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# Collaborative Research in Imperial Vienna: Science Organization, Statehood, and Civil Society, 1848–1914

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## Abstract

This article deals with the goals, practices, and transformations of collaborative research that emerged between and within bureaucratic and bourgeois models of science organization in the late Habsburg monarchy. It offers novel insights into the political, social, and epistemic dimensions of public engagement in research, and evaluates the frameworks, profit expectations, and challenges involved. As will be exemplified by joint undertakings in the High Alps, the “Orient,” and the Adriatic Sea, private-public partnerships in the form of scientific societies or institutional alliances assumed vital functions. Their stakeholders volunteered for large-scale research projects, coordinated and funded infrastructure such as field stations, research vessels, or collecting expeditions, and became driving forces in establishing new forms of intra-imperial and cross-border collaboration. As such, scientific societies are useful indicators for understanding science-related developments and for illuminating the tensions between imperialism, (inter)national aspirations, and civil-society building. Based on sources from the archives of the k.k. Meteorological Society, the Natural Scientific Oriental Society, and the Adriatic Society, this article will analyze scientific collaboration as a purposeful and power-related interaction process, oriented toward mutual benefits, that took place on three levels: between state-owned research facilities and private societies, between bureaucrats and bourgeois, and between scientists and “non-professionals.”

**Keywords:** science organization; collaboration; scientific societies; infrastructure; public; Habsburg monarchy

In 1865, Karl Fritsch (1812–79), vice-director of the Central Institute for Meteorology in Vienna, published an article in the *Österreichische Wochenschrift für Wissenschaft, Kunst und öffentliches Leben*.<sup>1</sup> The topic was a collaboration between state-funded research agencies and privately sponsored scientific societies.<sup>2</sup> Both organization types were established in the Habsburg monarchy, broadly in parallel, during the neo-absolutist period following the failed revolution of 1848; however, the initiatives on which they were based dated back to before the revolution. The k.k. Geological Survey began its activities in 1849, followed by the k.k. Zoological-Botanical Society and the k.k. Central Institute for Meteorology and Earth Magnetism in 1851, the k.k. Institute for Austrian Historical Research in 1854, and the k.k. Geographical Society in 1856.<sup>3</sup>

<sup>1</sup>Karl Fritsch, “Die Österreichische Gesellschaft für Meteorologie,” *Österreichische Wochenschrift für Wissenschaft, Kunst und öffentliches Leben* 6 (1865): 577–80, 617–19.

<sup>2</sup>In addition to the institutions mentioned above, scientific state agencies encompassed the imperial collections (later the k.k. Natural History Museum in Vienna), the k.k. Military-Geographical, and the k.k. Austrian Archaeological institutes. The state-funded Imperial Academy of Sciences in Vienna held a special position among the otherwise privately sponsored learned societies.

<sup>3</sup>For neo-absolutist ambitions to centralize scholarship within the monarchy, see Jan Surman, *Universities in Imperial Austria, 1848–1918* (Lafayette, 2019), 49–88; for science in the imperial capital, see Mitchell Ash, “Metropolitan Scientific Infrastructures and Spaces of Knowledge in Vienna,” in *Science in the Metropolis. Vienna in Transnational Context, 1848–1918*, ed. Mitchell Ash (New York, 2021), 1–21.

According to Fritsch, instead of “collisions and mutual disturbances,” the two models ought to complement each other in their tasks and in their requirements: the poorly staffed state agencies being enriched through the membership, professional diversity, and financial strength of private societies; the societies, in turn, through the expertise, infrastructure, and prestige of the state agencies.<sup>4</sup> He argued that such strategic alliances would make collaborative projects possible, going well beyond the limited resources of a single institution—and that these projects would benefit both civil society and the state:

A shining example for me was the organization of the k.k. Geological Survey, which . . . is also a state institute, and yet holds regular public meetings like an authorized scientific society. Who can deny that these meetings, and the publication of their reports, were the most powerful force for the Survey’s brilliant success and that these meetings . . . contributed the most to enhancing the institute’s standing in public opinion?<sup>5</sup>

Amid the crisis of the 1860s, which was marked by the loss of the Habsburg dominions in Italy, the defeat by Prussia, and the Austro-Hungarian Compromise, the intertwining of science with the public sphere promised to foster novel, more resilient models of science organization independent of state funding. Likewise, the formation of the Educational Council (1863–67), a key advisory body for university affairs directed by academics, fuelled efforts to gain institutional autonomy from political decision-makers.<sup>6</sup> Specifically, Fritsch called for the founding of an Austrian Society for Meteorology to give this rising field an “equal position among the natural sciences” and support the k.k. Central Institute for Meteorology and Earth Magnetism, which was “in a state of decline.” Despite the Institute’s growing workload of tasks, the government did not allocate an annual fixed endowment; moreover, the Imperial Academy of Sciences stopped sponsoring the Institute’s publications for economic reasons in 1860.<sup>7</sup> In this regard, the k.k. Geological Survey served as a role model for collaboration. Its director Wilhelm von Haidinger (1795–1871) had established the Geographical Society as the Geological Survey’s “sister organization.” By influencing public opinion, he had also convinced the emperor to withdraw his resolution, taken in 1860, to liquidate the survey as an independent imperial agency and subordinate it to the academy as part of austerity measures.<sup>8</sup>

This article will examine practices of cooperation between government- and bourgeois-driven types of science organization, their goals, roots, and transformations in the period between 1848 and 1914. It will analyze the significance of formal and informal partnerships, their collaborative undertakings, and challenges in the context of inter- and intra-imperial policies, and evaluate public participation in science. How can we assess the contribution of the bourgeoisie to research funding in the Habsburg Empire, beyond well-documented aspects such as the endowment of science awards by individual upper-middle-class patrons and the founding of the monarchy’s first extramural facilities for basic research, like the Vienna Institutes for Experimental Biology (1903) and Radium Research (1910)?<sup>9</sup>

<sup>4</sup>See Fritsch, “Gesellschaft,” 577. In 1864, eleven officials worked at the Geological Survey and seven (mainly administrative staff) at the Academy of Sciences. Besides its director, the Central Institute of Meteorology was run by one adjunct and two assistants, who were part of the support staff of the Vienna University. See Statistische Central-Commission, ed., *Statistisches Jahrbuch der Oesterreichischen Monarchie für das Jahr 1863* (Vienna, 1864), 96–97.

<sup>5</sup>Fritsch, “Gesellschaft,” 577–78.

<sup>6</sup>See Surman, *Universities*, 91–92.

<sup>7</sup>[Julius Hann], “Carl Jelinek,” *Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie* 7 (1877): 72. For the Institute’s crisis, see Christa Hammerl, “Die Geschichte der Zentralanstalt,” in *Die Zentralanstalt für Meteorologie und Geodynamik, 1851–2001*, eds. Christa Hammerl, Wolfgang Lenhardt, Reinhold Steinacker, and Peter Steinhauser (Vienna, 2001), 40–41.

<sup>8</sup>See Marianne Klemun, *Wissenschaft als Kommunikation in der Metropole Wien* (Vienna, 2020); and Johannes Mattes, “Imperial Science, Unified Forces and Boundary-Work: Geographical and Geological Societies in Vienna,” *Annals of the Austrian Geographical Society* 162 (2020): 155–210.

<sup>9</sup>See R. Werner Soukup, ed., *Die wissenschaftliche Welt von gestern* (Vienna, 2004); Gerd Müller, ed., *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna’s Biologische Versuchsanstalt* (Cambridge, MA, 2017); Wolfgang L. Reiter, *Aufbruch und Zerstörung. Zur Geschichte der Naturwissenschaften in Österreich* (Vienna, 2017); and Maria Rentetzi, “Designing (for) a New Scientific Discipline: The Location and Architecture of the Institut für Radiumforschung,” *BJHS* 38 (2005): 275–306.

In recent years, the study of cooperative practices has opened up fresh insights into the claims, challenges, and realities of imperial rule. Notable contributions by Jörn Leonhard and Ulrike von Hirschhausen, Volker Barth and Roland Cvetkovski, and Luminita Gatejel, among others, have analyzed intra- and inter-imperial forms of exchange and political, social, and economic collaboration.<sup>10</sup> This focus on the integrative power and internal diversity of “cooperative empires”<sup>11</sup>—a term coined by Jana Osterkamp to describe vertical and horizontal axes of “communication flows between the center and the periphery . . . and among the various provinces”—has increased scholarly awareness of imperial networks, career paths, and multiple spaces of decision-making.

Likewise, historians of science such as Mitchell G. Ash, Deborah R. Coen, Johannes Feichtinger, Marianne Klemun, and Jan Surman have studied major research endeavors as a significant element in Habsburg imperial rule.<sup>12</sup> While the monarchy relied on a variety of scientific, spatial, social, juridical, and administrative knowledge gathered, surveyed, and exchanged by its research institutes, these facilities, in turn, gained prestige and funding by fulfilling imperial tasks and became vital embodiments of statehood and territoriality.<sup>13</sup> As analyzed by Coen through the lens of climate and earthquake research, an essential part of nineteenth-century fieldwork sciences and their large-scale data-collecting ventures relied on public engagement, non-expert observations, and knowledge based on expert-lay communication.<sup>14</sup> Before the emergence of universities as full-fledged research facilities as a result of the Thun-Hohenstein Reforms (1849–60), it was mainly empire-wide scientific societies that provided the human resources, infrastructure, and legal basis for such collaborative undertakings, as well as pursuing their own research agendas. As private-public interfaces, these societies were often involved in imperial power politics and government tasks while also serving as institutions of civil-society building.

So far, forms of collaborative research in the Habsburg monarchy have been studied primarily at the interface of science, industry, and the military. Starting with material testing and experimental institutes (*Versuchsanstalten*), founded in the 1880s but not authorized by the state until 1910, Rupert Pichler and Reinhold Hofer examined the development of non-university applied research at the intersection of technical, political, and entrepreneurial aims in the First and Second Austrian Republic.<sup>15</sup> A volume on World War I by Herbert Matis, Juliane Mikoletzky, and Wolfgang Reiter dealt with the comprehensive organization and utilization of scientific-technical knowledge and the involvement of all social powers of the monarchy to achieve Austria’s military goals.<sup>16</sup> Intra-imperial undertakings such as the *Franzisco-Josephinische Landesaufnahme* (Third Land Survey), the set-up of a meteorological observation network, population censuses, and editions of Austrian historical sources have so far been discussed mainly in the context of state-owned research agencies,<sup>17</sup> whereas the impact of empire-wide scientific societies and their projects have received little attention by scholars.

<sup>10</sup>See Jörn Leonhard and Ulrike von Hirschhausen, eds., *Comparing Empires. Encounters and Transfers in the Long Nineteenth Century* (Göttingen, 2011); Volker Barth and Roland Cvetkovski, eds., *Imperial Co-operation and Transfer, 1870–1930* (London, 2015); and Luminita Gatejel, “Imperial Cooperation at the Margins of Europe: The European Commission of the Danube,” *European Review of History* 24 (2017): 1–20.

<sup>11</sup>Jana Osterkamp, “Cooperative Empires. Provincial Initiatives in Imperial Austria,” *Austrian History Yearbook* 47 (2016): 128–46. See also Jana Osterkamp, ed., *Kooperatives Imperium* (Göttingen, 2018).

<sup>12</sup>Mitchell Ash and Jan Surman, eds., *The Nationalization of Scientific Knowledge in the Habsburg Empire, 1848–1918* (Basingstoke, 2012); Deborah Coen, *The Earthquake Observers: Disaster Science from Lisbon to Richter* (Chicago, 2013); Johannes Feichtinger and Heidemarie Uhl, eds., *Das integrative Empire. Wissensproduktion und kulturelle Praktiken in Habsburg-Zentraleuropa* (Bielefeld, 2023); and Klemun, *Wissenschaft*.

<sup>13</sup>See Jan Arend, ed., *Science and Empire in Eastern Europe* (Göttingen, 2020).

<sup>14</sup>See Deborah Coen, *Climate in Motion: Science, Empire, and the Problem of Scale* (Chicago, 2018), 63–91; and Coen, *Observers*, 141–62.

<sup>15</sup>Rupert Pichler and Reinhold Hofer, *Geschichte der kooperativen Forschung in Österreich* (Innsbruck, 2014).

<sup>16</sup>Herbert Matis, Juliane Mikoletzky, and Wolfgang Reiter, eds., *Wirtschaft, Technik und das Militär 1914–1918* (Vienna, 2014).

<sup>17</sup>See Kurt Scharr, “Der Franziszeische Kataster und seine Rolle im Kaisertum Österreich,” *ÖGL* 62, no. 2 (2018): 120–30 (and the special issue edited by the author); Wolfgang Göderle, “Administration, Science, and the State: The 1869 Population Census,” *Austrian History Yearbook* 47 (2016): 61–88; and Christine Ottner, “Zwischen Wiener ‘Localanstalt’ und ‘Centralpunct’ der

This article argues for an understanding of science in the late Habsburg monarchy as a broader social enterprise intertwining state interests and civil society. Writing from a history of science perspective, I do not claim to provide explanations for societal transformations that transcend (scientific) knowledge production. However, by going beyond the usual scope of the history of science scholarship, this article will shed light on understudied actors and institutions that are not considered “academic” in their own right. In this respect, I follow current approaches in the histories of knowledge and science, broadening the angle of my study from epistemes and (scientific) practices to incorporate unsung stakeholders and their socio-political contexts.<sup>18</sup>

My argument is grounded in an analysis of the frameworks, transformations, and limits of public engagement in scientific undertakings. Based on sources from the archives of the k.k. Meteorological Society, the Natural Scientific Oriental Society, and the Adriatic Society, I will examine the interaction of socially inclusive and exclusive research practices in the exploration of the High Alps, the Balkan Peninsula, and the Adriatic—all key areas for the monarchy’s scientific agendas. Using the example of these three influential societies, I will ask: Under what conditions, goals, and profit expectations did certain “publics” engage in these ventures? What impact did different forms of participation have on the integrative claims and realities of Habsburg imperial rule, particularly in comparison with other European empires? Because collaboration (working together toward a common goal) and cooperation (working together toward individual goals) often occurred in tandem in these projects, depending on the actors involved, this article does not make a clear distinction between the two terms.<sup>19</sup> However, the term “cooperation” will only be used when at least two parties involved in a project shared the same purpose. I will focus less on interdisciplinary aspects of collaboration, preferring to analyze it as a purposeful and power-related interaction process, oriented toward the mutual benefit and conducted on three levels: between research agencies and private societies, between bureaucrats and bourgeois, and between scientists and “non-professionals.”

