gained most of its current policy currency.

Building a fruitful dialogue between concepts with such different pedigrees, however, is not an easy task, as the editors, together with Isabel Bolliger and Alexandra Griffiths, point out in the first chapter of the book, one of the most interesting of the collection. Research infrastructures is a concept of policy origin, and as the authors

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note, its definition is *political* rather than *analytical*. Essentially, its main function is to “consecrate” some research facilities in Europe, rather than individuate a clearly marked organizational field. Hence, almost anything can become a Research Infrastructure if the necessary political conditions hold, with the result that, as an analytical tool, the concept is rather empty. Big Science, although its origin lies in history of science, had undergone a process of “conceptual dilution” that risks rendering it equally unhelpful. If it began its career as a conceptual marker to identify large-scale scientific projects during the Cold War, characterized by huge instruments, “big machines,” industrial-organizational structures, “big organizations,” and closely connected to military and political power, “big politics,” in the last decades it has witnessed a considerable stretching of its scope far beyond the Cold War era. For instance, the idea of “transformed Big Science” has been introduced to capture the shift of the role of science in society from warrant of national security to engine of economic competitiveness and innovation. The result is that there is no longer a unique definition of Big Science, even in the scholarly community. The first chapter of the book nicely reviews these developments, without hiding the plurality—if not the confusion—that surrounds Big Science and research infrastructures as concepts. Rather, the chapter is successful in charting the intricate landscape of their uses and meanings, without the ambition to reduce them to univocal definitions.

Another factor complicating the discussion is that the current literature on Big Science and research infrastructure is scattered in a variety of research fields, including history and sociology of science, innovation studies, political science, and international relations. The interested scholar may easily get lost in such disparate material. Fortunately, the second chapter of the book, by Nicolas Rüffin, offers a valuable overview of the main research methods that have been tried thus far in these fields, assessing their strengths and weaknesses as well. This methodological discussion, together with the long bibliography at the end of the chapter, nicely complements the conceptual overview of the first chapter. Taken together, the first two chapters of the volume offer to the interested scholar the most up-to-date entry point to the literature on Big Science and research infrastructures currently available. The remaining eight chapters, on the other hand, are detailed empirical case studies of European science policies and research infrastructures. If the first two chapters are a must-read, the others can be read *à la carte*, depending on the specific interests of the reader.

Chapters 3, 4, 5, and 6 focus on the relationship between Big Science projects and European integration (Chapter 3) and the development of a distinctive European way to the policy of research infrastructures (Chapters 4, 5, and 6). In Chapter 3, Katharina Cramer shows how Big Science infrastructures have played a key role in the geopolitics of Europe in the twentieth and twenty-first centuries. Cramer convincingly shows how intergovernmental Big Science collaborations, such as CERN, resonate with broader European political and diplomatic struggles, acting at the same time as catalysts of the process of European integration in times of crisis. In this regard, it will be interesting to see how the collaborative scientific efforts of the European Union to develop a vaccine to Covid-19 will impact on this process.

In Chapter 4, Inga Ulnicane shows how the European Union and its predecessors have privileged a differentiated integration mode to research policy, favoring

intergovernmental agreements between member states rather than claiming research as a distinctive EU matter. The same attitude to facilitating rather than dictating national policies has characterized the setting up of the ESFRI roadmap, a sort of European agenda for the development of research infrastructures, chronicled by Isabel Bolliger and Alexandra Griffiths in Chapter 5, and the creation of the European Research Infrastructure Consortium (ERIC), a special legal form specifically designed by the EU for research infrastructures, analyzed by Maria Moskovko in Chapter 6.

With Chapter 7, by Thomas Franssen, the focus turns to a national context and scholarly fields that are understudied in classic analyses of Big Science, namely the humanities. Franssen convincingly shows how, in the Netherlands, the development of digital research infrastructures in the humanities was fostered by Dutch science policymakers as a solution to the endemic fragmentation of the field, leading to a policy-driven boom of funding for digital humanities projects. If the Dutch case shows how research infrastructures can be crucial tools for science governance, the case of the Halden Reactor Project, a nuclear research reactor in Norway, is used by Olof Hallonsten, Hjalmar Eriksson, and August Collsiö in Chapter 8 to detail the specific role played by research infrastructures in innovation systems. As the authors point out, research infrastructures function as durable resources and enablers of scientific research, rather than as direct producers of knowledge. Hence, the authors argue, their performance should be evaluated with different indicators than those used for other components of the innovation system, such as universities.

In Chapter 9, Andrew Williams and Jean-Cristophe Maudit show how managing access to research infrastructures can pose a dilemma to science policymakers. In fields like astronomy, the case analyzed by the authors, access to telescopes and other observatory facilities is crucial to produce scientific knowledge, but engenders a tension between an economic and a scientific logic. On the one hand, the funders that sponsored the construction of costly facilities expect guaranteed access for the funders' scientific community, claiming a return on their investment. On the other hand, the logic of science requires that access should be provided based solely on the scientific merit of the projects. As this chapter shows, research infrastructures may give rise to peculiar tensions between the social and epistemic structures of science, a topic that I think is worthy of further investigation by social epistemologists and philosophers of science.

The last two empirical chapters focus on the life cycle of research infrastructures. In Chapter 10, Hallonsten shows that most of the European research infrastructures share with so-called mega-projects the property of inevitably exceeding the allocated funding and being never completed in the expected times. In particular, the European Spallation Source, a facility for neutron scattering in Sweden, was first proposed in 1990 but started to be built only in 2014. Beatrice D'Ippolito and Charles-Clemens Rüling, on the other hand, present an analysis of the factors that keep a research infrastructure alive. By studying the Institut Laue-Langevin, the world's strongest neutron source for science based in France, they highlight how technical improvements, a strong user community, and a political voice in the policy forums concur to maintain a research infrastructure in a central position in the international scientific community.

Lastly, the concluding chapter takes stock of the empirical studies in light of the conceptual landscape detailed in the first chapter. With great honesty, the editors admit that the collection of case studies has not led to a clarification of the concepts of Big Science and research infrastructures. Both notions continue to remain elusive: the former because of its broadness, the latter because of its ultimate political function. Hence, as scholarly tools, probably it would be better to replace them with more fine-tuned concepts. However, as empirical phenomena, both Big Science and research infrastructures remain rich topics that deserve more investigation. In this regard, I note that they may be an object of study also for philosophers of science and social epistemologists. Although the philosophy of science has not devoted special attention to these phenomena thus far, I pointed out above how research infrastructure can be peculiar loci of friction between the epistemic norms of science and its organizational–economic structures. More generally, the science policy discourse usually takes for granted several assumptions about how science works and makes progress that could benefit from epistemological scrutiny or even applied conceptual engineering during their design. For philosophers of science interested in taking up such tasks, this volume is without a doubt a valuable resource. I hope that in the next round of investigations of Big Science and research infrastructures, the voice of philosophers will be heard as well.

Reference

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