

Benefits, Motivations, and Challenges of International Collaborative Research: A Sociology of Science Case Study

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Abstract

Contemporary science is marked by expanding and diverse forms of teamwork. Collaboration across organizational and cultural boundaries extends the possibilities of discovery. International collaborative research projects often provide findings beyond what one team could achieve alone. Motivated to maintain existing relationships and grow their scientific network, researchers increasingly collaborate, despite often unrecognized or underappreciated costs, since such projects are challenging to manage and carry out. Rarely studied in-depth and longitudinally, the perspectives of scientific team members are crucial to better understand the dynamics of durable collaboration networks. Thus, this retrospective case study of a sociology of science project applies the novel method of autoethnography to examine teamwork benefits, motivations, and challenges. Key challenges found include spatial distance and differences of culture, language, and career stage. This study, spanning North America, Europe, the Middle East, and East Asia, focused on collaborators' characteristics and evolving perceptions of team dynamics over a decade.

Key words: international research collaboration; research project; teamwork; autoethnography; sociology of science; global

1. Introduction: rising research collaboration in global science

Contemporary science is marked by expanding and diverse forms of teamwork. Collaborations across organizational, disciplinary, and cultural boundaries extend the possibilities of discovery, despite often unrecognized or underappreciated costs (see Hicks and Katz 1996; Leahey 2016). Currently, competition on multiple levels transforms universities (Musselin 2018) as individual and collective actors are simultaneously embedded in diverse nested and interdependent competitions (Krücken 2019). This is mediated through formal evaluations, performance measures, and continuously generated comparative indicators that increasingly target collaboration (Powell 2020). To succeed in this learning race to achieve new knowledge, participation in networks and interorganizational linkages, with continuous communication and collaborations of different sorts, will be crucial to success (Powell 1998). Yet both collaborative and internationally comparative research projects are more complex; with the principles of ideal research designs more difficult to achieve—and such teamwork demanding (Kosmützyk 2018; Wöhlert 2020). Data from different national contexts must be gathered and compared, taking into account that team members in research projects may have contrasting cultural and disciplinary

backgrounds; furthermore, they work within specific organizational conditions for conducting research (Dusdal et al. 2019). While most research projects are not explicitly comparative, considering collaborative research's exponential growth since the mid-1990s (Powell et al. 2017a), more attention is now devoted to (international) research collaborations (e.g. Hicks and Katz 1996; Shrum et al. 2007; Anderson and Steneck 2011; Jeong et al. 2014; Jeong and Choi 2015; Ulnicane 2015; Edelenbos et al. 2017; Wagner 2018). The meanings of international collaboration (Bozeman et al. 2013: 2ff) extend beyond the foundational definition: 'working together of individuals to achieve a common goal of producing new scientific knowledge' (Katz and Martin 1997: 7). As just one of myriad collaboration outcomes, coauthored publications, visible and measurable, have become the standard, though conservative, indicator of increasing research collaboration.

Several waves of studies on international research collaborations (IRC) have focused on drivers, patterns, effects, networks, and measurement. In case studies of 'big science' collaborations, Shrum et al. (2007) emphasize technology, data, organization, and trust. Kwiek (2020) shows that IRCs are a powerful stratifying force that distinguishes locally-oriented from internationally-oriented researchers in terms of their coauthorships and scientific productivity. Chen et al. (2019) identify key topics for future IRC research: to compare IRC

properties and variance; to investigate networks; and to develop measures to assess costs and benefits. Despite the continued exponential rise of collaboration across the sciences, IRCs that extend beyond the usual timeframe of a project have rarely been studied in-depth to understand evolving researcher interactions and relationships (Ulnicane 2015). Indeed, long-term relationships between collaborators and internal, team-level factors remain the ‘black-box of collaboration study’ (Jeong and Choi 2015: 460). Examining such factors, Bozeman et al. (2016: 226) interviewed dozens of researchers to develop a ‘subjectivist conception of collaboration effectiveness’ to uncover collaboration dynamics relating to field/discipline, collaborator characteristics, and team management. Similarly, we also follow Kollasch’s (2012: 173) call to examine hierarchical and horizontal relations to understand the ties that bind together international teams. Empirical studies on communication within intercultural research teams and impact on research processes themselves are also rare (Kaden 2009; Wöhlert 2020). Notable exceptions include the laboratory studies by Latour and Woolgar (1979) and Knorr-Cetina (1981), yet these classics illuminated laboratories in STEM fields, closed environments in which collaboration challenges across great distances or in different organizational contexts were not central.

Because researchers face multiple challenges when they work together, explicit reflection of such processes is necessary—especially as the majority of research in many disciplines is now collaboratively conducted and publications coauthored. The emerging field of ‘science of team science’ focuses on micro-level studies of research teams and their interactions (see, e.g. Tartas and Muller Mirza 2007; Fiore 2008; Slipersæter and Aksnes 2008; Thomas et al. 2009; Brewster et al. 2011; Falk-Krzesinski et al. 2011; Esser and Hanitzsch 2012; Brew et al. 2013; Hoffman et al. 2014; Sugden and Punch 2014). Studies mainly focus on natural sciences, life sciences, and engineering (see Wagner 2005; Gardner et al. 2012; Gray et al. 2012; Wang et al. 2014; Zhai et al. 2014; Zdravkovic et al. 2016), far less on social sciences and humanities. Specificities of IRC in these other fields remain underexplored (Reichmann 2013; for reviews, see Kosmützky 2018; Wöhlert 2020). Such research must also reflect specific methodological complications and the social complexity of diverse research teams conducting international and intercultural work, studied thoroughly neither in higher education research nor in sociology of science (Kosmützky 2017: 77ff.). This reflects the limited internationalization of social sciences (Kurzman 2017; Stevens et al. 2018). Case studies of team processes are relatively rare (but see Kumar 1985; Moody 2004; Hanges et al. 2005; Albert et al. 2015; Levitt 2015; Okamoto 2015). Longitudinal studies are even more unusual (but see Ulnicane 2015 on cases in nanoscience and technology).