## Learned Societies as Novel Tools of Science Organization

### *Alternative Paths of Institutionalization*

State-supported learned societies, modelled after those in London, Paris, and St. Petersburg, were the prevailing form of science organization until the mid-nineteenth century. Their limited presence in the Habsburg monarchy (excluding the Italian and Belgian territories) before the 1840s, coupled with state supervision of assemblies and the press, and the enduring influence of clerical scholarship, have long been associated with “backwardness” by scholars. As recent work by Per Pippin Aspaas, Franz Fillafer, and László Kontler, among others, has made plain, the bureaucracy of the nascent state, the imperial court, and the Catholic orders channelled efforts to establish learned societies into non-institutionalized research activities.<sup>20</sup> At the same time, however, they acted as their own corporations with their own models of academic progression and research organization.<sup>21</sup> This meant that informal modes of academic sociability, such as salon culture, reading circles, Freemasonry, and correspondence, predominated.<sup>22</sup> The employment of many scholars as bureaucrats in the imperial administration delayed the emergence of the scientist as an academically trained professional, fostering an understanding of scholarship as a (part-time) individual pursuit serving personal and patriotic needs.

That the objections of the Vienna bureaucracy in the *Vormärz* period were not directed against scholarship in general but against private, decentralized forms of scholarly organization is

Monarchie. Einzugsbereich und erste Geschichtsforschungsunternehmen,” *Anzeiger der philosophisch-historischen Klasse* (ÖAW) 143 (2008): 171–96.

<sup>18</sup>See, e.g., Marian Füssel, *Wissen. Konzepte – Praktiken – Prozesse* (Frankfurt, 2021); and Lorraine Daston, “The History of Science and the History of Knowledge,” *KNOW* 1 (2017): 131–54.

<sup>19</sup>On collaboration, see Hanne Andersen, “Collaboration, Interdisciplinarity, and the Epistemology of Contemporary Science,” *Studies in History and Philosophy of Science*, pt. A 56 (2016): 1–10.

<sup>20</sup>See Per Pippin Aspaas and László Kontler, *Maximilian Hell and the Ends of Jesuit Science in Enlightenment Europe* (Leiden, 2020); and Franz L. Fillafer, *Aufklärung habsburgisch* (Göttingen, 2020), 120.

<sup>21</sup>See Thomas Wallnig, *Critical Monks* (Leiden, 2019), 267.

<sup>22</sup>See Stefan-Ludwig Hoffmann, *Geselligkeit und Demokratie. Vereine und zivile Gesellschaft im transnationalen Vergleich* (Göttingen, 2003), 35; and Norbert Wolf, *Glanz und Elend der Aufklärung in Wien* (Vienna, 2023), 130–42, 160–210.

demonstrated by the targeted state promotion of “useful” research: for example, in medicine, cartography, mining, mineralogy, and pomology. The government-founded k.k. Agricultural Society (1807), a semi-public central association, was intended to transfer state-approved knowledge into local farming practice, but remained mainly in the hands of (aristocratic) landowners.<sup>23</sup> In contrast, museum associations and antiquarian societies in the crownland capitals, stemming from middle-class efforts with the patronage of individual aristocrats, played a decisive role in fostering regional identities through the creation of provincial museums.<sup>24</sup> A few societies that were founded due to economic depression and bourgeois-liberal demands, such as the (Lower) Austrian Trade Society (1839), aimed to prevent particularistic tendencies and establish a “regulated cooperation of such diverse forces” as “statesmen” and “entrepreneurs,” scholars, and practitioners.<sup>25</sup> These initiatives aligned with the urban popularization of research in Vienna starting in the early 1840s through public lectures, science writing in newspapers, and urban forums of knowledge dissemination.<sup>26</sup>

In the aftermath of 1848, scientific societies primarily developed in fields without state agencies or similar facilities for knowledge exchange. In these fields, they functioned first and foremost as communication hubs for their members. In the following decades, however, their priorities evolved: collaborative work, crowdfunding, and mobilization of the “public” were now at the fore. In Vienna, this “public” included the inherited aristocracy—specifically, aristocrats serving as politicians, diplomats, military officers, and entrepreneurs—but especially members of the liberal bourgeoisie, some of them ennobled and many of them related by kinship: scholars, teachers, bureaucrats, businessmen, bankers, artists, and individual social climbers.<sup>27</sup> The spread of popular lecture series, periodicals, reading clubs, and meeting venues created multiple, interconnected and partly competing public spheres within the scientific life of the capital. These especially involved associations held together by statutes, regular assemblies, dissemination of media, and a common body of knowledge and culture. Of the 74 societies with around 49,400 members that were engaged in (scientific) knowledge production in Cisleithania in 1865, 20 societies with 17,000 members were based in Vienna alone.<sup>28</sup> Scientific knowledge was not only publicly exchanged but also, increasingly, publicly discussed and evaluated; this in turn provided the basis for governmental and private funding decisions. Involving the public (as spectators or as participants) therefore brought significant advantages to government research institutions and their collaborators in achieving their goals and objectives.

### Inclusive and Exclusive Cultures

On an empire-wide level, collaborative projects sprouted from private and later government-sponsored initiatives to bring science organizations onto a new footing. Joint endeavors encompassing different players, institutions, and disciplines aimed to increase the efficiency of governance and scholarship and

<sup>23</sup>The societies established in the crownlands from 1807 onward to improve agriculture and forestry occupied a special position. They relied on a large membership and, like the k.k. Moravian-Silesian Society for Agriculture, Nature, and Regional Studies, were engaged in the natural historical examination of individual provinces. See Josef Häusler, *Die Entwicklung der k.k. Landwirtschaftsgesellschaft* (Vienna, 1907).

<sup>24</sup>See, e.g., Peter Assmann, Isabella Harb, and Roland Sila, eds., *Museum gestaltet Geschichte. 200 Jahre Tiroler Landesmuseum Ferdinandeum* (Innsbruck, 2022); Tomaž Lazar, Jernej Kotar, and Gašper Oitzl, eds., *National Museum of Slovenia* (Ljubljana, 2022).

<sup>25</sup>Library of the Austrian Trade Society, Invitation to form an association under the title “Österreichischer Gewerbeverein.” Circular written by Rudolf Arthaber, Heinrich Coith, Christian Hornbostel, and Michael Spörlin, 1838.

<sup>26</sup>For science popularization, see Klaus Taschwer, “Wie die Naturwissenschaften populär wurden,” *Spurensuche* 8 (1997): 4–31; Ulrike Felt, “Die Stadt als verdichteter Raum der Begegnung zwischen Wissenschaft und Öffentlichkeit,” in *Wissenschaft und Öffentlichkeit in Berlin*, ed. Constantin Goshler (Stuttgart, 2000), 185–220; and Mitchell Ash and Christian Stifter, eds., *Wissenschaft, Politik und Öffentlichkeit* (Vienna, 2002).

<sup>27</sup>For the intertwining of family life and science (patronage), see Deborah Coen, *Vienna in the Age of Uncertainty. Science, Liberalism & Private Life* (Chicago, 2007), 1–31; Reiter, *Aufbruch*, 71–116; and Georg Gaugusch, “The Founders of the Biologische Versuchsanstalt,” in Müller, *Vivarium*, 21–36.

<sup>28</sup>Dedicated natural science societies made up only a minor part of these. Apart from individual geoscientific societies in Styria and Bohemia, they were divided into disciplines only in Vienna. See Statistische Central-Commission, ed., *Statistisches Jahrbuch der Oesterreichischen Monarchie für das Jahr 1866* (Vienna, 1868), 333–40.

enhance the national welfare. However, what state agencies and scientific societies—many of which adopted the emperor's motto *Viribus unitis* (“with forces united”)—actually meant by “cooperative ventures” varied and was subject to change. Meanings ranged from undertakings that aimed to pool the knowledge of volunteer contributors from across the monarchy, to projects planned and funded collaboratively but carried out by a handful of specialists. As I will argue in this section, differences between organizational types—in terms of institutional roots, public engagement, and research conditions—resulted in the emergence of two distinct, lasting cultures of science organization with separate epistemic frameworks and modes of collaboration.

The delay in creating a central authority for the promotion of science, finally established as the Imperial Academy of Sciences in Vienna (1847), brought private initiatives to the fore in the early years of this development. A loosely defined group of young scholars gathered around the earth scientist Haidinger at the k.k. Mining Museum, an institution set up to train Mining Academy graduates.<sup>29</sup> Although the statutes of the resulting “Friends of the Natural Sciences” were not officially approved, the association developed a high public profile through its freely accessible lectures, subscription-based publications, and the involvement of people interested in different branches of (applied) research.<sup>30</sup> The model for its organization was the associational life of Edinburgh, where Haidinger had spent two years as a young mineralogist in the home of the public-spirited banker and naturalist Thomas Allan (1777–1833), who introduced him to the local learned societies.<sup>31</sup> In parallel with the growth of Haidinger's “Friends,” a narrow circle of distinguished scholars around the orientalist Joseph von Hammer-Purgstall (1774–1856) successfully petitioned the State Council to establish the future Imperial Academy of Sciences as an independent state body and the monarchy's supreme learned institution.<sup>32</sup> A select number of academics, initially appointed by the emperor and later elected from among the membership, were intended not only to devote themselves to “pure” research but also to decide on the approval and financial support of proposals and the publication of manuscripts by non-members. Public attendance at meetings and lectures was prohibited, as were newspaper reports of sessions submitted by attendees.

The rivalry between the two communities and the forms of science organization they favored—the exclusive “state academy,” the inclusive “free society”—persisted long after the founding of the Academy, especially since Haidinger and some of his “Friends” set out to join the Academy and reform it from within over the following decades.<sup>33</sup> As early as 1849, for example, the geologist Ami Boué (1794–1881) unsuccessfully proposed that, because of the increase in scientific specialization, the Academy should be reconstituted into “committees of related societies.”<sup>34</sup> In 1869, marking the end of a decades-long reform debate, the majority of Academy members once more voted against being “broken down into an aggregate of [private] societies.”<sup>35</sup>

These two cultures of science organization differed, not only in the status and in public engagement of the stakeholders involved, but also in their practices and sites of research. Drawing on their personal experiences, the majority of academics relied on traditional means of directing research and sharing knowledge such as prize questions, publication exchange, and the sponsorship of

<sup>29</sup>See Marianne Klemun, “Museums at the Habsburg Empire,” in *Museums at the Forefront of the History and Philosophy of Geology*, eds. Gary Rosenberg and Renee Clary (Colorado, 2018), 163–75; and Anonymous, “Die k.k. Geologische Reichsanstalt,” *Illustrierte Zeitung* 599 (1854): 422–25.

<sup>30</sup>See Wilhelm Haidinger, *Das k.k. Montanistische Museum und die Freunde der Naturwissenschaften* (Vienna, 1869), 84–88.

<sup>31</sup>For Edinburgh, see Diarmid Finnegan, *Natural History Societies and Civic Culture in Victorian Scotland* (London, 2009).

<sup>32</sup>See Brigitte Mazohl and Thomas Wallnig, “Anbahnungen einer Akademie in Wien,” in *Die Österreichische Akademie der Wissenschaften, 1847–2022*, vol. 1, eds. Johannes Feichtinger and Brigitte Mazohl (Vienna, 2022), 17–30.

<sup>33</sup>See Klemun, *Wissenschaft*, 136–49; Johannes Mattes and Doris Corradini, “Köpfe, Staat und Forschungspraxis,” *Akademie*, vol. 1, eds. Feichtinger and Mazohl, 160.

<sup>34</sup>Ami Boué, “Ueber den Associationsgeist,” *Sitzungsberichte der kais. Akademie der Wissenschaften, math.-nat. Klasse* no. 1 (1849): 38.

<sup>35</sup>Anton Schrötter, “Bericht,” in *Almanach der kais. Akademie der Wissenschaften* 19 (1869): 227–28. However, in 1872, Haidinger posthumously succeeded in introducing some of his ideas into the reform agenda of the German Academy of Naturalists Leopoldina. There, he had successfully proposed as members several former “Friends” or candidates who had previously been rejected by the Vienna Academy.

individuals.<sup>36</sup> In the absence of facilities, most scholars conducted research using their own home studies or in collection cabinets. Likewise, the small amount of state funding available precluded the employment of scientific staff. Haidinger, meanwhile, was motivated by the specific demands of research and evidence-building in the field, including (data) collection, comparison, and documentation, which he confronted while preparing the first geognostic general map of the monarchy (1843–48).<sup>37</sup> The shift from regional to empire-wide studies made collaboration with mining officials from different parts of the monarchy indispensable. Lower social barriers and the organization of many (local) experts for voluntary cooperation within a private society promised Haidinger’s “Friends” an advantage over the Academy, which relied on a few specialists.

However, the antagonism between “state-cultivated science” and “private societies” was not as acute as Haidinger’s supporters portrayed it to be.<sup>38</sup> By the 1860s at the latest, the grounds of the conflict had shifted to political convictions, scientific status, and resources. With the Geological Survey (1849), a state agency emerged that functioned as a hub for private societies and incorporated former members of the “Friends of Natural Sciences,” which had dissolved in 1851.<sup>39</sup> Moreover, associations that had fallen short of financial expectations sought the proximity of the imperial family. The Viennese bureaucracy perceived an advantage in involving civil initiatives and supported private associations so long as they shared the political consensus on the integrity of the state as a whole, the legitimacy of its government, and its political and cultural claim to rule. Former “Friends” participated in the establishment of inclusive natural scientific societies in Bratislava, Brno, Budapest, and Prague.<sup>40</sup> Exclusive organizations also found successors. By 1890, science academies in Budapest, Krakow, Prague, and Zagreb obtained state approval, but they widely differed in the shares of private and state involvement, their membership pool, and (inter) national orientation, and thus existed in separate, parallel spheres rather than in a single body.<sup>41</sup> In contrast to those in Vienna, academies in the crown lands were strongly involved in science popularization as a way to reinforce their national language and culture.

### *Intra- and Extra-Imperial Undertakings*

Collaborative research as a phenomenon began during the neo-absolutist period, but some large-scale projects were not implemented—or their results put to use—until the 1870s. This type of research relied on the Viennese central administration and its intellectual agenda to preserve the monarchy as a supranational entity in the face of internal and external crises. Large-scale undertakings, termed by Deborah Coen “imperial and royal science,” aimed to determine and dismantle disparities within the empire and legitimize its territorial framework as a natural and cultural unit.<sup>42</sup> These intra-imperial projects ranged from topographical, geological, and statistical surveys, herbaria, and meteorological observations to the recording of antiquities, excavations, and extensive source editions. The Academy Commissions and the Institute for Austrian Historical Research employed a broad range of staff—mostly unpaid—to carry out (ancient) history research projects; these ran in parallel to, rather than in conversation with, those led by Theodor Mommsen (1817–1903) in Berlin.<sup>43</sup> Research projects in the natural sciences tended to be unique, with no comparable international equivalents. These were mostly conducted by state agencies, sometimes in collaboration with each other, or independently by new discipline-specific societies.

<sup>36</sup>See Mattes and Corradini, “Köpfe,” 168.

<sup>37</sup>See Wilhelm von Haidinger, *Bericht über die geognostische Übersichtskarte* (Vienna, 1847), 29–43.

<sup>38</sup>[Franz Hauer], “Das Jubiläum der Geographischen Gesellschaft,” *Wiener Allgemeine Zeitung* 654 (1881): 7–8.

<sup>39</sup>The statutes of the Geographical Society (1856), founded by Haidinger in the premises of the Geological Survey, resembled a previously rejected proposal for reform of the Academy.

