

Social innovation for resilience in international collaborative research

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Abstract

The internal dynamics and structure of collaborations affect the performance of its members and, ultimately, the success of the collaborative enterprise. This is tested under conditions of disruption, stressing team dynamics and their ability to succeed. Teams may adapt, employing social innovations which facilitate their ability to adjust to uncertain and changing circumstances. We examine these innovations within the context of international collaborative teams, specifically in the context of the COVID-19 pandemic. The study employs a mixed-methods, multi-country case study research design to identify successful teams' characteristics and develop a typology of social innovations that can promote team resilience. The analysis focuses on individual, group, and organizational factors that contribute to teams' adaptability, including adjustments in behaviors, expectations, work and resource allocation, and social interactions. Our study sheds light on how teams' resilience capacity helps teams innovate their social dynamics and navigate external shocks and succeed in dynamic environments.

1. Introduction

Crisis provoke reactions in social groups to adapt, survive and thrive. These responses are of particularly interest when the social agents are scientist sharing the same goal and located across

the globe. This work investigates how international collaborative teams responded to the disruptions and negative effects of the COVID 19 pandemic. In doing this, this paper contributes to understand the social dynamics of international scientific teams.

Scientific research has become increasingly a collaborative endeavour that creates new opportunities for scientific discoveries, development of solutions and new arrangements for accessing resources. Technological advances and funding structures have favoured researchers joining efforts, and have changed the conception of boundaries (e.g., geographical, disciplinary, cultural, and organizational) that limited collaborations in the past. Research collaborations also encounters interruptions and setbacks that can hinder the participation of its involved parties, and negatively affect the success of the enterprise. This particularly scenario is inexorable when the world faces a health crisis. The existing literature on science teams has addressed questions concerning productivity, visibility, and impact of researchers, drawing on research outputs and networks structures (e.g., publications, citations, and patents). See Sud & Thelwall (2016); De Stefano et al (2013); Wuchty et al (2007). Other sets of the literature have focused on the rationales driving researchers to stablish and sustain collaborations (Boudreau et al., 2017), and on the factors, e.g., strategies, roles and structures effecting collaboration patterns (Hall et al., 2018; 2017; Verbree et al. 2015; Bozeman & Boardman, 2014; Bozeman & Gaughan, 2011). In face of the COVID-19 pandemic, some studies have indirectly shown that the pandemic has had some positive outcomes for some scientists and teams (Myers et al., 2020).

Regardless of the advances presented by the current scholarly works, evidence of global social innovation in science capacity and resilience is lacking. Using a case-based and comparative research design of European and US funded projects, we bring to the fore of the discussion the human dimensions of collaborations, namely how team members engage, support one another in aspects comprehending the formal and informal dimensions of the collaboration, have opportunities for, and cultivate open, honest and often risky vetting of ideas and solutions, matters for their success. Our empirical approach identifies how teams, and their members adapt to the range of unforeseen disruptions, but also deliberately make adjustments to the social interactions, behaviors and expectations within the team context. Our case studies focus on scientific teams funded on distinct international collaborative projects, offering important opportunities for comparison regarding context and social/cultural norms and embeddedness in the international community. This enables us to examine variation in team cultures, adaptation and resilience based on dominant team as well as local/institutional culture.

2. Scope and analytical approach of the study

2.1 International collaborative teams amidst the COVID crisis

The internal dynamics and structure of a collaboration affect the performance of its members and ultimately the success of the collaborative enterprise. International collaborations, which are both difficult to initiate and fragile in normal times due to geographic, cultural, and other factors unique to collaboration across distance (Cummings & Kiesler, 2005; 2007), are also subjected to environmental factors. The disruptions caused by the COVID-19 pandemic restricted researchers from global travel and related research mobility, which in turn limited access to research resources and skills that are facilitated by geographical mobility (Sugimoto et al., 2017; Wagner & Jonkers, 2017; Zippel, 2017). While, at the other hand, we posit that the disruptions caused by an external global shock tests the capacity of research teams to adapt, and triggers social innovations at the individual and team levels, thus generate resilience within scientific teams.