To understand varying benefits, motivations, and challenges of IRC, it is essential to analyze evolving relationships of involved scientists and organizations (Wöhlert 2020). Thus, we carried out a case study of teamwork within a highly international, multicultural research team in the sociology of science. This autoethnographic case study emphasizes cultural differences, including intercultural communication. Documentary analysis, several rounds of interviews, and a retrospective survey provide reflections and insights on the aspects of teamwork and divisions of labor among team members at different career stages working in universities in North America, Europe, the Middle East, and East Asia. The study longitudinally explored benefits, motivations, and challenges that researchers from diverse cultures and at different career stages experienced within an international collaborative research team.

Next, we outline known benefits, motivations, and challenges of IRC. Then, we present our retrospective autoethnographic analysis of team dynamics in this case study and its implications. Finally, we discuss how science policymakers could better support IRCs as the increasingly crucial mode of producing new scientific knowledge.

2. Characterizing international research collaborations: benefits, motivations, and challenges

International research collaborations have increased in volume and importance, responding to higher education expansion and the advancement of knowledge as well as the increasing professionalization and specialization of science. Further factors include rising investments, easier access to (financial) resources, an association with the scientific elite, mutual intellectual or social influences, increased scientific productivity, easier and less expensive communication, and exchange programs (Luukkonen et al. 1992; Dusdal et al. 2019). Although it is far from simple and takes innumerable forms, collaboration has become taken-for-granted. Collaborative networks and relationships between organizations and researchers are difficult to study, especially given their complexity and the primacy accorded individual scientists. Conventionally, collaboration has been measured through coauthored publications because such outputs are readily accessible, whereas the dynamics and subjective experiences of collaboration remain largely hidden (but see Shrum et al. 2007).

Scientific collaborations—with the goal to achieve new scientific knowledge that cannot be generated by one researcher alone (Katz and Martin 1997; Bozeman et al. 2013)—often begin informally, establishing trust between researchers meeting in face-to-face situations (Jeong et al. 2014). Long-standing collaborations reflect helpful ‘collaboration management strategies’ and good ‘work-style fit’ (Bozeman et al. 2016: 232) along with shared understandings of disciplinary norms. Depending on the field and team constellations, collaborations may be driven by ideas, questions, and theories; equipment and resources; or data (Wagner 2005).

As scientists increasingly work in teams, they need to meet, understand, cooperate, and collaborate—doing so for myriad reasons (Beaver 2001). In some fields, research has become so complex that individual scientists cannot achieve meaningful results without collaborating—the so-called collaboration imperative (Bozeman and Boardman 2014: 1). Shared infrastructure also facilitates collaboration. Today’s modal paper in the natural and social sciences represents the work of multiple researchers, often working in different organizational and cultural contexts. This collective shift toward teamwork (Adams 2013; Fortunato et al. 2018), and the implied division of labor and specialization, extends from fundamental research to the applied world of patents (Wuchty et al. 2007; Mosbah-Natanson and Gingras 2013).#

Collaboration occurs on multiple levels that need to be distinguished (Kosmützky 2017: 54ff.). As intrinsically social processes that are difficult to define and operationalize, collaboration takes on many forms; few are explicit: providing infrastructure and services, managing the division of labor or transmitting know-how (Jeong et al. 2014: 521f.). In combination with scientific motives, social purposes, even friendship, are often mentioned. Agreeing on research aims, distributing tasks fairly, and maintaining communication are key components of successful long-term collaborations (Melin 2000; Ulnicane 2015). Further, to maintain and renew long-

term (international) collaborations, it is important to include younger researchers and others with new ideas and relevant skills.

2.1 Determinants of successful international research collaboration

Individuals' knowledge, experience, and reputation are crucial in producing and publishing scientific knowledge, with the career stage crucial for successfully carrying out diverse roles within IRCs (Bozeman et al. 2016: 233). Senior scientists tend to have larger networks and access to resources. They have established their reputations and mentored younger scholars (Jeong and Choi 2015). Long-term collaborations may remain creative and productive long-term due to understanding different work commitments, crediting contributions correctly, and negotiating conflicts (Bozeman et al. 2016: 237). Existing relationships, repeated interactions, and intellectual synergies provide the basis for durable collaboration networks (Ulnicane 2015: 433f). Our case study demonstrates this.

2.2 Benefits of international research collaboration

As most collaborations begin informally and grow gradually, analyses must attend to social and cultural aspects as well as constraining and enabling factors within different science systems and research organizations—and on the team level (Leahey 2016). Collaboration has many consequences; the results are mixed (Beaver 2013). Some conclude that the proportion of high-quality papers increases with more authors per paper (Lawani 1986). Fanelli and Larivière (2016) argue that while total published papers have increased, individual publication rates, based on the number of first-author papers, or by measuring publications fractionally, have not. IRCs are associated with higher-quality research than national collaborations; internationally coauthored papers tend to have greater research impact (Rigby and Edler 2005; Levitt and Thewall 2010; Adams 2013). Thus, the numerous benefits of collaborative work justify IRC (Rigby 2009). Many of these benefits were, ultimately, confirmed in our case study.