<sup>40</sup>See [Franz Hauer], “Wissenschaftliches Leben in Wien,” *Das Vaterland* 1, no. 57 (1860): 5 (supplement).

<sup>41</sup>See Doris Corradini and Johannes Mattes, “Die Akademie und die Internationalisierung,” in *Akademie*, vol. 1, eds. Feichtinger and Mazohl, 294–98.

<sup>42</sup>See Coen, *Climate*, 63–91; and Ash and Surman, *Nationalization*.

<sup>43</sup>See Thomas Winkelbauer, *Das Fach Geschichte an der Universität Wien* (Göttingen, 2018), 96–110; and Torsten Kahlert, “*Unternehmungen großen Stils*.” *Wissenschaftsorganisation, Objektivität und Historismus* (Berlin, 2017).

In distinction to the meta-disciplinary provincial associations, these societies emerged in the 1850s to 1870s in Vienna in research fields that were not yet academically accredited or had inadequate personnel, financial, or infrastructural resources. Bringing together private individuals from across the crown lands, they gained Habsburg family members as protectors; some even received the privilege of using the honorary title “k.k.” (imperial-royal), which was reserved for state authorities.<sup>44</sup> Similar to state agencies, they offered powerful support for creating a concept of intra-imperial diversity and implementing it under a single governmental rule.<sup>45</sup> The projects they undertook—albeit on a privately funded or voluntary basis—aimed to pool sources, raw data, and specimens from the crown lands and centralize them in Vienna. Their members, who included civil servants, business owners, and aristocrats, carried out joint survey and collection tasks, prepared and participated in field research, and acted for the benefit of the state in the hope of personal gain and prestige. Research in these societies was a holistic, inclusive, and patriotic endeavor.

Unlike in Britain or France, where governments and learned societies had entrusted the navy or individual naturalists with (overseas) research ventures before 1848, the Habsburg administration and its societies were primarily interested in exploring and developing the monarchy’s own territory.<sup>46</sup> Alongside neo-absolutist policy, financial and practical considerations played a decisive role. For example, the k.k. Zoological-Botanical Society limited its activities to “the political border of the empire” by choice, justifying this move by alluding to the sheer abundance of material that could be collected and studied within the monarchy.<sup>47</sup> Meanwhile, the research of territories beyond its borders relied widely on the ambitions and investments of individual scholars and was anything but a collaborative undertaking.<sup>48</sup> An exception was the circumnavigation of the world by the Austrian navy frigate SMS *Novara* (1857–59). Participants wrote popular reports for Viennese newspapers, distracting their readers from the political crises at that time.<sup>49</sup>

This intra-imperial focus changed with the reorientation of Habsburg foreign policy toward Southeastern Europe after German unification (1871) and the occupation of Bosnia and Herzegovina (1878) by Austro-Hungarian forces. State-run extra-imperial ventures such as the International Arc Measurement, carried out by the k.k. Military-Geographical Institute (1871–75), took place at the invitation of the Ottoman Empire or independent Balkan states.<sup>50</sup> Moreover, the Suez Canal brought Asia within reach, and along with it, (trade) policy interests to the fore. The Vienna Academy, and to a lesser extent private societies, moved gradually from awarding individual travel grants to funding centrally planned expeditions, especially to the Balkan Peninsula and the Near East.<sup>51</sup> These projects continued to be funded by private initiatives, albeit with an increasing share of funding by the government and the imperial family in return for fulfilling their requests. Nevertheless, as the botanist Otto Stapf (1857–1933) conceded regarding the exploration of Southeastern Europe: “very little [of it] . . . has been achieved through purposeful, planned effort.”<sup>52</sup>

<sup>44</sup>This honorary title, granted by the emperor to about twelve scientific societies, could involve benefits such as postage exemption.

<sup>45</sup>See Rok Stergar and Tamara Scheer, “Ethnic Boxes: The Unintended Consequences of Habsburg Bureaucratic Classification,” *Nationalities Papers* 46, no. 4 (2018): 575–91.

<sup>46</sup>Accordingly, the proposal by the geologist Eduard Suess at the Assembly of German Naturalists and Physicians (1856) in Vienna to establish an international “Alpine Geological Society” was rejected. Finally, in 1862, the Austrian Alpine Club was founded. See Suess, “Ansprache,” in *Der Österreichische Alpenverein und die Sektion “Austria”* (Vienna, 1912), VI.

<sup>47</sup>Zoological-Botanical Society, ed., “Versammlung am 7. Mai,” *Verhandlungen des Zoologisch-Botanischen Vereins* 1 (1851): 6.

<sup>48</sup>See Siegfried Reissek, “Die österreichischen naturforschenden Reisenden,” *Schriften, Verein zur Verbreitung naturw. Kenntnisse* 1 (1860): 21–51; and Theodor Kotschy, “Ueber Reisen und Sammlungen des Naturforschers,” *Schriften, Verein zur Verbreitung naturw. Kenntnisse* 3 (1862): 250–96.

<sup>49</sup>See Ferdinand Hochstetter, *Gesammelte Reiseberichte* (Vienna, 1885); and Renate Basch-Ritter, *Die Weltumsegelung der Novara* (Graz, 2008).

<sup>50</sup>See Béla Kovács and Gábor Timár, “The Austro-Hungarian Triangulations in the Balkan Peninsula,” in *Cartography in Central and Eastern Europe*, eds. Georg Gartner and Felix Ortig (Berlin, 2009), 911–21.

<sup>51</sup>Marianne Klemun and Johannes Mattes, “Expeditionen und Forschungsreisen,” in *Akademie*, vol. 1, eds. Feichtinger and Mazohl, 197–273.

<sup>52</sup>Otto Stapf, “Der Antheil Oesterreich-Ungarns an der Erforschung des Orientes,” *Monatsblätter des Wissenschaftl. Club* 10, no. 10 (1889): 97.



While geological research was carried out in a more organized manner, leading to the creation of large-scale synthetic maps, zoological-botanical explorations were difficult to coordinate due to collectors' individual focuses on particular sites. Explorative ventures to the Arctic or inner Africa such as the Austrian-Hungarian Polar (1872–74) and the Austrian Congo expeditions (1885–87) held a special position.<sup>53</sup> Despite their great popularity, these remained largely private ventures, used by the Geographical Society as vehicles for the mobilization of Viennese scientific patrons and civil society. As well as the ambitions of previous undertakings, such as intra-imperial consensus-building and the strengthening of dependency relations between center and provinces, colonial interests gained ground—also due to the need to keep up with other European powers.

Similar processes can be observed in Budapest, where, in parallel to Vienna, discipline-specific societies emerged from the 1870s onward; membership was generally drawn from within the Kingdom of Hungary rather than from across the monarchy. However, pre-existing interdisciplinary scientific and medical societies, such as those established in the monarchy's provincial capitals, continued to flourish. To take one example, the Royal Hungarian Society of Natural Science still had 8,000 members in 1890, thanks to its popular periodical.<sup>54</sup> Another difference to Vienna was that the ventures of the Budapest associations, such as the exploration of Lake Balaton by the Hungarian Geographical Society, had an intra-imperial focus: they remained confined to the territory of the Hungarian kingdom. Moreover, expeditions abroad remained the private interest of wealthy aristocrats, either as explorers themselves or as science patrons. Accompanied by university graduates, they travelled to Central Asia and East Africa; the former often in search of the “origins of the Hungarians.”<sup>55</sup> Meanwhile, scientific institutions were less involved in these ventures and, like the Hungarian Academy of Sciences, did not send expeditions to the Balkan Peninsula before World War I.<sup>56</sup>

This leads us to two preliminary conclusions: first, that learned societies gained traction in the Habsburg monarchy later than in other empires, but between the 1840s and 1880s—from the dawn of science popularization to the rise of universities as full-fledged research facilities—they were major nodes of science organization. In terms of their (inter)disciplinarity, funding, and public engagement, they were highly diverse due to the different institutional roots, policies, spatial settings, and research agendas involved. Thus, a division between inclusive and exclusive cultures of science organization seems more appropriate than the common name-related distinction between academies and societies, which provides little information about the actual public engagement of an institution. Second, Viennese learned societies contributed, sometimes as junior partners of state agencies, to the creation of a scientific framework for imperial identity. This locates them as co-initiators of a much wider development reflected, for example, in the United States in the founding of federal agencies such as the Coast and Geodetic Survey (1878), and as precursors of the internationalization of science.<sup>57</sup> In their research, Viennese societies relied on a specific form of citizen participation that did not, as yet, distinguish between scientists and “non-professionals.” As I will argue in the following section, by successfully turning their intra-imperial foci to the outside—the High Alps, the “Orient,” and the Adriatic—they developed new models of participation and transformed from knowledge exchange hubs to infrastructure providers.

## From Knowledge Hubs to Infrastructure Providers

### *Periodicals and Field Stations: The Meteorological Society*

The move to launch a private meteorological society in Vienna came from the staff of the k.k. Central Institute of Meteorology and Earth Magnetism, by then established as an independent state agency, but

<sup>53</sup>See Johan Schimanski and Ulrike Spring, *Passagiere des Eises. Polarhelden und arktische Diskurse* (Vienna, 2015); Stephan Walsh, “Liberalism at High Latitudes: The Politics of Polar Exploration,” *Austrian History Yearbook* 47 (2016): 89–106; and Ingrid Kretschmer, “Die Österreichische Kongo-Expedition,” *Cartographica Helvetica* 40 (2009): 3–10.

<sup>54</sup>See Magyar Természettudományi Társulat, ed., *Tegnap és ma* (Budapest, 1937), 25.

<sup>55</sup>See Balázs Ablonczy, *Go East: A History of Hungarian Turanism* (Bloomington, 2022).

<sup>56</sup>See Kurt Gostentschnigg, *Wissenschaft im Spannungsfeld von Politik und Militär. Die österreichisch-ungarische Albanologie* (Wiesbaden, 2017), 80.

<sup>57</sup>See Ash, “Infrastructures,” 6.

still connected with the Imperial Academy of Sciences.<sup>58</sup> This initiative was part of an 1864 reform program by newly appointed Institute director Carl Jelinek (1822–76), which involved the publication of a meteorological periodical, the erection of a new Institute building, and the hiring of auxiliary staff.<sup>59</sup> By placing meteorology on a broader, public footing, the Institute aimed to gain independence from the Academy and its decreasing printing subsidies. In 1848, the Academy had begun the central collection and evaluation of weather data from empire-wide observing stations by telegraph. However, the lack of human and financial resources for effective collaborative work within the Academy itself forced them to establish this project as a separate institute: effectively, a spin-off organization.<sup>60</sup> The Austrian Meteorological Society, founded in 1865, was intended to supplement the Institute with the advantages of a private society: above all, a broad membership.<sup>61</sup> By involving volunteer observers such as teachers, officials, and clergymen, spread all across the crown lands, the Society developed into the Institute's most popular wing, acknowledging the efforts of observers and strengthening their ties to scientific life in Vienna.<sup>62</sup>

Since the Academy and the Society shared both representatives and premises, the distinction between state agency and private society was not initially obvious to all members of this new organization.<sup>63</sup> Although the Society remained a junior partner in this mutual relationship, it took over significant responsibilities in public engagement, funding, and credibility building. First of all, by holding monthly meetings, the Society networked the Institute's few paid scientists with scholars "from a wide variety of professions, honorees, and friends of science."<sup>64</sup> Its board, headed by influential government officials and Academy members such as Josef Lorenz von Liburnau (1825–1911) and Viktor von Lang (1838–1921), acted as an interface with political and scientific bodies. Second, the Society's funding through membership fees—which in the late 1860s accounted for about 30 percent of its annual endowment—provided support for projects that exceeded the remit of a state agency.<sup>65</sup> This was particularly true for the publication of the biweekly (since 1875, monthly) journal *Meteorologische Zeitschrift*, which far surpassed the Institute's yearbook in scope and international visibility. Third, in this periodical, the Society had an effective tool to demand from their contributors certain standards, reliability, and comparability in the practices of scientific data collection and documentation.<sup>66</sup> The editors managed the accreditation of local knowledge printed in the journal in the form of observations, data series, or diagrams, providing a trusted source for further work. In short, the Society served as a relay for the exchange of knowledge. It played a primary role in two areas that were critical to the scientific credibility of the new field: the production of measurement data in the field by observers, and the communication of scientific results to the (inter)national audience. The Society and its journal thus contributed to framing the new field of meteorology as a multi-stage collaborative practice connecting observers, scientists, and the public sphere.

Soon recognized as one of the foremost periodicals in its field, the journal bolstered the Institute's reputation and advanced the careers of its long-standing editors such as Julius von Hann (1839–1921),

<sup>58</sup>See Christa Hammerl and Fritz Neuwirth, "150 Jahre Österreichische Gesellschaft für Meteorologie," *ÖGM Bulletin* no. 1 (2015): 8–50. On meteorology in the monarchy see Coen, *Climate*, and on the Meteorological Society 101–2.

<sup>59</sup>See Austrian Academy of Sciences Archive, Sitzungsprotokoll der math.-nat. Klasse, 3 Feb. 1865 (B 510).

<sup>60</sup>See Hammerl, "Zentralanstalt," 19–27. Later, the Institute took over other projects initiated by the Academy, such as earthquake research and the exploration of the physical conditions of the Adriatic Sea.

<sup>61</sup>See Carl Jelinek, "Gründung," *Zeitschrift der Österr. Gesellschaft für Meteorologie* 1 (1866): 1–7. In 1904, the Society obtained permission to use the honorary title "k.k." See Austrian State Archives, AVA Inneres Mdi Allgemein 15.4 Vereine, 20876-04.

<sup>62</sup>While observers in Prussia and Russia received financial compensation, this was not the case in Switzerland, Britain, or the Habsburg monarchy.

<sup>63</sup>See [Carl Jelinek and Julius Hann], "Die k.k. Centralanstalt und die österr. Gesellschaft für Meteorologie," *Zeitschrift der Österr. Gesellschaft für Meteorologie* 1 (1866): 14–15.

<sup>64</sup>Fritsch, "Gesellschaft," 618.

<sup>65</sup>In 1869, the Institute received a state endowment of 9,200 fl., while the Society had an income of 2,900 fl. See "Budget" and "Cassa-Bericht," *Zeitschrift der Österr. Gesellschaft für Meteorologie* 4 (1869): 283–87, 591.