Teams adapt to restrictions, meeting virtually and shifting research activities. Yet, advances cannot only be explained by the advantages of expanded and improved technological solutions. We argue that while technological solutions matter for facilitating adaptation to the pandemic, social innovations at the individual and team levels are equally or more important for generating resilience within scientific teams during the protracted crisis. For example, some studies have suggested that navigating the COVID crisis may require a different type of cooperation among scientists to address scientific challenges (Ellemers, 2021). Further, they may have long-lasting changes on team dynamics and structures. Social innovation is an important component of resilience, as new ideas facilitate adaptive change, enable flexibility, and adjust learning orientation (Moore, et al. 2012). Resilient individuals and teams can step out of their comfort zone, improvising, and as a result, creating novel and useful ideas and solutions (Cooper, Liu, & Tarba, 2014; Stoverink, et al. 2020). This helps to address issues relevant to the ongoing team collaboration, but also (for example) onboarding of new team members (Bowers et al., 2017).

2.2 Research questions and analytical approach

The questions driving this research are: What social factors explain why some internationally networked research project teams thrive during the time of COVID-19, while others languish? In the case of international research teams, the concept of resilience facilitates better understanding of the teamwork conditions and team structures that also enable and encourage social innovation amidst contexts of adversity, such as during the pandemic. In an increasingly globalized scientific landscape, the grand policy question is how to internationalize scientific teams while, at the same time, respond to local demands.

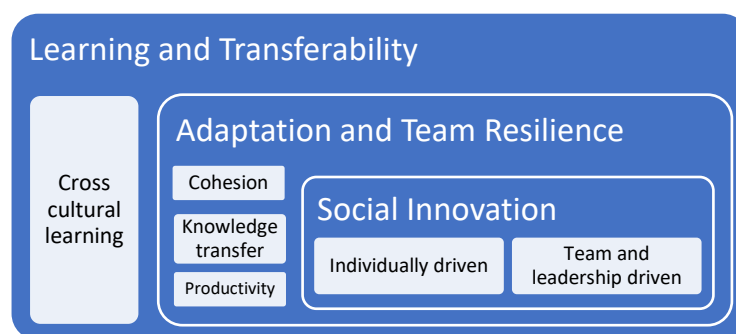
2.2.1 Teams and resilience

We adopt Katzenbach & Smith's (1993) definition of teams, namely "A team is a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable. This definition of teams offers theoretical foundations that can be tested against empirical work via the mobilization of the overarching dimensions of skills, synergies, shared commitment, and organization of the team. The context in which research teams engaged in international research collaborations was marked by the global spread of the novel coronavirus and ensuing COVID-19 pandemic. This forced teams to change their initial structure and agreements, giving place to adapting behaviours and reorganisation of resources. We argue that this adaption extended well beyond leaving office spaces, and the integration of communication technologies and other technological solutions, to those that are more behavioural in nature. Indeed, many knowledge workers employment transitioned to a remote version. However, contrary to e-workers who have traditionally worked from home voluntarily, government mandated lockdowns and changing institutional norms around COVID-19 created an "enforced work from home" situation where team members had to continue working towards team goals while managing home environments that may not be suitable for work purposes (Waizenegger et al. 2020). We draw on recent studies as a basis to understanding the individual and inter-personal behavioral social innovations that research teams adapted in order to continue their research activities in the context of a global health crisis (Stoverink et al. 2020). Team resilience can be considered a team trait that emerges and develops, and is tested, when adversity or disruptions on the business-as-usual takes place. We assume that in adapting to adversity, teams would have responded in innovative ways that would not have otherwise taken place. Social innovations within teams would depend on its composition (seniority of members, resources, diversity of skills), structure, and institutional context.