2.3 Motivations of international research collaboration

Researchers obviously collaborate for innumerable reasons (see Beaver 2001, 2013: 50f.; Sonnenwald 2007). Motivations include research organization and researcher reputation, higher visibility, opportunities for multidisciplinary research, access to research funds, and mentoring of younger researchers. Development of new methods and sharing knowledge, equipment, laboratories, or (big science) infrastructures, including data, encourage researchers to collaborate, in the process extending their networks. More personal reasons include friendships with chosen colleagues, intrinsic motivation, or the ambition to maximize personal scientific output (see Conchi and Michels 2014). In this case study, we analyze which of these motivations were central.

2.4 Challenges of international research collaboration

International and culturally diverse research projects provide valuable opportunities to advance scientific knowledge production, yet also imply challenges, risks, and drawbacks (Kosmützky 2018). The advantage of joining forces and finding synergies of expertise incorporates the risk of invisibility of single researchers within the larger team. Particularly, younger researchers' contributions may be subsumed. Principal investigators may not be involved in the day-to-day research because their main responsibility is to compete for funding and manage teams. Likewise, IRCs are time-consuming,

requiring administration, coordination, and continuous exchange among teams (Beaver 2013: 53) as well as intercultural and interpersonal agreements on goals. Tasks must be distributed and responsibilities fulfilled, individually or in constellations (Easterby-Smith and Malina 1999). Handling communication challenges, especially when scientists work in different locations over long time periods, demands clear communication styles to create understanding, trust, and sensitivity; advanced social planning; and functioning technological supports (Livingston 2003). In particular, 'spatially dispersed scientific collaborations' demand substantial coordination to effectively bring ideas and expertise together (Cummings and Kiesler 2005: 704). Melkers and Kiopa (2010) identify the research gaps of social interactions and researcher engagement in IRCs. Thus, our retrospective case study gathers autoethnographic insights from team members.

3. Autoethnographic case study: objects, methods, and data sources

IRC, especially on team level, can be analyzed, categorized, and explored in different ways (Beaver 2013: 45ff). Less often studied, spatially distributed teams must deal with multiple methodological and sociocultural complexities that differentiate them from local teams (Kosmützky 2017). To address this research gap, we explore the potential of autoethnography, as this newer approach has been applied to facilitate explicit reflection of research processes. We chose this method to retrospectively guide research and provide insights into the evolving experiences and perspectives of IRC team members. This enables the reconstruction of the discontinuous, sometimes disorganized, work within a multicultural team across four continents. Over a decade, the team constituted itself, carried out research together, and published findings that any one regional team could not have accomplished alone. This approach encourages reflexivity about experiences and valorizes personal narratives—to make sense of the meanings that we researchers retrospectively ascribe to extensive collaboration processes across different stages of career development. While not generalizable, this retrospective, self-reflexive autoethnography synthesizes lessons learned and risks in carrying out IRCs, focusing on team dynamics.

Autoethnography, as a research method, uses researchers' own experiences in describing and evaluating beliefs, practices, and experiences in particular contexts; it recognizes and values researchers' social embeddedness. More than a method, it not only describes research processes but simultaneously serves as the product of research (Ellis et al. 2010; Adams et al. 2015: 21ff). In contrast to claims that research should be neutral, impersonal, and objective (Delamont 2009), autoethnography acknowledges and uncovers often hidden but important drivers of social research, namely subjectivity and personal connections. Such relationships are difficult to observe with standard methods in science of science, such as scientometrics, which measure only the most visible results of collaboration. Methodologically, autoethnography combines content analysis of documents with interviews to support retrospection (Ellis et al. 2010). Personal experiences are connected with the current state of research (Ronai 1992). These generative benefits are balanced by challenges, including lack of theorizing, self-centeredness or insufficient self-criticism, and too few observations (Ellis et al. 2010).

To avoid these pitfalls, alongside our reflections and evaluation of the project collaborations, the study was conceptualized as an analysis using multiple methods to gather data longitudinally.

Conducted by two members of the Europe-based subteam over a four-year period, the study includes (1) document analysis, (2) guided autoethnographic interviews, and (3) a retrospective survey of project researchers and managers eight years after project start. Exploring the use of this newer approach in this research field helps us to uncover aspects of IRCs often unobserved when conducting standard expert interviews or participant observations of a ‘foreign’ research team.

The decision to study our own research collaboration was taken after the project officially ended; follow-up projects were in the planning stages. In-depth interviews were carried out with a small number of team members (four) from different status groups (principal investigator, project manager, doctoral student) and cultural backgrounds (North America, Europe, East Asia) in person or virtually. In 2016, document-based sources, including official project documentation, research and administrative notes, official communications with the funding agency and partner universities spanning the Northern hemisphere, and innumerable project and personal e-mails were collected, sorted, and selected. Most materials were collected from project folders stored for joint use. Furthermore, we retrieved dozens of communications from our own e-mail archives.

The study gathered interview extracts and voices from project members from all regional subteams. Guiding themes and topics included the following:

1. *Motivation and experience*: Why did you decide to join the research project? Please share your experiences.
2. *Research and learning*: What were your research goals and questions within the project? What did you learn?
3. *International collaboration*: How do you define ‘international collaboration’. What dis/advantages or costs and benefits did working in a highly international, diverse team have for you? Would you like to work in such a project again? Why (not)?

After transcription, results were synthesized, with key points illustrated below. To enable renewed reflections from team members’ evolving retrospective standpoints eight years after project begin, a follow-up survey on selected findings and focused on benefits, motivations, and challenges of IRC was conducted in August 2020. This included an extensive table of statements ranked by the participants (see Table 1). We sent the questionnaire to the whole team; five members responded. Thus, a majority of (former) team members participated in at least one phase of our autoethnographic study. Their responses manifest different perspectives and team-connectedness after the project’s official end. Half of the original team members, from different world regions and in different career stages, continue to actively collaborate and co-author papers.