<sup>66</sup>By discussing new methods and instruments, the journal went beyond the "instructions to observers" put together by the Institute's first director, Carl Kreil, and later expanded by Jelinek. See Carl Jelinek, *Anleitung zur Anstellung meteorologischer Beobachtungen* (Vienna, 1869).

who was in charge for an impressive fifty-four years. Initially, the journal was aimed at two target groups: first, the Viennese communities that should ideally be convinced of the benefits of meteorology beyond the “accumulation of numbers;”<sup>67</sup> second, the observers of the Austrian monitoring network, which grew from 128 stations in 1865 to 467 in 1895. For meteorology, which was particularly reliant on the trustworthiness of its data collection, instructions included in journals were an important means of quality control before improved travel conditions allowed for the establishment of a scientific conference culture.<sup>68</sup> Observers therefore received the journal free of charge. With the internationalization of meteorological research during the 1870s, in which the Vienna Institute played a leading role, foreign readerships—and thus the comparability and objectivity of published findings—increased in importance.<sup>69</sup>

The Society’s second long-term project—the provision of infrastructure for the investigation of higher atmospheric layers—became financially feasible after 1886, when the expenses for the journal were shared between the Austrian and German Meteorological Societies. Leading the way in research on Alpine weather phenomena, Hann had successfully proposed the systematic establishment of high-altitude observatories at the Meteorological Conference in Rome (1879).<sup>70</sup> Before technologies such as kite or balloon ascents became available, summit stations such as those on Hochobir (2,041 m) and Schmittenhöhe (1,935 m) were vital for studying vertical temperature differences and inversion weather conditions.<sup>71</sup> Special conditions applied to their operation, however, and for financial reasons, meteorologists were dependent on the joint use of existing infrastructure and collaboration with Alpine clubs; the flexible organization of a private society was more practical in this regard than the administrative framework of a state agency. Accordingly, the Society began to pay hut wardens to act as observers, to purchase the measuring devices required, and to contribute to the operating costs of a few Alpine huts that either housed instruments or were situated within walking distance.<sup>72</sup> Once the Institute started to publish weather maps and forecasts in 1877, Alpine clubs developed a keen interest in the tourist benefits of weather data; albeit only at the local level.<sup>73</sup>

The erection of a summit station on Hoher Sonnblick (3,106 m) (Figure 1), the highest in the Alps until the 1930s, similarly relied on joint scientific and touristic use of infrastructure. Although observatories operated on several peaks in Europe and the United States, some only temporarily, the data obtained on Sonnblick attracted international interest due to the systematic nature and continuity of records.<sup>74</sup> The Society coordinated this large-scale project, which was implemented in just two years from 1884 to 1886. Since membership fees did not cover the long-term expenses, the Society launched a public appeal to raise private and state funds.<sup>75</sup> The result was the Sonnblick Club (1892): a popular scientific spin-off association, which took over the observatory’s maintenance and networked Viennese donors with local supporters.<sup>76</sup> The Society’s assumption of new responsibilities, such as the supervision of other altitude stations and from 1900 the promotion of balloon ascents, had

<sup>67</sup>Jelinek, “Gründung,” 1.

<sup>68</sup>See Joseph Lorenz von Liburnau, “Ueber Characterisirung der Winde. Ein Wort an die Stationsbeobachter,” *Zeitschrift der Österr. Gesellschaft für Meteorologie* 2 (1867): 145–58.

<sup>69</sup>See World Meteorological Organization, ed., *One Hundred Years of International Co-Operation* (Geneva, 1973), 1–18; and Hammerl, “Zentralanstalt,” 50–52.

<sup>70</sup>See Julius Hann, *Bericht erstattet dem zweiten internationalen Meteorologen-Congress* (Vienna, 1879).

<sup>71</sup>See Felix Auerbach, “Wetterwarten,” *Zeitschrift des Deutschen und Österr. Alpenvereins* 20 (1889): 57–70; and Marianne Klemun, “Zur Geschichte der ältesten und höchsten meteorologischen Stationen,” in *Der Hochobir*, ed. Bettina Golob (Klagenfurt, 1999), 83–94.

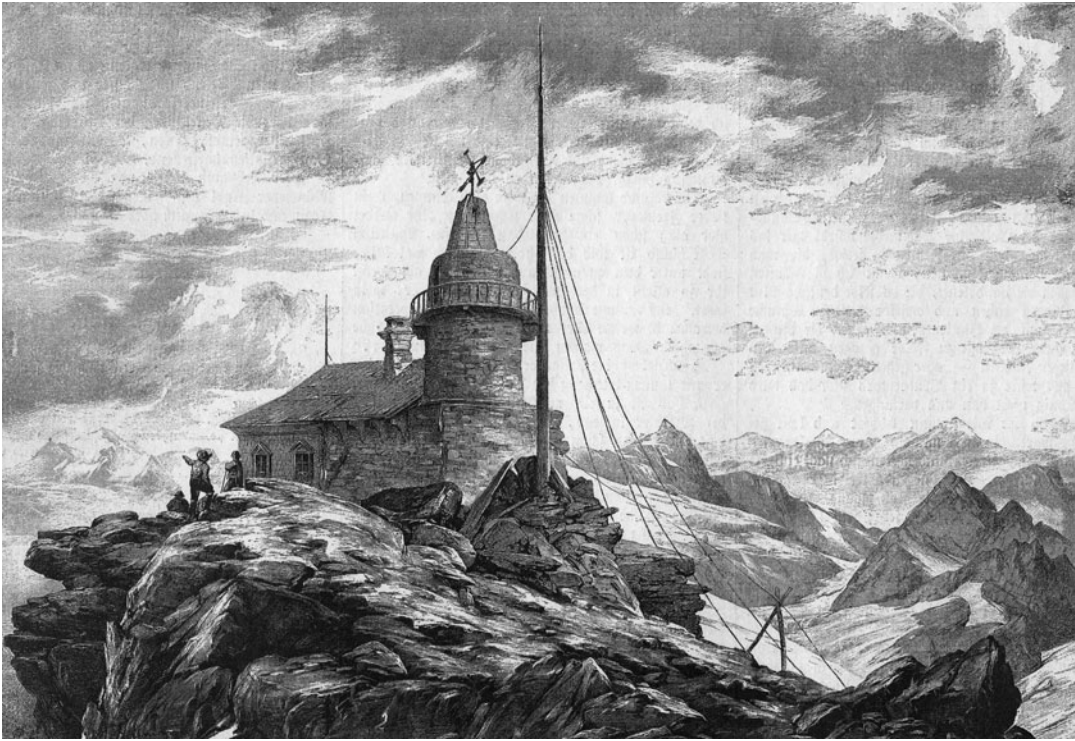
<sup>72</sup>That collaboration with the German and Austrian Alpine Club was marked by conflict is shown, for example, by contracts (1886, 1891, and 1897) concerning the operation of the Sonnblick Observatory. In 1897, the observers were placed under the supervision of the Society, which recruited and paid them. See Archive of the Austrian Meteorological Society, Uebereinkommen (15 June 1897), 3.

<sup>73</sup>From 1886 onward, the “Section for Local Meteorology” of the Austrian Tourist Club published weather reports for mountain tours around the capital area in newspapers every Saturday.

<sup>74</sup>See Deborah Coen, “The Storm Lab: Meteorology in the Austrian Alps,” *Science in Context* 22 (2009): 463–86; and Albert Obermayer, “Über das Sonnblick-Observatorium,” *Schriften, Verein zur Verbreitung naturw. Kenntnisse* 33 (1892): 380–417.

<sup>75</sup>See Meteorological Society, “Gefährdung der Meteorologischen Station,” *Jahresbericht des Sonnblick-Vereines* 1 (1892): 49–52.

<sup>76</sup>See Albert Obermayer, “Beobachtungsstation,” *Jahresbericht des Sonnblick-Vereines* 1 (1892): 1–15, 53 (statutes).



**Figure 1.** The Meteorological Observatory on the Sonnblick peak (3,106 m). Engraving by Anton Heilmann, in *Ueber Land und Meer* 57 (1887), 332.

a long-lasting effect on both its membership and funding. Initially, the Society was a platform for the accumulation and (scientific) accreditation of knowledge. Observers were an important part of its membership but were increasingly excluded from the data-analysis project and considered as mere “data collectors”—effectively, part of the measurement toolkit. Later, the Society evolved into an infrastructure provider addressing its efforts to science patrons. Due to a decline in private sponsorship, however, by 1910 the Sonnblick observatory had become a research facility increasingly funded by state subsidies but operated by private societies.<sup>77</sup>

### *Habsburg-Loyal Naturalists and Collecting Expeditions: The Oriental Society*

The Natural Scientific Oriental Society, founded by Theodor Fuchs (1842–1925), a paleontologist at the k.k. Natural History Museum in Vienna, had a different organizational framework. Its foundation was rooted in a proposal, discussed in 1889, to transform the 1,600-member-strong k.k. Geographical Society into a specialized body of university-trained professionals dedicated to the study of the Ottoman realm.<sup>78</sup> The Geographical Society had turned to science popularization in the 1880s to finance its ambitious overseas ventures, but the creation of geography chairs at Habsburg universities and the increasing nationalization of research had diminished its unifying power among its fellows. The rejection of this proposal, which would have undermined the Geographical Society’s broad membership and holistic approach, paved the way for the launch of the Oriental Society as an independent organization in 1893.<sup>79</sup> Unlike other associations, the Oriental Society did not publish a journal, nor

<sup>77</sup>For the Society’s proposal to transfer the direction of the Sonnblick Observatory to the state, see Archive of the Austrian Meteorological Society, Letter to the k.k. Ministry of Commerce (1 Dec. 1910), 3.

<sup>78</sup>See Albrecht Penck, *Ziele der Erdkunde in Oesterreich* (Vienna, 1889); and Mattes, “Science,” 163.

<sup>79</sup>See Theodor Fuchs, “Der erfreuliche Aufschwung,” *Jahresbericht der Gesellschaft zur Förderung der naturhist. Erforschung des Orients* 1 (1895): 3–11. Until Franz Toula took over the presidency of the Society in 1905, it was called the “Society for the Promotion of Natural History Research of the Orient.”

did it draw its strength from a large number of contributors and regular membership fees. Rather, the Society used its income—exclusively made up of donations by private sponsors and political, scientific, and economic bodies—to dispatch its own expeditions to Southeastern Europe and the Near East. In this respect, the Society saw itself as an “extension [of] and addition” to state agencies and other societies. But in terms of human resources and facilities, it was reliant on the Natural History Museum.<sup>80</sup>

For Habsburg policymakers, the stereotypical term “Orient” embodied the idea of the monarchy as a “cultural state” and its civilizing mission in the “East.”<sup>81</sup> It encompassed a highly heterogeneous area extending “from the southeastern borders of our monarchy . . . to India and Central Asia,” but with a distinction between the Balkan Peninsula and Asia Minor.<sup>82</sup> While the latter was intended to be exploited commercially and scientifically in the interest of economic gain as well as diplomatic objectives, the former was also the focus of expansive and integrative claims. Scholarly engagement with the “Orient” was supposed to underpin Habsburg political supremacy and safeguard access to economic resources. However, it also contributed fundamentally to the ways in which the monarchy understood itself as a transitional zone, within which differences between “East” and “West” were neutralized.<sup>83</sup> In its public funding appeal, the Oriental Society transferred this biased idea of a culturally shaped “Inner Orient” onto the natural geography of the empire. As with ethnographic or linguistic research, to study the geoscientific, zoological, or botanical diversity of the “Orient” meant to explore the monarchy itself and, as such, scholars considered it a patriotic endeavor.<sup>84</sup>

Meanwhile, separate philological and antiquarian chairs for Oriental Studies were established at Habsburg universities between 1860 and 1890. There were no equivalent discipline-building processes in natural history research, which was more dependent on international comparison of specimens and data.<sup>85</sup> This created an opening for the new Society, which intended to bundle various scholars, institutions, and their knowledge under its umbrella and channel scientific, political, and economic interests into extra-imperial ventures. By “concentrating [private and state] forces on a spatially defined area,” “Austrian natural research” was meant to enable the Habsburg Empire to keep up with the “growing powerful competition from other [European] states” in the Ottoman realm.<sup>86</sup>

Collaboration both within the Society and with its external partners took place on multidisciplinary, inter-institutional, and extra-imperial levels. First, within its board, renowned naturalists from fields such as geology, geography, zoology, and botany combined their initiatives and decided jointly—sometimes in consultation with state authorities—on the objectives, destinations, and participants of each venture.<sup>87</sup> Shared use of an expedition’s staff and facilities across disciplines was intended to minimize the expense of a given undertaking while also maximizing its impact. Second, for state agencies that did not have the funds or permission from foreign authorities to conduct field research in difficult-to-access areas such as Albania or Montenegro, the Society provided the infrastructure for collection trips abroad in exchange for subsidies. Likewise, private societies or individuals were able to secure a share of the yield, or to write their own instructions for collectors in exchange for financial or in-kind donations.<sup>88</sup> Third, in the Balkan Peninsula, the Society created a network of influential scientists who acted as local informants, established political contacts, and arranged official invitations

<sup>80</sup>Municipal and Provincial Archives of Vienna, A 2.9.1.6./1, 1893–1900, Theodor Fuchs, Presentation before the Zoological-Botanical Society, 1895, 2.

<sup>81</sup>See Johannes Feichtinger, “Komplexer k.u.k. Orientalismus,” *Orientalismen in Ostmitteleuropa*, eds. Robert Born and Sarah Lemmen (Bielefeld, 2014), 31–63.

<sup>82</sup>Stapf, “Antheil,” 97.

<sup>83</sup>See Johannes Feichtinger, “Nach Said. Der k.u.k. Orientalismus,” in *Bosnien-Herzegowina und Österreich-Ungarn*, eds., Clemens Ruthner and Tamara Scheer (Tübingen, 2018), 307–24; and Stijn Vervaet, *Centar i periferija u Austro-Ugarskoj* (Zagreb, 2013).

<sup>84</sup>See Municipal and Provincial Archives of Vienna, A 2.9.1.6./1, 1901–27, Theodor Fuchs, Founding call, 1894.

<sup>85</sup>See Sibylle Wentker, “Orientalistik in Wiener Zeitschriften,” in *Wissenschaftliche Forschung in Österreich*, eds. Christine Ottner, Gerhard Holzer, and Petra Svatek (Göttingen, 2015), 199–200.

<sup>86</sup>Municipal and Provincial Archives of Vienna, A 2.9.1.6./1, 1901–27, Fuchs, Founding call, 1894.

<sup>87</sup>See the Society’s minute book (1893–1938) in the Vienna Natural History Museum Archive, ID 1771/1, 2 May 1903 (Crete Commission), and 19 November 1907 (Executive Committee).

<sup>88</sup>See *ibid.*, 14 April 1902 (Asia Minor Expedition).

for the travelers. In this way, it transformed the intra-imperial model of corresponding members into a system of proactive Habsburg-loyal agents.

Before the Society began to undertake centrally planned, fully funded expeditions in the early 1900s, it served as a hub for sharing knowledge and building networks between the capital's communities and naturalists abroad.<sup>89</sup> Members in the crown lands supported the ventures financially but were barely involved in decision-making processes. Foreign naturalists from Southeastern Europe, on the other hand, were the prime target of member recruitment efforts. Many of these had actually studied in Vienna, and from their student days, they often knew the Society's leading figures such as Nikolaus Dumba (1830–1900), Ottoman Consul General and industrialist, or the geologist Franz Toula (1845–1920). This shared academic background continued to provide a common framework, so foreign members did not hesitate to volunteer as data collectors or organize and lay the groundwork for research trips. As travelers in their own right, they promised greater success due to their local expertise, language skills, and access to sites and sources. It is beyond question that this form of cooperation facilitated acculturation, i.e. the adoption of Viennese practices and scientific values abroad. These included the use of German for science communication, consensus on the integrity of the monarchy, and shared reference to the same bodies of knowledge such as theories, terminology, and handbooks. Ultimately, the Society's "lively scientific dialogue with colleagues and natural history institutes from the Orient" was intended to create a loyal educational class in the peripheries of the empire and keep both national and scientific independence movements at bay.<sup>90</sup> Foreign naturalists likewise benefited from access to the Society's resources, spaces, and networks, using these to share knowledge, gain credibility in public, peer, and official circles, and open doors to bilateral collaboration and career opportunities. The Society gave members abroad a voice in Vienna's communities by publicly discussing their research and integrating their findings into the existing body of scientific knowledge.

The expeditions organized by the Society were not individual explorative endeavors but extensive trips for the systematic collection of natural history specimens. These are fundamental to all natural history research: if scientific bodies were unable to send out their own missions, specimens had to be exchanged or purchased at great expense.<sup>91</sup> This meant that their distribution among different facilities was often arranged before a trip had even begun. In the case of the Society, the primary beneficiary was the Natural History Museum, to which the specimens were to be donated unless otherwise agreed.<sup>92</sup> Since the study of collected specimens kept numerous experts busy for many years, such trips were significant investments in the future of scientific institutions. While subsidies from a few private donors accounted for the lion's share of the Society's income at the turn of the century, by 1910, this role was taken over by governmental agencies. In individual cases, the funds raised through public appeals and applications to state authorities came close to the most prestigious expeditions of the Academy and enabled some major undertakings, including trips to Asia Minor (1900–02), Crete (1904), Albania (1906), Mesopotamia (1910), and Armenia (1914).<sup>93</sup> "In the manner of the k.u.k. Legations and Consulates or the representatives of larger domestic trading houses," one or two travelers, mostly university graduates, would stay at their destinations over long periods, have a guide at their disposal, and assiduously engage in collecting (Figure 2).<sup>94</sup> Although travelers were specialized in a single discipline, activities on-site were often diverse and might include cartographic surveys. The Society thus understood collaboration as the bundling of private

<sup>89</sup>See Franz Toula, "Aufruf," *Jahresbericht des Naturw. Orientvereins* 11 (1905): 3–6.

<sup>90</sup>"Satzungen," *ibid.*, 8.

<sup>91</sup>See Kurt Schmutzer, "Naturalists at Work," in *Expeditions as Experiments*, eds. Marianne Klemun and Ulrike Spring (London, 2016), 97–119.

<sup>92</sup>See "Sammlungsangelegenheiten," *Jahresbericht der Gesellschaft zur Förderung der naturhist. Erforschung des Orients* 6 (1900): 6.

<sup>93</sup>The Society's expenses for the Mesopotamia Expedition, for example, amounted to 25,000 crowns, which was about twice the annual income of a full professor at the Vienna University (8,000–16,000 crowns). See Roman Sandgruber, *Traumzeit für Millionäre* (Graz, 2013), 108.

<sup>94</sup>See Municipal and Provincial Archives of Vienna, A 2.9.1.6./1, 1901–27, Fuchs, Founding call, 1894.



**Figure 2.** Expedition of the Oriental Society to Cilicia (Asia Minor) in 1901. Franz Schaffer (right, by tent entrance), geologist and volunteer of the Vienna Natural History Museum, Gottfried Stransky (left), dragoman (interpreter) of the Austrian Archaeological Institute in Smyrna, and their Ottoman companions. Municipal and Provincial Archives of Vienna, A 2.9.1.6./2 Album Schaffer, 1.

and state resources to enable multidisciplinary undertakings planned by the board, the yield of which was distributed centrally.

### *Research Vessels and (Inter)nationalism: The Adriatic Society*

The Society for the Promotion of the Scientific Exploration of the Adriatic, launched in 1903 by renowned Viennese scientists and politicians, was also meant to facilitate multidisciplinary collecting activities. In the process, it evolved into a promoter of an integrative understanding of maritime habitats and their diversity. As with the “Orient,” the Adriatic Sea was vital to the Habsburg claim to supremacy, on a par with European sea empires. With the bustling free port of Trieste and rapid services through the Suez Canal to the Far East, it was the monarchy’s “window on the world”; but in the face of rising nationalism and rivalry with Italy, the Adriatic became the object of nationalist ideas aimed at making it a “mare nostrum.”<sup>95</sup> As the lecture by zoologist Berthold Hatschek (1854–1941) at the Society’s founding meeting demonstrates, the study of this sea was integral to imperial ambitions and had a high mobilization capacity, not least due to the Austrian Littoral’s popularity as a tourist destination.<sup>96</sup> Given how the monarchy’s navy and Lloyd shipping company used the Adriatic for military and commercial purposes, it would be “Austria’s task to systematically pursue its exploration,” turning the Society’s agenda into a patriotic duty.<sup>97</sup> However, since this venture would overburden the state, the Society—following the example of

<sup>95</sup>Borut Klabjan, “Scramble for Adria: Discourses of Appropriation of the Adriatic Space,” *Austrian History Yearbook* 42 (2011), 18.

<sup>96</sup>See Anonymous, “Zur Erforschung der Adria,” *Neue Freie Presse* 13857 (1903): 9–10.

<sup>97</sup>Founding committee, “Aufruf,” *Jahresbericht, Verein z. Förderung d. naturw. Erforschung d. Adria* 1 (1904): 5.

marine stations in Naples, Bergen, and Woods Hole (USA)<sup>98</sup>—sought funding through private donations and entered into a mutually beneficial partnership with the k.k. Zoological Station in Trieste.<sup>99</sup>

Previous Habsburg explorations of the Adriatic, starting in the 1850s, followed the model of intra-imperial ventures but were also inspired by British and French round-the-world expeditions. It set out to emulate these in the “fatherland’s sea,” albeit on a smaller scale. Apart from research by individual naturalists on coastal areas, the navy was the driving force and indispensable collaborator in projects on the open sea. Vice-Admiral Bernhard Wüllerstorff-Urbair (1816–83), who headed the Meteorological Society during his tenure as Minister of Commerce, commissioned the navy to resurvey the coastline and depth of the Adriatic (1866–73) as well as encouraging oceanographic studies by teachers of the Naval Academy in Rijeka.<sup>100</sup> He also created an Academy Commission (1867–84), which aimed to investigate the sea’s physical conditions, especially currents, salinity, and temperature, by means of stations set up at the coast. The Commission, however, gradually ceded this task to the Central Institute of Meteorology. Subsequent deep-sea expeditions (1890–98), based on collaboration between the navy, the Academy of Sciences, and the Vienna Natural History Museum, involved marine biology but shifted the geographical focus to the Eastern Mediterranean and Red Sea. The survey of topographical, geophysical, and biological conditions at more than 400 predetermined sites over the summer period, making the Mediterranean one of the best-explored seas of the world, was limited in the Adriatic to the collecting of zoological-botanical specimens, predominantly in its southern stretch.<sup>101</sup>

The Society built on these initiatives, but in its interdisciplinary orientation and breadth of sponsorship, it placed Habsburg marine research on a new footing. Its approach was based on cutting-edge studies on the interdependence of physical conditions and marine organisms, which were begun in the 1860s by individuals such as Lorenz von Liburnau—one of the Society’s founding fathers—and were now continued on an institutional level.<sup>102</sup> In contrast to costly and cumbersome navy ventures, specimen collecting and measurements at the same spots over a whole year using motor launches, a narrow survey grid, and the deployment of a few, specialized researchers were intended to provide trustworthy and comparable data, and thus fresh insights into the dependence of biological and oceanographic conditions.<sup>103</sup> In its shift from the study of world oceans to limited sea areas, the Society followed international developments.<sup>104</sup> However, its integrative approach was also a response to the prohibition on penetrating Italy’s maritime territory; and its limited funds in comparison to other European projects initially reduced the scope of its studies to the Gulf of Trieste. From the Society’s point of view, the exploration of the Adriatic not only delivered local knowledge but was also key to a better understanding of global maritime environments.

The fact that the Society, despite its short period of activity before 1914, was able to raise substantial funds and recruit prominent science patrons, politicians, and even Habsburg family members to its board was primarily due to two mobilizing factors. Pooling resources was the only way for Austria to keep up with the growing international competition—especially from German scientists who had established a state-funded Laboratory for Marine Research in Kiel. In the Adriatic, too, a marine station of the Berlin Aquarium, founded in Rovinj in 1891 but initially without permanent research staff,

<sup>98</sup>See Elena Canadelli, “Biological Stations and the Study of Marine Life,” *ICES Journal of Marine Science* 73 (2016): 1447–57; and Charles Kofoid, *The Biological Stations of Europe* (Washington, 1910).

<sup>99</sup>On the Station’s history, see the ongoing book project: Gerhard Aubrecht, Josef Dalla Via, Alfred Goldschmid, Verena Stagl, and Manfred Walzl, “Die Geschichte der k.k. Zoologischen Station Triest,” *Acta ZooBot Austria* 157 (special issue for Friedrich Schiemer) (2020): 21–24.

<sup>100</sup>See Joseph Luksch and Julius Wolf, “Der Antheil Österreich-Ungarns an den oceanographischen Forschungen,” *Österr. Rundschau* 18 (1895): 1–20, 102–27; and Joseph Lorenz Liburnau, “Die neue österreichische Aufnahme und Beschreibung des adriatischen Meeres,” *Österr. Revue* 5, no. 9 (1867): 90–113.

<sup>101</sup>See Günther Schefbeck, “The Austro-Hungarian Deep-Sea Expeditions,” *Biosystematics and Ecology* 11 (1996): 1–27.

<sup>102</sup>See Joseph Lorenz Liburnau, *Physicalische Verhältnisse und Vertheilung der Organismen im Quarnerischen Golfe* (Vienna, 1863).

<sup>103</sup>See Joseph Lorenz Liburnau, “Bericht,” *Jahresbericht, Verein z. Förderung d. naturw. Erforschung d. Adria* 1 (1904): 13–17.

<sup>104</sup>See Eric Mills, *Biological Oceanography* (Toronto, 2011), 17.



threatened to eclipse the monarchy's own efforts.<sup>105</sup> Second, the Society used its initial plans to conduct applied research for commercial fisheries and to erect its own aquarium in Trieste to secure public support, even if these aims quickly took a back seat to basic research or else were abandoned entirely. As in other societies, knowledge exchange between members still played a role, but public lectures and exhibitions served fundraising purposes. Research outcomes, in turn, were mainly aimed at an audience of university-trained professionals, with results published in Austrian and international journals.

The partnership between the Society and the Zoological Station in Trieste—the monarchy's only maritime station, erected in 1875 as a branch of the Vienna and Graz universities, pursued mutual interests.<sup>106</sup> The Society obtained a logistical base and the station's staff trained volunteers for its work program, which was prepared well in advance by interdisciplinary commissions. This enabled the Society to better fulfil its coordination and fundraising responsibilities. Meanwhile, the (poorly) state-funded Station, which was primarily intended for teaching purposes and to supply Habsburg universities with specimens, was able to develop into a recognized research facility. The infrastructure provided by the Society, such as seagoing vessels and scientific instruments, could be used jointly by the Station free of charge or leased from the Ministry of Education for teaching. Part of the acquisition cost was thus returned to the Society as rent. Its largest investment was the construction of the 20-m research vessel *Adria*, the first of its kind in the monarchy. With shared laboratory workstations for a total of six oceanographers, zoologists, and botanists, its set-up fostered joint data collection and integrative thinking (Figure 3).<sup>107</sup> The plankton biologist Carl Cori (1865–1954), director of the Station and Society Board member, served as an interface between the two institutions. He not only supervised the building of the *Adria* but also directed the multi-week research cruises that took place four times a year.

The gradual upgrade of the fleet, as well as the widening of the survey radius from the Gulf of Trieste (1904–05) to the coastal sea between the Tagliamento estuary and Istria's southern tip (1906–10), had a lasting impact on how researchers and institutions collaborated. While the Station's staff initially worked together on an open motor launch, sometimes with the assistance of a local teacher, on board the *Adria* young “professionals” from Vienna gradually took over the leadership role on behalf of their academic teachers. This new vertical division of labor in the sampling process, together with new measuring instruments in line with international standards—which required professional knowledge to operate—created a clear hierarchy in on-board collaboration.<sup>108</sup> As the survey area expanded, the diversity of marine environments and ecological factors such as inflowing rivers, weather conditions on land, and human pollution became increasingly evident. Recognizing that ocean samples were not enough for a thorough understanding of marine habitats, scientists proposed to incorporate data and scientists/observers from existing meteorological and hydrological stations along the coast and also to establish new monitoring stations.<sup>109</sup> Investigating large-scale processes, such as clockwise currents through the Adriatic, would also require comparable data from other coastal stretches.

Geographers interested in large-scale hydrographic or economic aspects sparked the internationalization of Adriatic research. In German-speaking countries, they moved the development of oceanography forward and, at the Ninth International Geographical Congress (1908), proposed pooling research interests in the Mediterranean—and especially the Adriatic—in parallel with the International Council for the Exploration of the Sea, founded by countries bordering the North and Baltic Seas. Accordingly, the Italian Society for the Progress of Science set up a “Comitato talassografico” (Oceanographic Committee), which in 1910 was transformed into a government agency headed

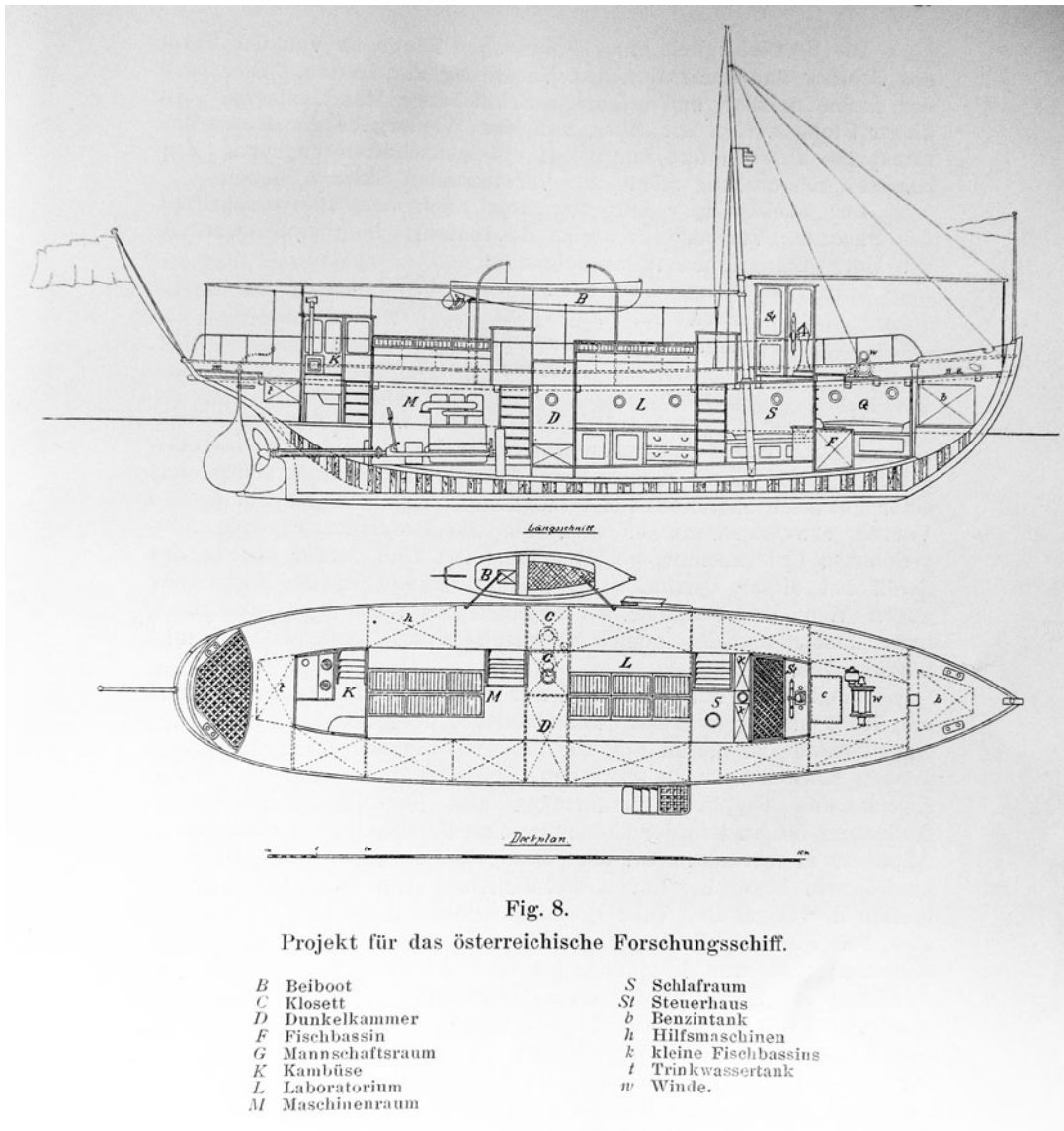
<sup>105</sup>See Dušan Zavodnik, “North Adriatic Centenarian: The Marine Research Station at Rovinj,” *Helgoländer Meeresuntersuchungen* 49 (1995): 441–53.