We now turn to an overview of the project’s genesis, team size, duration, and budget; its members’ cultural diversity and career stages; patterns of mobility, distribution of labor, and leadership; and the team’s sociodemographic and academic characteristics. Then, we delve into the subjective meanings associated with this IRC, derived from team members’ perspectives.

4. Case study of an IRC project in the sociology of science

First ideas about possible transatlantic research collaboration were explored in Summer 2010 by a small group of researchers—later project principal investigators (PIs)—after an international workshop on higher education (HE) in Germany. From two countries

and of three generations, they had known each other for ten to twenty years and developed friendships. After another year informally discussing common research interests, more concrete project ideas emerged: to analyze (1) worldwide HE expansion, (2) its consequences for scientific research over the twentieth century, and (3) universities’ contributions to scientific discovery. These interests were then aligned to the explicit economy-centered interests of the funding agency’s call for proposals. A focus on scientific productivity emerged, with the explicit use of this language exemplifying ‘programmification’—the impact of funding agencies’ priorities on proposed research (see Zapp et al. 2018). A more detailed project proposal, written with a colleague who had direct contact with the funding agency, was submitted in December 2011. Half a year later, this ‘local’ PI received the five anonymous peer reviews and the first approval notification. On 15 May 2012, he informed his collaborators via e-mail across the time zones:

Hi Team: I just heard a few minutes ago that QNRF approved our application for funding. That’s about all I know at the moment. Stay tuned for more information in the coming weeks. In the meantime, congratulations on a job well done. Let the games begin... (PI 2).

In fact, the to-be-assembled project team would be built upon decades-old relationships, coupled with global recruitment of country experts and young researchers—through existing networks that reflect internationalization powered by doctoral education in research universities; in this case, an American public university with substantially international graduate student population (Fernandez et al. 2020). Among the main purposes of collaboration is the division of labor (Katz and Martin 1997). But as science has evolved and spread around the world, researchers are even more broadly scattered geographically than in earlier eras. Here, IRC networks served as a ‘vehicle for knowledge diffusion’ (Jeong and Choi 2015: 462), for access to funding, and for recruitment. Due to this projects’ spatial distribution of researchers across four continents, information exchange, discussion of research goals among subteams, division of labor, and task coordination were crucial (see Lewis et al. 2012). All team members were employed in universities of the Northern hemisphere, distributed across seven countries in North America, Europe, the Middle East, and East Asia.

4.1 Team size, budget, and project duration

The team size, budget, and project duration are interrelated, because substantial financial resources are necessary to enable project investigators to form and maintain IRC teams (Jeong and Choi 2015: 462). Larger teams may develop contemporary and popular ideas, but have short-lived impact, on average, yet this persists longer when younger researchers are well-integrated (Wu et al. 2019). By contrast, smaller teams may positively irritate science and technology studies with more radical ideas and survive longer when they build a stable core of researchers that remain active (Palla et al. 2007; Fortunato et al. 2018). Larger international teams support visibility and information exchange in various contexts, facilitating network growth (Horta and Austin Lacy 2011: 459f.). The team studied consisted of ten researchers (full professors, associate professors, doctoral students), one research director, one project manager, and numerous research assistants (in several countries).

Most members participated without their positions being (fully) project-funded; thus, co-financing by research universities was essential. The budget of about US\$600,000 was used mainly to fund

a project manager and research stays, travel, and data acquisition. Years later, residual overhead costs supported publishing results open access. Particularly, given the brief two-year official project duration, university co-sponsorship was substantial. Financially and in terms of team size, this project was relatively small for such a globe-spanning project compared with, for example, international projects funded by the EU Framework Programme for Research and Innovation. While a no-cost six-month extension was granted, no publications based on the project's big data and bibliometric analyses appeared during the grant period. In years since, research by various team members has appeared in book and article forms, in English and German, and won numerous awards. The project context also provided an important platform to present previously conducted research to gain visibility in other scientific communities.

4.2 Cultural and linguistic diversity and gender

The group's national, cultural, and linguistic diversity was considerable: starting with the project's lead PI in North America, four team members were US citizens. Three team members, representing Europe, came from Germany and Romania, and one each came from China, Japan, Korea, and Taiwan. Day-to-day project management was organized in Qatar by a woman from Iran. With the ongoing and increasingly rapid globalization of science, researchers seek opportunities outside their country of origin; unsurprisingly, country of origin and current location were often different (Anderson and Steneck 2011). Indeed, most team members were officially employed and/or enrolled outside their country of origin. The most common languages spoken were English, the main project language, German, and Chinese (Mandarin).

Noteworthy, the ratio of female/male researchers was 1:10, whereas project support and research assistance were provided mainly by female team members. If research shows that female scientists have different communication and leadership styles (Jeong and Choi 2015), in this team gender issues were never discussed explicitly.

4.3 Division of labor and career stage

Beyond gender, differences in career stage and power relations among researchers of various status and cultural backgrounds existed. Hierarchies affected communication—from knowledge exchange to critique—as well as expectations (Roelcke 2010; Kosmützky 2018). While project leaders often lack professional training in managing international projects, learning their skills 'on the job' (Hantrais 2009), this was not so here: the project and 'Subteam North America' were led by a renowned senior scientist from that region with long-standing contact to all network members. He selected most team members, many of whom he had trained, collaborated with, or hosted at his university. The core group of PIs, well-connected for over a decade, included a former doctoral student who acted as crucial local contact securing project funding; he led 'Subteam Middle East'. This confirms that 'established social capital' is necessary to successfully recruit diverse researchers from abroad to collaborate (Melkers and Kiopa 2010: 391). The involved subteams and their relationships reflect the extensive social interactions necessary for successful collaboration. IRC teams are increasingly the norm, but building international, intergenerational networks that provide collaboration opportunities demand tenacity.

North America is a significant partner for IRCs because of its scientific outputs and central position in global science (Luukkonen

et al. 1992; Powell et al. 2017a). Culturally diverse, 'Subteam North America' consisted of Americans and both professors and doctoral candidates from China, Korea, and Taiwan working together at a large US research university. This subteam prepared and maintained the huge volume of raw data—Web of Science Science Citation Index Expanded (SCIE)—purchased from Thomson Reuters (now: Clarivate Analytics).

This database was painstakingly recoded by 'Subteam Europe', evolving to ensure overall data quality and meet project goals. Contributing four European case studies, this subteam integrated several senior researchers and organized a concluding international conference panel, an important step toward an edited volume collecting all country case studies (Powell et al. 2017a). Cultural and linguistic diversity as well as recruitment of additional experts later on ensured that the country case studies of the key science-producing regions were contributed by authors able to review domestic literature and with extensive knowledge of HE and science systems.

'Subteam Middle East' provided project management infrastructure and hosted all team members during three workshops. These meetings were organized from and took place in Qatar, where the funding agency required two-thirds of the project budget to be spent. Coordination by the project managers was essential to realize project goals between these rare gatherings in person.

Team members from four East Asian countries delved into national case analysis, less so explicit comparative work. These members had genuine interests and expertise in big data, taking responsibility for substantial encoding, cleaning, and preparation of the dataset for common use, and the development of methods and tools for subsequent analyses. One Asian PI, trained in and a professor in North America, coauthored the analysis of his country of origin with external collaborators. An assistant professor based in another Asian country worked on his case study alone but compared journal coverage of Clarivate Analytics' Web of Science and Elsevier's Scopus to capture differences in selectivity of the two leading bibliometric databases. Analysis of the third and fourth Asian countries was completed in dissertations by doctoral candidates in 'Subteam North America', who had intermittently joined 'Subteam Middle East' to work on the dataset. Post-project, they returned to their East Asian countries but completed their dissertations under supervision of the project's lead PI in the US.

4.4 Mobility

Highly mobile, the project team consisted of members of different national origins, with half of the senior PIs and all doctoral candidates working in research universities in countries other than their country of origin. Various sub-teams collaborated on different aspects and in different phases, meeting in their university or region. Particularly, the doctoral candidates—whether Asian or European—were mobile regarding both their doctoral degree granting universities and in conducting data preparation and analysis in third countries. Only three face-to-face meetings of all members occurred during the project, due to physical distance and costs (coordination, travel). The kickoff meeting was held in February 2013 in Doha, Qatar, whose national research foundation (QNRF) funded the research. This was followed by a second meeting and international conference visit and presentation of first results in November 2013. Finally, a third meeting was conceived as a 'data workshop' in March 2014, designed for discussion of discovered historical trends and global findings—such as the exponential rise of (international)

coauthorship. Most members attended and presented findings during an international conference in Washington, DC, in March 2015, to engage in cross-disciplinary dialogue, an important but rare opportunity to meet in person (Melkers and Kiopa 2010: 397f.). To tackle this challenge in practice, the team organized monthly virtual meetings and communicated continuously via e-mail. Reflecting on the project, members missed personal and on-site communication between subteams. Clarifying problems took much more time than if all researchers had been locally-based, for example writing innumerable e-mails to discuss an issue related to a STATA do-file, instead of walking down the hallway to immediately clarify face-to-face. Thus, research stays by all three doctoral candidates in other subteams were crucial.

4.5 Communication and language

Doing research and producing knowledge in the *lingua franca* are everyday activities globally, but working in multilingual teams results in communication challenges, especially when team members aspire to publish in (leading) peer-reviewed journals (Wöhlert 2020). Although English was the common project language (Pelikan 2015), only three team members were native speakers. This cultural diversity became particularly obvious when analyzing project documents. Most researchers used their first language for their own research notes, but shared documents and official communications, conference presentations, and publications were mainly written in global English. The team division of labor led to diverse languages being used. Wells (2013) argues that using English as the project language gives native speakers a great advantage to express themselves linguistically, culturally, and socially. Non-native speakers felt inhibited in team interactions (see Bagshaw et al. 2007), but even more so in drafting publications later, overcome only through considerable investments by the native speakers in writing and proofreading. Senior scholars' openness and patience and inclusivity were crucial for project development and facilitating the publication of results in leading English-language journals.

Nevertheless, the team's diverse cultural, disciplinary, and academic backgrounds resulted in communication problems, both in theoretical debates and in data analysis and interpretation. Analysis of team correspondence emphasized the importance of discussing and agreeing on definitions of key terms, debating theoretical approaches, and selecting methodologies—also to develop mutual understanding and trust, which is vital for successful IRCs (Bracken and Oughton 2006). Because the project strove to combine quantitative and in-depth institutional analyses, increased attention to intercultural communication would have been crucial; these challenges were underestimated.