<sup>106</sup>See Aubrecht et al., “Geschichte,” 21–24; and [Julius Wiesner], *Österreichische Adriaforchung* (Vienna, 1913), 8–9.

<sup>107</sup>See Carl Cori, “Das österreichische Forschungsschiff *Adria*,” *Jahresbericht, Verein z. Förderung d. naturw. Erforschung d. Adria* 5 (1908): 16–29.

<sup>108</sup>See Gustav Göttinger, “Die Ozeanographische Ausrüstung,” *Mitteilungen der Geographischen Gesellschaft* 53 (1910): 196–216.

<sup>109</sup>See Carl Cori, “Über die Meeresverschleimung,” *Archiv für Hydrobiologie* 1 (1906): 385–91.



**Figure 3.** Draft for the construction of an “Austrian research vessel,” launched under the name *Adria* in 1908. It was the monarchy’s first ship designed explicitly for scientific purposes, and in addition to seawater aquariums and a laboratory with instruments and microscopy stations, it provided accommodation for six researchers and five crew members. Carl Cori, *Ein österreichisches Forschungsschiff* (Vienna, 1906), 19.

by the Minister of the Navy and primarily serving the needs of the fishery and shipping industries.<sup>110</sup> The swift fruition of these efforts, leading to Italian coastal research ventures with navy vessels, and the possibility of claiming similar support from the Austrian government to enter high-seas research, prompted the Vienna Society and its new leading figure, the German-born geographer Eduard Brückner (1862–1927), to seek cooperation with Italian stakeholders. The bilateral Permanent Adriatic Commission (1910), resulting from governmental negotiations and initially serving to coordinate and standardize methods, defined eight profiles running from west to east along the Adriatic coast. Both countries would undertake close-meshed observations and exchange the results. For the

<sup>110</sup>See Sandra Linguerrì, *Vito Volterra e il Comitato talassografico italiano* (Firenze, 2005).

four profiles to be explored by the Habsburg monarchy, the Society was provided with the navy vessel SMS *Najade*, with two-thirds of the operating costs borne by the state.<sup>111</sup>

As an outcome of this international collaboration, the Society became a privately run governmental body for coordinating and providing infrastructure for marine research. It effectively bypassed the German station in Rovinj, since 1911 an institute of the Kaiser Wilhelm Society, as well as the efforts of the Hungarian Adriatic Society (*Magyar Adria Egyesület*), established in Budapest in 1910 as a reaction to the Austro-Italian alliance.<sup>112</sup> These bilateral projects lasted until the advent of World War I and revealed the ecosystem of the Adriatic through the exchange of data obtained on the open sea and at coastal stations, and their compilation in maps.<sup>113</sup> However, there was no joint publication of the results and ecological insights obtained during the collaboration.

## Collaborative Practices

### *State Agencies and Private Societies*

In London, Paris, and Berlin, private societies and, to some extent, scientific state agencies could rely on donations from the wealthy bourgeoisie and aristocracy.<sup>114</sup> In Vienna and other parts of Cisleithania, however, scientific patronage did not develop to the same extent, and many donations were instead directed toward artistic pursuits.<sup>115</sup> Here, both state and private mainstays of science organizations were less well-endowed and more dependent on collaboration. Partnerships were established with other research facilities, but also with the navy, the diplomatic service, and sponsors from the higher nobility, who provided the infrastructure for research activities.<sup>116</sup> Collaborations between state agencies and private societies became crucial. Mostly initiated by senior scientists in response to growing (inter)national competition and political or financial crises, these partnerships relied on the pooling of scientific, governmental, and civil-society interests to carry out individual projects. As the case of the Central Institute of Meteorology and its Society illustrates, they could also develop into long-term, strategic alliances. While state agencies tended to maintain institutional continuity through their fixed endowments, premises, and mandates, private societies and their modes of collaboration were more changeable. These societies could operate more autonomously in their practices and integrative goals than could state agencies. This flexibility made them better suited for project-based or multidisciplinary work.

Joint projects between state agencies and private societies served mutual benefits. At the institutional level, these partnerships were grounded in sharing human, financial, and infrastructural resources to enable collaborative work, with the societies mostly taking on the role of a junior partner. Partnerships were shaped by economic considerations and strengthened the power of particular research fields or institutions by exploiting synergies, such as increasing the efficiency, productivity, and sustainability of particular undertakings, minimizing risks, and mobilizing additional political and public support.<sup>117</sup> At the individual level, partnerships drew on the harmonious (but not hierarchy-free) interaction of exclusive and inclusive pools of contributors with varying academic

<sup>111</sup>See Josephinum Collection (Vienna), Legacy Julius Tandler, 4036-1, Report on a conference for the establishment of a Permanent Adriatic Commission (June 1910), 9; and Alfred Grund, "Die italienisch-österreichische Adriaforchung," *Lotos* 59 (1911): 325–40.

<sup>112</sup>From 1913, the Hungarian Society conducted its own research cruises departing from Rijeka. These met the standards of the Austro-Italian collaboration but were not part of it. See Gyula Leidenfrost, "Az első magyar Adria-expedíció," *A Tenger* 4 (1914): 71–144.

<sup>113</sup>See Eduard Brückner, "Einige Ergebnisse," *Schriften, Verein zur Verbreitung naturw. Kenntnisse* 56 (1916): 372–76.

<sup>114</sup>See Bernard Lightman, "Huxley and the Devonshire Commission," in *Victorian Scientific Nationalism*, eds. Gowan Dawson and Bernard Lightman (Chicago, 2014), 100–30; Robert Fox, *The Savant and the State* (Baltimore, 2012); and Manuel Frey, *Macht und Moral des Schenkens* (Berlin, 1999).

<sup>115</sup>See Wolfgang L. Reiter, "Mäzenatentum, Naturwissenschaft und Politik," *Österreichische Zeitschrift für Geschichtswissenschaften* 25, no. 3 (2014): 212–47.

<sup>116</sup>See Herbert Matis, "Dual Use Research," in *Wandlungen und Brüche*, eds. Johannes Feichtinger, Marianne Klemun, Jan Surman, and Petra Svatek (Göttingen, 2018), 145–54.

<sup>117</sup>See Ash, "Infrastructures," 7.

statuses, sites of activity, and forms of knowledge. As demonstrated by the Oriental Society, this organizational model could involve both Habsburg and foreign scholars, who, in the hope of personal gain, acted for the benefit of state and society. At the epistemic level, partnerships aimed to accumulate and accredit extensive bodies of local sources, which, as a trustworthy basis for further research or decision-making, promised multiple benefits for science, politics, and civil society. To avoid jeopardizing cooperation, the societies were careful about the ownership of knowledge and meticulously listed all donors in their publications, especially those from the crown lands and abroad. Often, such collaborations made it possible to monitor several stages of knowledge production, from field observations to the (inter)national dissemination of results, ensuring their comparability and thus the credibility of the relevant discipline.<sup>118</sup> Strategic alliances might also involve applied research, as illustrated by the joint use of infrastructure by the k.k. Photographical Society and the k.k. Institute for Graphic Education and Research, both headed by the chemist Joseph Eder (1855–1944).<sup>119</sup>

The simultaneous internationalization and nationalization of the monarchy's research landscape in the 1870s opened up new opportunities for institutional collaboration.<sup>120</sup> A booming congress culture and the creation of bi- or multilateral commissions to coordinate (overlapping) national ventures eclipsed previous means of knowledge exchange such as correspondence networks, scholarly travel, and publication sharing.<sup>121</sup> Viennese scientific societies, usually in tandem with state agencies, co-initiated transimperial undertakings, especially in fields that enjoyed political and public support and necessitated the concerted collection and evaluation of findings by multiple parties, often across the globe. These undertakings included, for example, the organization of the first International Meteorological Congress in Vienna in 1873 and the activities of the resulting International Polar Commission,<sup>122</sup> as well as the Habsburg-supported exploration and economic exploitation of the Congo. To further his purportedly altruistic ambitions, the Belgian King Leopold II had successfully proposed the latter in 1876 as a multilateral project, financed and operated by several European geographical societies.<sup>123</sup> In historical and philological fields, international exchange tended to begin later, as these were often based on the study of national or linguistic areas. However, as Martin Rohde has shown with the example of the Shevchenko Scientific Society in Lviv, which united Ukrainian scholars from both sides of the Austro-Russian border, national approaches could also foster transimperial collaboration.<sup>124</sup> Overall, the Viennese societies only rarely succeeded in elevating their intra-imperial models of cooperation to an international level. As the internationalization of Adriatic research indicates, cross-border cooperation was often limited to data collection or the preparation of meetings, also due to differing national interests.

The rise of universities as sites of research placed privately organized scholarship, already less developed than in Britain or France, under growing pressure and accelerated the decline of the older gentleman-scholar style of intellectual life. Although learned associations for professors and students existed at universities, these served social or representative rather than joint research purposes.<sup>125</sup> Moreover, the new state-supervised university organization on the basis of ordinaries (full professorships), finally written into law in 1873, was incompatible with the bourgeois-driven research model that was rooted in the participation, seniority, and holistic approach of many volunteers.<sup>126</sup> This led

<sup>118</sup>See Coen, *Climate*, 4–13.

<sup>119</sup>See Maren Gröning, "Die Photographische Gesellschaft," in *Die Explosion der Bilderwelt*, ed. Michael Ponstingl (Vienna, 2011), 167–75.

<sup>120</sup>See Ash and Surman, *Nationalization*.

<sup>121</sup>See Robert Fox, *Science without Frontiers* (Corvallis, 2016).

<sup>122</sup>See Roger Launius, James Fleming, and David Devorkin, eds., *Globalizing Polar Science* (New York, 2010); and Frank Berger, Bruno Besser, and Reinhard Krause, eds., *Carl Weyprecht* (Vienna, 2008).

<sup>123</sup>See Sanford Bederman, "The 1876 Brussels Geographical Conference," *Terrae Incognitae* 21 (1989): 63–73; and Jan Vandersmissen, "Emile de Laveleye, Leopold II and the Creation of the Congo Free State," *Belgisch Tijdschrift voor Nieuwste Geschiedenis* 41 (2011): 7–57.

<sup>124</sup>See Martin Rohde, *Nationale Wissenschaft zwischen zwei Imperien. Die Ševčenko-Gesellschaft der Wissenschaften* (Göttingen, 2022).

<sup>125</sup>See Naturwissenschaftlicher Verein, ed., *Festschrift* (Vienna, 1907), 3–20.

<sup>126</sup>See Kamila Staudigl-Ciechowicz, "Zwischen Aufbegehren und Unterwerfung," in *Universität – Politik – Gesellschaft*, 650 *Jahre Universität Wien*, vol. 4, eds. Mitchell Ash and Josef Ehmer (Vienna, 2015), 429–60.

to growing rivalries between representatives of state agencies and of the universities and, in some societies, to a monopolization of the management by full professors, making private organizations dependent on university departments and staff.

The professionalization of science and its delimitation as a specific occupational profile also affected partnerships between state agencies and private societies. Around 1890, the latter transformed into research platforms that provided state agencies with infrastructure and funding, coordinated tasks, and disseminated results to the public, but whose “ordinary” members were no longer directly involved in knowledge production. Figure 4 illustrates this transition by comparing the annual balances of the Meteorological, Oriental, and Adriatic Societies, broken down by state and private income sources and spending on publications and infrastructure. Until the late 1870s, the societies were largely funded by membership fees and used most of their income to publish their own journals. Subsequently, donations from private individuals—initially from the higher nobility, and from 1885 onward mainly from the wealthy bourgeoisie—gained importance and made it possible to set up field research facilities. However, the funds raised through public crowdfunding campaigns, including a growing number of small donors, were not sufficient for the societies’ long-term operation. For this reason, beginning in the 1900s, many societies, together with state agencies, sought to increase government subsidies for the infrastructure they operated or, like the Ethnographical Society, to hand responsibility for their museum entirely to the state.<sup>127</sup> Since the state administration was more willing to provide subsidies to private bodies than to enter into long-term commitments, the latter strategy succeeded in only a few cases, particularly in applied branches of research. The Adriatic Society’s income over ten years was nevertheless equivalent to one-half and one-third, respectively, of the private endowment for the first extramural facilities for basic research: the Institute for Experimental Biology (founded in 1903 as a private facility and transferred to the Vienna Academy in 1914) and the Academy Institute for Radium Research (1910).<sup>128</sup> Private societies and their partnerships with state agencies should therefore be understood as precursors of extramural research organizations, financed by crowdfunding and state subsidies. The combination of less regulation and greater collaboration meant that they encouraged multidisciplinary and project-based research. Given the equipment of the research vessel *Adria*, laboratory work played some part in these projects, but the emphasis was on fieldwork.