4.6 Output

Although the project officially ended in June 2015, after a no-cost extension, and the final report was submitted in August 2015, the research team continued to collaborate. Since then, numerous publications by diverse team member constellations have appeared, including an edited volume of contributions from regional subteams (Powell et al. 2017a) that won several awards. That book's introduction was jointly written by team members from different locations and career stages to frame the country case studies and synthesize global trends (Powell et al. 2017b). By the end of 2020, six peer-reviewed research articles in high-quality journals had appeared. A monograph (awarded a prestigious dissertation prize) appeared in German (Dusdal 2018); another book (in English) is

forthcoming (Baker and Powell, forthcoming). Three book chapters have been published (in English; two translated into Arabic), two encyclopedia entries, one commissioned report (available in English and French), one contribution to published conference proceedings, and six transfer publications (newspaper articles, interviews, radio, and electronic media such as podcasts). Currently, three additional journal articles using the project database are under review. The project's three doctoral candidates successfully defended their dissertations (two in 2017, 2019). These outputs and a follow-up project build upon the team members' joint efforts to construct one of the largest longitudinal bibliometric databases, covering about 90 million entries across a 111-year period. Having specified the project's characteristics and dynamics, we next present reflections from the autoethnographic study on the team members' perceived benefits, motivations, and challenges of IRC.

5. Reflections on the benefits, motivations, and challenges of IRC

Turning to our autoethnography, we present empirical results based on reflections and insights on conducting research, the division of labor, and social relationships in a globe-spanning project. We discuss what autoethnography may contribute to our better understanding of diverse benefits, motivations, and challenges of IRC.

The study emphasized relationships between members of different cultural, disciplinary, and status backgrounds, uncovering how crucial were the established relationships—spanning three continents and multiple generations—among the project's PIs.

International cooperation for me is when scholars from different national backgrounds focus on one big research topic and the collaboration, which means they really could help each other to figure it out (PhD 1).

On the one hand, people would just say it's people in different countries... But you're [interviewer] sitting here, we're both sitting here, are we internationally collaborating? Yes, but you could do your PhD here, you could be a professor here... what's behind it is the universalization of education, in particular of universities (PI 1).

Particularly among scholars in different countries, collaboration leads to more influential, often-cited research (Katz and Hicks 1997; Fortunato et al. 2018). This is a key argument for further globalizing the scientific enterprise and recognizing the brain circulation and intercultural teamwork that facilitates recognition and impact across scientific communities (Sugimoto et al. 2017; Wagner and Jonkers 2017). For these team members, the benefits of IRC were clear: in-depth global trend analysis and comparison of different national case studies would not have been possible without the knowledge and methodological expertise of collaborators from different countries, at various career stages, and with diverse know-how. The team members learned from each other about historical contexts and the scope of longitudinal trends, broadening their knowledge about higher education and science systems worldwide.

Important meanings associated with IRC were (1) support to cross disciplinary boundaries, and (2) discussions of theoretical and methodological innovation. Reflection of different scientific cultures, strongly related to researcher socialization—in their disciplines, in particular methodologies, and in contrasting cultural contexts—is necessary to engage in dialogue.

'Learning from each other's experiences and competencies; it's impossible to understand a foreign system just by reading articles about it' (PhD 1).

This example shows the significance of and mutual dependence of researchers to broaden their (comparative) knowledge and expertise. Researchers from several countries collaborating impacts team communication. Diverse understandings of hierarchies and dealing with colleagues from different status groups and cultures had important consequences. For example, *'...different norms how team members talk to each other'* and *'no classic boss and student relationship, but in 'our culture' in [Asian country] they listen to the senior scholar. No equal conversations'* (PhD 2). Furthermore, different conceptions of theoretical approaches and expertise in data coding and interpretation were among the challenges the team faced.

In addition to general reasons **motivating** collaboration (Beaver 2001, 2013; Sonnenwald 2007), team members identified numerous specific motivations: learning new methods; research topic relevance; pressure to acquire third-party funding; time to do multidisciplinary work; understanding other higher education and science systems; friendship; and the potential to advance theoretical thinking and methodological expertise. As one PhD student reported:

'I really enjoy the time with my team because some scholars share their skills'; 'I decided to participate based on these two incentives: I mean, the first is that the topic is relevant to my research... and the second is it may be interesting to work in another country'; 'the topic could fit into my future career, I decided to join' (PhD 2).

Another stated that *'after the seminar, [PI 1] asked me to write a proposal with him'* (PhD 1).

Two additional motivations evident in the interviews were the pressure to acquire research grants and third-party funding: *money (laughter)*' (PI 1). Available time to participate was essential: *'I had heard about [the project] and the international collaboration stuff and on his team of grad students I was the only one who was doing higher education research who had time'* (PhD 1).

Further motivations included learning about other higher education and science systems. A shared history among team members promoted their wish to join forces in the project. This confirms Melkers and Kiopa's (2010: 391, 408) finding that growing interest in IRC also reflects the personal desire to work together and to access new and diverse resources and knowledge not available at home.

The team's multidisciplinary and expertise in multiple methods advanced thinking and facilitated development of new approaches, including the unique database construction. Thus, this case corroborates diverse benefits and motivations of IRC mentioned in the research literature.

Next, we address **challenges** faced by the team members. International and multidisciplinary projects require considerable organization and structured management of tasks (work packages). This was experienced as a major challenge.

'Asian people always like to work overtime. But I know [PI 1] would never do that' (PhD 2).

Working styles represent aspects of the scientific culture, cultural background, career stage, and individual personality. Cultural, organizational, and team expectations may not always be in harmony.

Indeed, for some team members, it was challenging to adapt to different social situations and ways of discussing research problems across status groups. Yet experiences in different subteams helped them to overcome fears and to open up, reflecting the influence of global scientific norms.

Not only do different communication styles hinder or enhance collaboration, the geographical location of researchers across time zones and on other continents demanded flexible organization to ensure steady work progress. The distribution of labor needed to be continuously (re)negotiated to achieve the milestones and complete work packages that often relied on other sub-teams. Team members did not explicitly discuss these topics in advance, implicitly assuming that the others would understand their responsibilities to deliver on time—*'We never discussed it'* (PhD 1). This manifests the implicitness of norms as well as non-rational qualities of much collaborative work. More regular communication among team members about tasks and specific goals and needs of individual team members, but also about culturally variant workstyles, could have been optimized. Open communications and support by team leaders even after funding ended were essential for this IRC's long-term success. Culturally diverse subteams with members working outside their countries of origin were responsible for a range of interlocking tasks, requiring individual members to manage different expectations—organizational and interpersonal—to meet the goals set forth in a field new to many. For those writing national case studies on their home country, collaboration proceeded more easily than for those analyzing contexts foreign to them or comparatively.

Over time, more frequent, often bilateral, exchanges within and across the subteams led to better solutions than larger, general discussions with the entire team. Furthermore, while multidisciplinary teams may facilitate innovative ideas and develop new methodological approaches, the lack of shared disciplinary grounding posed challenges. As one doctoral student noted, *'I have never taken a real sociology course'* (PhD 1), which resulted in delays due to the necessary (and gradual) embedding of findings within the project's theoretical approach. This comment emphasizes that recruitment processes must take into account the constellation of researchers assembled and project tasks.

As key challenges to successful collaboration, multiple members mentioned time constraints, insurmountable disciplinary differences, and diverse theoretical and methodological strengths and weaknesses. For example, *'I need to teach them how to do STATA'* or *'... scholars from different backgrounds [...] have their own interests. I think that is very unique'* (PhD 2). Contrasting norms and discussion cultures, communication styles, and handling of hierarchies and status differences were identified as additional challenges. Furthermore, taken-for-grantedness and the reflection of changing task distribution and subteam membership were mentioned as difficult to negotiate. By contrast, facilitators included *'Not making the project too tight; being generous with people; flexibility; I tried to be mellow about it; principle: everybody can use the data, you just have to communicate about it; everybody can publish their own things'* (PI 1). This last example from our interviews shows that flexibility and resilience are important skills team leaders should bring. It is important to keep the overall project goals in mind, but IRCs must also provide room to evolve and to develop new ideas, especially given varying tasks and learning processes within the team and across subteams.

Surveying team members at different career stages and in diverse higher education systems worldwide eight years after project begin, we found a range of benefits, motivations, and challenges (Table 1).

Table 1. Benefits, motivations, and challenges of international research collaborations.

Benefits
<ul style="list-style-type: none"> • Becoming acquainted with other higher education and science systems • Conducting comparative research • Learning from and helping each other • Distribution of labor • Multidisciplinarity advances thinking and facilitates development of theoretical approaches and methods • Broadening knowledge
Motivations
<ul style="list-style-type: none"> • Friendship among team members; reinforcement of existing relationships • Research topic relevance • Career advancement • Learning new theoretical approaches and methods • Networking • Time to do multidisciplinary work
Challenges
<ul style="list-style-type: none"> • Organization and structured management of work packages and tasks • Contrasting cultural and organizational expectations and norms • Career stage differences in researcher needs • Contrasting styles of communication (exchange of information) and work • Team communications and language skills • Distribution of labor • Time constraints (limited project duration) • Diverse theoretical and methodological strengths and weaknesses

Source: Authors' representation.

Among the many benefits, team members mentioned learning about other higher education and science systems and conducting global research. Learning from and helping each other was closely related to the distribution of labor across subteams that enabled results beyond what any individual or regional team could have accomplished alone. Beyond broadening knowledge, the considerable benefits deriving from the project, a perhaps surprising result is the social significance of team members' friendships, the reinforcement of existing relationships, and networking. Thus, this social dimension should not be marginalized in future analyses of research collaboration. Further motivations to participate included the relevance of the research topic, career advancement opportunities, and—associated with the clear benefits of such international, multidisciplinary teams—the learning of new theoretical approaches and methods. Individual work does not provide similarly diverse opportunities to learn.

Simultaneously with numerous benefits and strong motivations to collaborate, the team members also reflected on more and less foundational challenges to the project as it evolved from a short-term funded project to a less formal, long-term global collaboration supported solely by intrinsic motivation to learn, to advance the common research agenda, and to maintain friendly social relations. Unsurprisingly for a truly global project with considerable empirical ambition, the organization and structured management of work packages and tasks was challenging, despite the dedicated project management and continuous usage of information technology. In fact, more challenging than actual work organization were contrasting expectations and norms relating to culture and specific

organizational contexts. Obviously, individual, disciplinary, and career stage differences affected what researchers needed—and this changed over time as the younger scholars matured, completed their dissertations, and embarked on new projects, some directly building upon the project's medium-term achievements.

Critically noted, along with different modes of working, were contrasting styles of communication and differing language skills that inhibited free exchange of information. Beyond these more individual challenges, the distribution of labor and the time constraints due to the limited duration of project funding delayed or limited the IRC's output. Finally, while diverse theoretical and methodological backgrounds reflected team strengths and weaknesses, these also posed challenges for optimal collaboration, especially due to lack of sufficient opportunities for dialogue across considerable spatial distance.

These findings confirm the diversity and complexity of benefits, motivations, and challenges of IRC; of cultural, organizational, and individual characteristics; and of informal and formal collaboration processes leading to scientific contributions, such as coauthored publications. In team science and beyond, these topics require further attention in science, policymaking, and project-based practice. Cultural and social dynamics of collaborative research in multidisciplinary and international teams remain insufficiently investigated. We next reflect on the autoethnographic approach taken and reflect on implications for future research.