### *Bureaucracy and Bourgeoisie*

In contrast to political associations, which were prohibited until the Basic Law (*Staatsgrundgesetz*) of 1867, scientific societies were “mediating bodies between government, state apparatus, and private initiative.”<sup>129</sup> Through their events, lectures, and meetings, scientific societies provided an environment in which aristocrats adopted bourgeois behaviors. Class distinctions between aristocracy and bourgeoisie became less pronounced as a result of social goals serving the common good, such as education, welfare of the state, and prosperity. Accordingly, Archduke Stephan (1817–67) joined the Lower Austrian Trade Society in 1839 as a regular member, and anyone who used noble titles during meetings had to pay for a bottle of sparkling wine.<sup>130</sup> Even the Political-Juridical Society, one of the mobilization sites of the March Revolution, exerted influence in political decision-making in the 1840s because many of its members also occupied influential positions in the state administration.<sup>131</sup> Many liberals active in

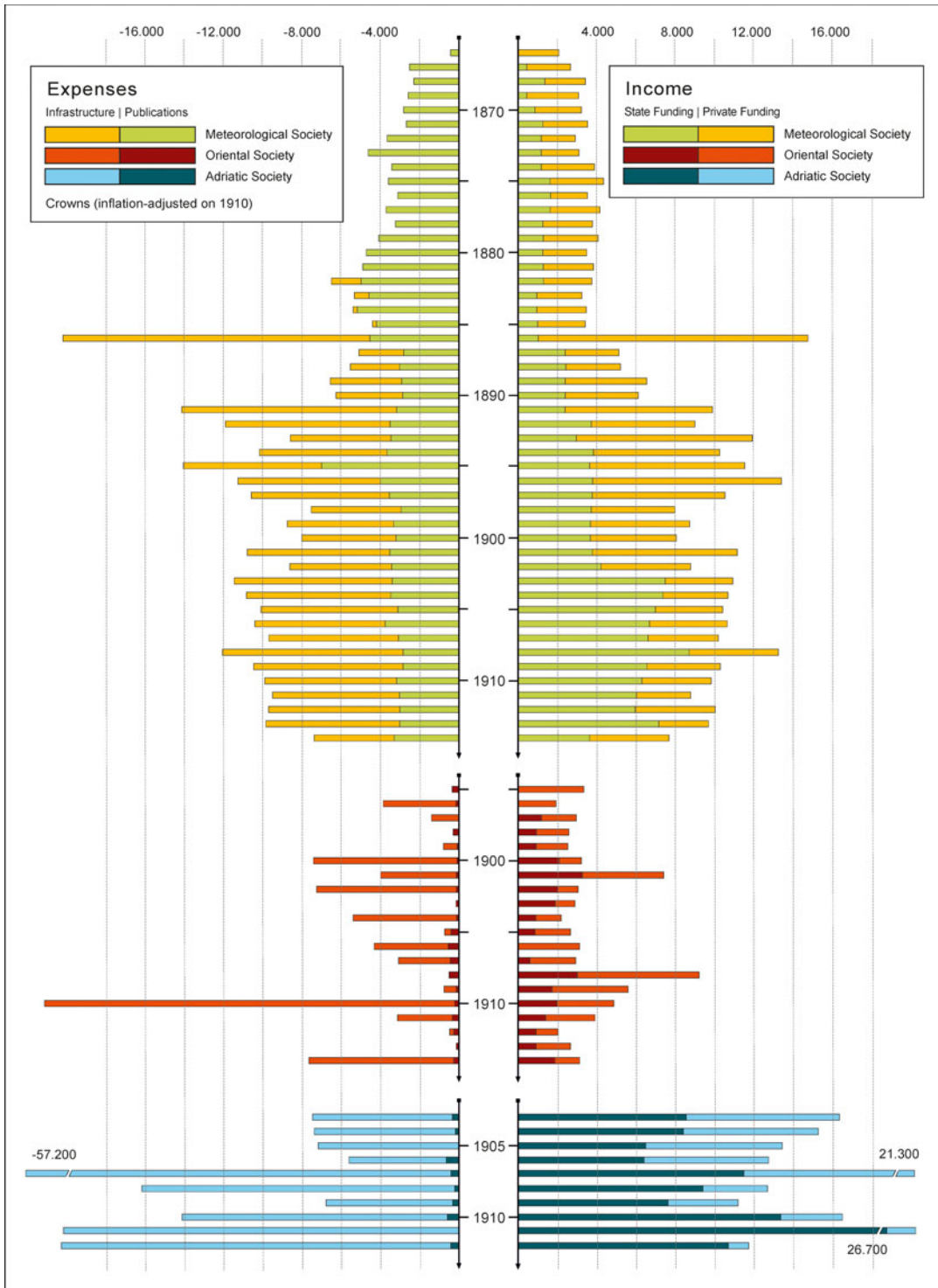
<sup>127</sup>See Herbert Nikitsch, *Auf der Bühne früherer Wissenschaft. Aus der Geschichte des Vereins für Volkskunde* (Vienna, 2006), 146–48.

<sup>128</sup>The income of the Adriatic Society between 1903 and 1912 amounted to 160,000 crowns, while the private endowments to found the institutes of Radium Research and Experimental Biology were 500,000 and 300,000 crowns, respectively. See Reiter, *Aufbruch*, 166, 297.

<sup>129</sup>Werner Drobesh, “Vereine und Interessenverbände auf überregionaler (cisleithanischer) Ebene,” in *Die Habsburgermonarchie 1848–1918*, eds. Helmut Rumpler and Peter Urbanitsch, vol. 8, pt. 2 (Vienna, 2006), 1029.

<sup>130</sup>Ludwig Frankl, “Wie der niederösterreichische Gewerbeverein entstanden ist,” *Die Presse* no. 92 (1862): 1–3. See Hans Peter Hye, “Josef Bermanns Tagebücher,” *Wiener Geschichtsblätter* 44 (1989): 124–25.

<sup>131</sup>See Drobesh, *Vereine*, 1035.



**Figure 4.** Comparison of annual expenses and income of the Meteorological, Oriental, and Adriatic societies from 1866 to 1914. Expenses are split between costs for publications and research infrastructure such as field stations or collecting trips, and income between state funding (by the government or imperial house) and private funding (by membership fees or science sponsors). Source: Treasury reports in the journals of the relevant societies.

these associations, including Viennese factory owners like Theodor Hornbostel (1815–88), and senior bureaucrats from the (partially ennobled) bourgeoisie or the old landowning nobility like Anton von Schmerling (1805–93), also held leading positions in societies of the neo-absolutist period—sometimes parallel to, as a step toward, or following a career as minister or ministry official. The fact that relatives of early members—even those who changed profession—remained active in societies up to the third generation indicates that public and domestic spheres were intertwined and that bourgeois families passed on the disposition to participate in associational life and science as a collaborative.<sup>132</sup> This practice particularly involved women, who initially attended society lectures as the presenters' wives, sisters, or daughters before successfully applying for membership themselves; Helene Hornbostel (1815–89) established her own educational association for women.<sup>133</sup>

The Habsburg bureaucracy was the backbone of Vienna's learned societies. From commissioners to diplomats, the civil service was a heterogeneous but ever-growing group in the constitutional state.<sup>134</sup> Until the *Gründerzeit* economic boom and the rise of new middle-class actors, medium- and high-ranking officials represented the “most distinguished group of the educated bourgeoisie.”<sup>135</sup> An exception to this was the hereditary/high nobility, who worked primarily in the foreign and education ministries. Loyal to the imperial house, but at the same time, a co-driver of liberal and national claims, the bureaucracy contributed significantly to the emergence of the Viennese bourgeoisie as a community sharing the same culture and virtues, regardless of its social stratification.<sup>136</sup> A solid income, flexible office hours, and sometimes work-related travel provided middle and senior officials with opportunities for scholarly activities, such as the collection of natural specimens or artefacts. These were often private initiatives, but their impact was not limited to fulfilling a personal passion; they brought public benefit, which could in turn open up new career opportunities. Naturalists such as Ignaz Schiner (1813–73), a dipterologist and ministry official, transformed societies into places of bureaucratic self-realization that, while espousing liberal demands including freedom of expression, co-determination, and public accessibility of knowledge, were also committed to patriotism and non-partisanship. The “bureaucratic science” practiced in associational life assumed increasingly bourgeois traits toward the late nineteenth century, partly due to the popularization efforts of bureaucrats themselves.<sup>137</sup> At the same time, it shifted old-style intellectual(-political) exchange to informal forums such as salons or coffeehouses and turned it into a form of leisure activity.<sup>138</sup>

The various occupational groups that joined the societies of the neo-absolutist period alongside the bureaucrats—such as the staff of scientific state agencies, members of the liberal professions, and a small number of entrepreneurs—tended to have common social backgrounds and political beliefs. Together with the high bureaucracy, the first group (scientific staff) furnished the presidents of most societies until the 1880s; they came from families with experience in imperial or feudal administration and viewed themselves as servants of the state. With some reservations, the same applied to the membership of societies in the crown lands: this included the regional bureaucracy, university-trained *Gymnasium* teachers, military officers, and ecclesiastical scholars. The fact that the petty bourgeoisie did not join the societies until around 1880, despite surprisingly low membership fees, may have been due to the requirement for adequate time to devote to scholarly activities as well as the

<sup>132</sup>On the Exner-Frisch family see Coen, *Uncertainty*.

<sup>133</sup>See Brigitte Mazohl-Wallnig, ed., *Bürgerliche Frauenkultur im 19. Jahrhundert* (Vienna, 1995); and Sandra Klos, Otilie Manegold, and Johannes Mattes, “Claiming Space in Science: Women in Scholarly Societies,” in *Politisches Handeln von Frauen in der Habsburgermonarchie*, eds. Barbara Haider-Wilson and Waltraud Schütz (Bielefeld, 2024), forthcoming.

<sup>134</sup>See Waltraud Heindl, “Bureaucracy, Officials, and the State in the Austrian Monarchy,” *Austrian History Yearbook* 37 (2006): 34–57; for an overview, see Gary B. Cohen, “The Austrian Bureaucracy as the Nexus of State and Society,” in *Habsburg Civil Service*, eds. Franz Adlgasser and Fredrik Lindström (Vienna, 2019), 49–65.

<sup>135</sup>Waltraud Heindl, *Josephinische Mandarine. Bürokratie und Beamte* (Vienna, 2013), 223.

<sup>136</sup>See *ibid.*, 167; for a comparative perspective, see Hannes Grandits, Pieter Judson, and Malte Rolf, “Towards a New Quality of Statehood. Bureaucratization and State-Building in Empires and Nation States,” in *The Routledge History Handbook of Central and Eastern Europe*, eds. Włodzimierz Borodziej, Sabina Ferhadbegović, and Joachim von Puttkamer (London, 2020), 41–161.

<sup>137</sup>See, e.g., Ignaz Schiner, “Ein naturhistorischer Ausflug in meinem Zimmer,” *Der Salon* 2, no. 1 (1854): 322–28.

<sup>138</sup>See Helga Peham, *Die Salonièren und die Salons in Wien* (Graz, 2013).

need for a recommendation from an existing member.<sup>139</sup> Expertise could compensate for a humble social background or occupational position: For example, Prince Richard Khevenhüller-Metsch (1813–77), the first president of the Zoological-Botanical Society, was officially represented by Johann Heckel (1790–1857), son of a music teacher and warden in the imperial collections.

It was only in the 1880s, when scientific knowledge began to pervade the public sphere, that the new wealthy bourgeoisie, among them “parvenus” from industry and finance, became active as major science donors.<sup>140</sup> This development effectively transformed scientific societies into research providers. Its forerunners were the honorary members of Viennese societies, among them representatives of Austrian or foreign princely houses, who began paying many times the annual membership fees as part of a broader process of charitable engagement. Moreover, in the 1860s, the upper nobility, such as the Liechtenstein, Schwarzenberg, and Wilczek families as well as scientists or their wealthy relatives, made individual donations, in the latter case often by bequest, including an endowment from the parents of chemist Adolf Lieben in 1863.<sup>141</sup> The mobilization of the wider grand bourgeoisie, including entrepreneurs, bankers, and industrialists from the Rothschild, Gutmann, Arthaber, Wittgenstein, Kupelwieser, and Kuffner families—often of Jewish origin and in some cases ennobled—took place about a decade later, outside the established societies and through familial, institutional, and public networks.<sup>142</sup>

An important driving force in this process was the geoscientist Ferdinand Hochstetter (1829–84). The son-in-law of a British business family and famous for his press reports during the voyage of the *Novara*, Hochstetter was aware of the significance of science outreach and attracting new donors to implement larger collaborative projects.<sup>143</sup> In 1875, he successfully launched the Scientific Club, a society modelled on a London gentlemen’s club and intended to bring together scholarship and big business.<sup>144</sup> As long-standing head of the Geographical and African societies, Hochstetter recognized the distinguishing potential and mobilization power of Arctic and Africa expeditions and fostered these, taking as his model the belated colonial ambitions of Belgium and Germany. Although the popular North Pole and Congo ventures both relied on public funding, in the former the lion’s share of donations still came from the upper nobility, while in the latter, the balance shifted in favor of the wealthy Viennese bourgeoisie.<sup>145</sup> Fundraising from this social group may have been facilitated by the fact that some of its members, such as the classical philologist Theodor Gomperz (1832–1912), were pursuing academic careers themselves, often as well-paid university professors.<sup>146</sup> Subsequent collaborative projects by scientific societies benefited significantly from the new, broader public sphere, which emerged in Vienna in the 1880s and also included the petty bourgeoisie. Its expansion was driven by sensational research trips (especially to Africa) that channeled colonial “civilizational” ambitions and generated a great deal of media attention. In this new setting, scientific donors eagerly followed public reporting of “their” ventures—as did the grand bourgeoisie in general—but were usually less involved in their implementation, and no longer brought their own interests to the planning process.

<sup>139</sup>Membership fees, which before 1848 often included a voluntary donation upon entry, were not an obstacle. In the case of the Geographical Society, dues amounted in 1873 to about 0.8 percent of the annual income (600 guilders) of a bureaucrat of the lowest grade, with a downward trend evident in the following years.

<sup>140</sup>See Oliver Kühschelm, “Das Bürgertum in Cisleithanien,” in *Die Habsburgermonarchie 1848–1918*, eds. Helmut Rumpler and Peter Urbanitsch, vol. 9, pt. 1 (Vienna, 2010), 849–907; and Hannes Stekl, Peter Urbanitsch, Ernst Bruckmüller, and Hans Heiss, eds., *Zur Geschichte des Bürgertums*, vol. 2 (Vienna, 1992).

<sup>141</sup>See Soukup, *Welt*.

<sup>142</sup>The Auer von Welsbach, Cohn, Dumba, Dreher, Krupp, Pířbram, Schoeller, Trebitsch, and Wiener von Welt families were also among the supporters of scientific societies. See Reiter, *Aufbruch*, 71–116; and Konstantinos Raptis, *Kaufleute im Alten Österreich* (Vienna, 1996), 260–68.

<sup>143</sup>See Sascha Nolden, “Ferdinand Hochstetter,” in *Österreicher in der Südsee*, ed. Hermann Mückler (Vienna, 2012), 127–47.

<sup>144</sup>See Wissenschaftlicher Club, ed., *Kurze Darstellung seines Entstehens* (Vienna, 1876), 1.

<sup>145</sup>See Rechnungs-Abschluss (Nordpol-Expedition), in *Wiener Zeitung* no. 290 (1874): 1104–6; Franz Le Monnier, “Österreichische Congo-Expedition,” *Mittheilungen der Geographischen Gesellschaft* 28 (1885): 225–32; and Schimanski and Spring, *Passagiere*, 378–82.

<sup>146</sup>See Sandgruber, *Traumzeit*, 108–15.



### Scientists and “Non-Professionals”

In the mid-nineteenth century, collaboration between the various groups present in private societies was based on and shaped by members’ social and academic standing rather than their occupational profiles. Emphasis was placed on collegiality, trust, and openness in associational life, with the intention of creating political, social, and scientific unity and avoiding particularism. The shared values of the educated bourgeoisie, including a thirst for knowledge, diligence, and love of order, were meant to keep “national, language, rank, and status differences” at bay.<sup>147</sup> According to society statutes, members had equal rights in the election of the board, the submission of motions, and the use of joint facilities such as libraries and collections. However, senior officials and the staff of scientific state agencies soon assumed leadership roles as board members and journal editors. Especially for ministry officials, who were not elected as Academy members, private societies provided an alternative platform to roll out and implement ideas and plans. Members from the crown lands, initially recruited through the founders’ correspondence networks, submitted sources, data, and specimens that were compiled, compared, and finally published within the Viennese societies. The naming of contributors—and the use of their letters, which were read aloud at meetings and later printed—was a significant form of recognition, especially for private individuals.<sup>148</sup>

Boundary-work between an increasingly limited group of “professionals” and a diverse pool of “private” scholars, among them naturalists, collectors, and patrons, began as early as the 1860s both within scientific societies and in their collaboration with state agencies. These demarcations resulted from discipline-building processes that aimed to unify research based on common concepts, methods, and academic training in order to enhance its credibility. The societies’ journals evolved from merely printing minutes to publishing extended articles selected by editors, which in turn positioned those members less experienced in academic writing as passive recipients and consumers of scientific knowledge. Moreover, epistemic shifts within scientific fields meant that fieldwork was increasingly quantified, economized, and standardized, gradually relegating expert volunteers to the marginal role of data collectors.<sup>149</sup> This was the case for observers in summit observatories, who now found themselves limited to reading and maintaining measuring instruments; travelers collecting in the “Orient” for a growing market in scientific objects, who were increasingly excluded from their study and analysis; and for ship crews in the Adriatic, who found their role limited to analysing water samples. In contrast, in fields such as geography or prehistory—where discipline-building processes started late and fieldwork relied on individual exploratory endeavors and access to the sites studied—private scholars retained their academic status longer.<sup>150</sup> Furthermore, there were considerable intra-imperial differences. In Hungary, where research was shaped by aristocratic patrons, unaffiliated scholars formed a substantial part of the scientific community past the turn of the century; this was also the case in Austrian cities without universities.<sup>151</sup>

Nevertheless, in Vienna, the distinction between scientists and “non-professionals” came to dominate later in societies than in those of other European capitals. This was probably due to internal efforts to harmonize rising tensions, as well as the fact that language was a more prominent distinguishing factor than was professional or amateur status.<sup>152</sup> The internationalization and nationalization of associational life in the 1870s shifted the societies’ focus to cosmopolitan world exhibitions and growing political conflicts within Habsburg scientific facilities. While, in the following decades, many members from the crown lands resigned and continued their activities in the provincial

<sup>147</sup>Eduard Fenzl, “Eröffnungsrede,” *Verhandlungen des Zoologisch-Botanischen Vereins* 2 (1852): 1–5.

<sup>148</sup>See the mention of publications, specimens, and other donations received before each meeting of the Zoological-Botanical Society.

<sup>149</sup>See Ruth Bartin, “Men of Science: Language, Identity and Professionalization in the Mid-Victorian Scientific Community,” *History of Science* 41 (2003): 73–119.

<sup>150</sup>See Dane Kennedy, *The Last Blank Spaces. Exploring Africa and Australia* (Harvard, 2013), 62–94.

<sup>151</sup>For Lviv, see Martin Rohde, “Local Knowledge and Amateur Participation. Shevchenko Scientific Society,” *Studia Historiae Scientiarum* 18 (2019): 165–218; on regional differences Jonathan Topham, “Introduction,” *Isis* 100 (2009): 310–18.

<sup>152</sup>See Jan Surman, “Eine Wissenschaft – eine Sprache?” in *Das habsburgische Babylon*, ed. Alexandra Nuč and Michaela Wolf (Vienna, 2020), 84–98.

societies—some of which were split internally along national lines—the Viennese societies opened up to the German-speaking petty bourgeoisie of Lower Austria, Bohemia, and Moravia. In turn, growing cross-border knowledge exchange, the adoption of foreign measuring instruments and standards, and the development of research facilities in Budapest and Prague fostered demarcation processes between discipline-focused scientists and representatives of a more holistic, bourgeois understanding of scholarship.<sup>153</sup> The ousting of the latter from decision-making positions within societies was ultimately a reaction to the new publicity that had emerged around the African and Polar expeditions, which were costly but controversial due to their low scientific yield. Around 1900, most of the Viennese societies were headed by university professors, like the geographer Eduard Brückner, who simultaneously presided over the Adriatic, Geographical, and Meteorological societies. Involvement in the societies allowed these professors to expand their academic audiences to include the scientifically engaged bourgeoisie.

In summary, the gap between science popularization (which began in the 1840s) and the professionalization of scholarship (the emergence of the scientist as an academically trained professional around the 1880s) had a lasting impact on how researchers collaborated with their partners within and beyond Vienna.<sup>154</sup> First, this discrepancy provided opportunities for marginalized groups to participate in knowledge acquisition processes, allowing them to act in roles such as observer, collector, or taxidermist. This was especially the case in periods of crisis, when societies experienced a decline in membership and/or income. Women benefited from the fact that members defined themselves less by academic training or disciplinary specialization than by social standing, statehood, and commitment to joint projects, and thus successfully applied for membership earlier than in many other European metropolises.<sup>155</sup> Second, private scholars, who were often officials, teachers, or doctors by profession, long maintained their participation in the academic community. In some cases, they gained considerable influence in science and its popularization.<sup>156</sup> In the late nineteenth century, however, many private scholars fell into new dependency relationships as suppliers of knowledge, data, or specimens for a few “professionals.” Third, empire-wide societies were able to maintain their status and integrative function until the 1890s. At the turn of the century, many societies transformed into popular organizations through an increase in membership, with a simultaneous decrease in the proportion of international and non-German-speaking members in the crown lands.

## Conclusion

This article has shed light on science in late Habsburg Vienna as a collaborative enterprise, geared to shared needs and aspirations of—at first glance—opposing state and private, bureaucratic and bourgeois, professional and public stakeholders. While historians have so far examined cooperation using the example of state agencies and the Vienna Academy of Sciences, the focus here is the little-studied empire-wide societies, their collaborative projects, and the intra- and extra-imperial claims and “publics” involved. Private science organizations, reinforcing the consensus between the political elite and the rising bourgeoisie, served not only imperial statehood but also civil-society building. I contend that science in the Habsburg monarchy was not an elite endeavor, especially when pursued in the field, archives, or collections and outside of the academy, university, or laboratories. Rather, around the mid-nineteenth century, it became a broader social practice than historians have previously

<sup>153</sup>See Wolfgang Göderle, “Materializing Imperial Rule? Nature, Environment, and the Middle Class in Habsburg Central Europe,” *Hungarian Historical Review* 11 (2022): 445–76.

<sup>154</sup>On developments in Europe see, e.g., Agustí Nieto-Galan, *Science in the Public Sphere* (London, 2016); and Andreas Daum, *Wissenschaftspopularisierung im 19. Jahrhundert* (Munich, 2002).

<sup>155</sup>Membership meant accreditation for women and gave them access to events and infrastructure. However, female members still had to fight for the right to give lectures and publish in the societies’ journals. See Klos, Manegold, and Mattes, “Space.”

<sup>156</sup>Since, unlike in Germany, not only private scholars but also renowned academics were engaged in science popularization in the Habsburg monarchy, no distinct group of professional popularizers emerged. See Taschwer, “Naturwissenschaften;” and Johannes Mattes, “‘Central Nodes’ and ‘Neutral Grounds’: Boundary-Work Between Scholarship, Scientific Amateurism and the Public,” *Physis* 56 (2021): 181–99.

assumed, and one with an increasingly bourgeois character. Similar developments occurred in other European empires; however, as studies on London, Berlin, and St. Petersburg show, these were characterized by a higher degree of social stratification, and/or initially involved only the top ranks of the state administration and urban bourgeoisie.<sup>157</sup> Although important impulses for associational life came from Britain, the spheres of science and commerce in the Habsburg capital remained rather loosely connected, and state officials often took over the tasks that gentleman scientists held in foreign associations. Viennese learned societies were not free of political and social tensions or scholarly boundary-work, and they also adopted national ideas and colonial ambitions as well as the professionalization of science, in some cases, early on. But they tended to gain resilience when organized inclusively. According to Pieter Judson's studies of Habsburg institutions, their "distinctiveness" may not lie in their "failure to unite diverse populations," but rather in the "positive ways" in which they sought to make projects "organized around such differences work effectively."<sup>158</sup>

Collaborative research within private societies and among their partners, merging sources and contributors from various parts of the monarchy and beyond, relied on the division of labor across epistemic, spatial, and socio-political relations. With state agencies and their staff often taking over the processing of sources, these collaborative projects accumulated, linked, and accredited diverse bodies of local sources, unifying the disciplines they helped to create. The societies established dependency relationships between their members in the imperial center and those in the regions under study; these institutions pursued expansive and integrative goals, but also offered volunteer contributors abroad access to the resources and networks in Vienna. On the micro level of associational life, societies continued to pursue liberal ideas, but their service to neo-absolutist bureaucracy meant that they embodied statehood to the outside world. Due to their institutional hybridity, they enjoyed a higher level of autonomy and adaptability to non-scientific aims than state agencies, and drew their strength from providing arenas of exchange and transnational cooperation. Partnerships between Viennese institutions boomed during political or financial crises and periods of growing (inter)national scientific competition; collaborations with growing learned societies in capital cities such as Budapest, Prague, Krakow, Zagreb, and Trieste remained the exception—apart from a significant initial overlap in membership, which declined by 1900.<sup>159</sup> A tipping point came in the 1880s, when some societies, with the support of private donors, effectively turned their intra-imperial projects inside out: they began to erect research infrastructure in external environments perceived as vital to imperial statehood. This included the observatories in the High Alps, collecting trips to the "Orient," and research vessels operating in the Adriatic littorals.

Within the monarchy, individual societies thus became precursors of an international development toward managing and collectively financing basic research through state-accredited, but privately run, organizations.<sup>160</sup> However, they did not have sufficient financial resources to establish their own research institutes. Instead, they mostly used existing facilities and sought to expand their staff's research capacities. Discipline-specific and able to raise fewer funds, the societies lagged behind the foundations of the Vienna Academy and, in the absence of major individual donors, were dependent on state subsidies in the long term.<sup>161</sup> The Viennese scientific community had nothing to match the Kaiser Wilhelm Society (1911), founded in Berlin by a private–public partnership and a collective of (mostly Prussian) scientific donors.<sup>162</sup> Although there was no shortage of potential sponsors in

<sup>157</sup> Andreas Schwarz, *Der Schlüssel zur modernen Welt. Wissenschaftspopularisierung in Großbritannien und Deutschland* (Stuttgart, 1999); and Joseph Bradley, *Voluntary Associations in Tsarist Russia* (Harvard, 2009).

<sup>158</sup> Pieter Judson, *The Habsburg Empire. A New History* (Cambridge, 2016), 451–52.

<sup>159</sup> An exception was a collaboration (1910–13) between the academies in Vienna and Krakow to carry out archaeological excavations in Egypt. The transfer of staff between universities, on the other hand, was common. See Johannes Feichtinger, Katja Geiger, and Doris Corradini, "Die kaiserliche Akademie um die Jahrhundertwende," in *Akademie*, vol. 1, eds. Feichtinger and Mazohl, 376; and Surman, *Universities*, 150–51.

<sup>160</sup> See Thomas Adam, "Wissenschaftsförderung im Deutschen Kaiserreich," in *Auf dem Weg zu einer Geschichte der Kaiser-Wilhelm-/Max-Planck-Gesellschaft*, eds. Dieter Hoffmann, Birgit Kolboske, and Jürgen Renn (Berlin, 2015), 195–217.

<sup>161</sup> See Feichtinger et al., "Akademie," 312.

<sup>162</sup> See Adam, "Wissenschaftsförderung," 198–202.

Cisleithania around 1910, with around 1,500 millionaires, their number, wealth, and annual income fell short of the 8,300 millionaires in Prussia alone.<sup>163</sup> Other decisive factors may include a weaker tradition of private endowment compared to Germany, the inability of societies in Vienna to attract donors from the crown lands, and the well-established tradition of unpaid participation in the work of the societies. However, the term “citizen science,” as it is currently used to refer to public participation in research, is only partially appropriate to label the broader social practice of imperial science depicted in this article.<sup>164</sup> Although mid-nineteenth-century bourgeois engagement in research relied on civic values, public accessibility, and the voluntary collaboration of many, there were still no distinct professional identities, and large segments of society, such as the working class and rural population, remained excluded. Many of the “bourgeois scientists” engaged in Viennese associational life and its collaborative enterprise as representatives, authors, or collectors, considered themselves not only “lovers” or “supporters” of science,<sup>165</sup> but full members of the scholarly community. Even after the loss of their academic status at the turn of the century, the vast body of knowledge that these individuals had accumulated continued to flourish. Preserved in publications, maps, and collections, it served as a fundamental resource for future research endeavours and the administration of the nation states that emerged from the monarchy.

**Acknowledgments.** This research was funded by the Marie Skłodowska-Curie actions (MSCA) grant agreement No 101066820 (Poles and People) from the European Commission, and by the University of Oslo, which covered the open access fees. I would like to thank Gerhard Aubrecht, Franz Fillafer, Maren Gröning, Norman Henniges, Sandra Klos, Astrid Mahler, Ottilie Manegold, Fritz Neuwirth, Friedrich Schiemer, Stefan Siennell, Ulrike Spring, Stijn Vervaet, and Sarah Zöchling for reading and commenting on this essay and/or providing sources. I am also grateful for the constructive and enriching suggestions of the editors and two anonymous reviewers. Last but not least, I especially thank Kirsty Jane Falconer (Prague) for her language editing of this article.

<sup>163</sup>See Sandgruber, *Traumzeit*, 20–24; and Rudolf Martin, *Jahrbuch des Vermögens und Einkommens der Millionäre in Preußen* (Berlin, 1911), XV. The imbalance is less pronounced when comparing the capitals: 900 millionaires in Lower Austria (including Vienna) contrast with 3,000 millionaires in Berlin.

<sup>164</sup>See Rohde, “Knowledge,” 208; and Katrin Vohland et al., eds., *The Science of Citizen Science* (Cham, 2021).

<sup>165</sup>See Ignaz Schiner, “Ueber Dilettantismus in der Entomologie,” *Wiener Entomologische Monatschrift* 3 (1859): 346–52.