6. Discussion and conclusion

The benefits, motivations, and challenges of international collaborative research were analyzed to understand diverse subjective perspectives on the dynamics relating to such collaboration in a specific globe-spanning team. We reviewed research on IRCs on the team level, embedding therein our empirical material, based on autoethnographic interviews and a retrospective survey with the project's researchers and managers. The case study provides diverse perspectives of members in an international, multidisciplinary team in the sociology of science. Our findings confirmed previous findings on IRCs, but also provided novel insights relating to IRC team dynamics.

For example, the significance of and mutual dependence of researchers to broaden their knowledge and expertise is an essential element of successful research collaborations. Using autoethnography, we uncovered implicit norms and non-rational qualities of collaborative work. This result emphasizes the need for more regular personal communications among team members about the contents of their work, but also about their individual goals, unique contributions, and (career development) needs. The creation of an open communication environment by team leaders is crucial, especially in projects with multilingual members (see [Wöhlert 2020](#)). Careful recruitment of team members reflecting project goals and approaches is necessary, questioning assumptions that recruitment should be objective or ignore existing personal relationships, as a crucial source of trust. Cultural and career stage issues should be explicitly addressed by team leaders, who attend to evolving task distribution and provide room to develop new ideas and learn to practice critique within hierarchies. Such findings suggest further research focus on IRC team dynamics.

While the presented findings derive from one case study and thus cannot be generalized, the results of this autoethnography highlight specific dimensions of IRCs in the social sciences—and confirm

previous findings. Using autoethnographic methods to analyze developments over a decade, we presented insights into cultural differences and intercultural communication challenges, but also into myriad benefits and motivations of collaborating across boundaries, both spatial and social. Open questions for future research include the assessment of relevant dimensions of culture in IRCs—such as national, organizational, or epistemic—as well as discussion of the diversity of cultures within multidisciplinary and intercultural teams and its influence on IRC. The above outlined methodological critiques of autoethnography, such as lack of self-criticism and subjectivity notwithstanding, this approach acknowledges and uncovers often hidden but equally important drivers of research, namely interpersonal connections and curiosity, which are difficult to observe applying other methods, such as bibliometrics that emphasizes collaboration's most visible outputs.

Further implications for future research include the investigation of team-level dynamics of IRCs and the specific needs of researchers at different career stages. The utilization of individual team members' strengths and how these can be applied in team building and achieving project goals is another important strand of research. Most studies concentrate on the benefits of IRCs, discounting the challenges. Yet holistic perspectives are needed for realistic planning and durable success in (larger) collaborations that pay off (much) later than official project duration, for the individual researchers, for their organizations, and for global science. The social and networking dimensions should not be underestimated in motivating such research, which may be considered risky, as trust is a key to the sharing of ideas that lead to discoveries. The chosen mixed-methods approach combined analysis of coauthored publications and interpretative analysis of autoethnographic interviews and surveys with various team members (at PI, doctoral, postdoctoral, and project manager levels).

In contrast to the presented retrospectively-designed case study and based on the above findings, for future IRCs, we recommend implementation of accompanying team-oriented autoethnographic research throughout the project—and following researchers' scientific careers longitudinally—to monitor and reflect on researchers' dynamic roles within such complex project arrangements and less formal collaboration networks as their careers develop. This approach would have been beneficial for an in-depth analysis and interpretation of the presented results as well as to capture important nuances and informal processes that contribute to the development of social and intellectual capital on the team level in IRCs (see Melkers and Kiopa 2010: 404).

While there is some variability in the duration of funded projects, the typical 2- or 3-year timeframe is often insufficient to complete empirical data-gathering or the in-depth (comparative) analysis needed for either in-depth understanding or policy recommendations. For complex international projects, teamwork is challenging; thus, necessary trust—including support and friendship—is crucial, especially beyond the official project duration, to complete publications and design follow-up projects; particularly within new settings and constellations of researchers. More explicit reflection of cultural backgrounds and language competencies as well as theoretical and methodological knowledge would facilitate teams' overcoming key challenges, yet this is often not explicitly made a key criterion during peer review, even though such preparation and processes are essential for long-term project success.

Complex projects, and those in particular disciplines utilizing rare infrastructure, often exhibit collaboration imperatives. Comparative and global higher education and science research are

hardly possible without the in-depth contextual knowledge provided by researchers from different places. Team leadership and planning—related to the division of labor and communication, work styles, and cultural and disciplinary backgrounds—demand more attention from scholars and policymakers alike. For the project members, spatial mobility was essential to achieve project goals, yet the burden was unequally distributed. The COVID-19 global pandemic has led to the broad questioning of the effects of spatial distance on IRCs as communication technologies develop even further. More than ever in highly competitive academic labor markets, explicit project planning is crucial. The key motivations and benefits of IRCs are the advancement of scientific careers via opportunities to learn new theories, develop methodological skills, and expand contextual knowledge. Building international, intergenerational networks provides the explicit collaboration opportunities necessary to ensure that the benefits outweigh the challenges of international collaborative research that, in many fields, is increasingly the norm.

Acknowledgements

We thank David P. Baker and our other SPHERE team members who contributed to our international research collaboration and to this case study. For encouragement, advice, and comments on earlier drafts, we thank Sarah-Rebecca Kienast, Anna Kosmützky, Diego Kozłowski, Marcelo Marques, Romy Wöhlert, Mike Zapp, and the anonymous reviewers. We dedicate this article to the memory of Robert D. Reisz (1964–2020), a convivial and dedicated team member and Dean of the Faculty of Political Science, Philosophy and Communication Sciences, West University of Timisoara, Romania, who passed away unexpectedly and far too young.

Funding

We acknowledge the Qatar National Research Fund, a member of Qatar Foundation, for co-funding this research (NPRP Grant No. 5-1021-5-159). The findings herein are solely the responsibility of the authors.

Conflict of interest statement. The authors have no conflicts of interest to declare.

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