2.2.2 Analytical dimensions of the study

We explore three intertwining features of the social dynamics of international collaborative teams integral to how teams succeed in response to the pandemic. Our research questions are organized around the following dimensions (see Figure 1): social innovation, adaptation, and resilience, and learning and transferability. Social innovations include new team decisions, actions and initiatives that alter the collaboration context, inputs, activities, and outputs to facilitate accomplishment of research. Resilience captures the collaboration dynamic in which “team members use their individual and collective resources to protect the group from stressors and positively respond when faced with adversity” (Bowers, et al. 2017). The engine of social innovation and the implications for resilience occur within a multicultural environment that both frames and learns from individual and team level experiences during the pandemic.

Figure 1. Intertwining features of the social dynamics of international collaborative teams



The research design builds on an interdisciplinary and theoretically based existing knowledge specific to individual and group dynamics within the context of teams. It also involves a novel methodological approach to identifying teams for case study by implementing advanced computing techniques in a new and robust bibliometric dataset, complemented by other snowball sampling techniques. We identify areas of convergence across international teams that will enable us to produce conclusions about team governance and innovation in different cultural/contextual settings that complements and catalyzes the use of technology over distance, and that can be implemented by multi-country teams in the future. Findings identify actionable tools, mechanisms and approaches that increase the resilience and success of global collaboration in times of disruption.

3. Research design and methods

Due to the exploratory nature of the research questions in this study, we use a mixed-methods case study research design, consisting of interviews, bibliometric data, focus groups and a survey. Our cases are research teams funded on distinct projects that involve international collaborators.

3.1 Case selection

Our focus is on teams that are primarily science and/or engineering STEM research projects, and the specific selection criteria include:

- a) country setting: partner countries represented on international collaborative teams;
- b) team context: multiple members at multiple ranks within a funded research team (projects with at least two PIs);
- c) scientific context: lab-based research and field-based research have realized different effects from the pandemic which will be important to take into account (codified these categories according to the description of the projects);

- d) collaborative history: new/existing collaborative ties which will reveal different aspects of resilience and innovation (through bibliometric data); and
- e) funding source: team project funding source (domestic or international) and related roles as team leaders versus participants.

Our sampling approach is purposeful and takes a two-pronged approach to identify collaborative teams that meet our criteria for inclusion: a) Bibliometric Analysis and b) Snowball Sampling. First, we used bibliometric data obtained from the Dimensions database to identify teams using co-authorship and affiliation data. We then used author's identifiers to detect new and pre-existing collaborations. Funding acknowledgements offered a preliminary idea of collaboration triggers.

In order to elicit evidence of diverse institutional and cultural settings across research teams, and to tap into the knowledge and capacities of our international project partners, we have selected large international collaborative teams funded through U.S. and European funding agencies. This comparative element in our research offers important opportunities for comparison regarding context and social/cultural norms and embeddedness in the international community. Ultimately, to investigate the dynamics of teams before and after the external shock, we selected 8-10 projects funded prior or at the beginning of the COVID pandemic. Teams vary by type of science (lab-based, computational, field-based), number of partner countries, and PI gender.

4. Data collection

Guided by the criteria above, we identified funding instruments fostering international collaboration and operating in different research contexts, namely 'The Partnerships for International Research and Education (PIRE)' NSF program that supports international scientific activities across a wide range of disciplines, and the ERC 'Synergy Grants', which fund transformative research of global scale.

5. Results

***At this stage of the research, all case selection is complete, and interviews are underway, to be completed in Summer 2023. Initial analysis will commence immediately and be ready for presentation at STI 2023.*

References

- Boudreau, K. J., Brady, T., Ganguli, I., Gaule, P., Guinan, E., Hollenberg, A., & Lakhani, K. R. (2017). A field experiment on search costs and the formation of scientific collaborations. *Review of Economics and Statistics*, 99(4), 565-576.
- Bowers, C., Kreutzer, C., Cannon-Bowers, J., & Lamb, J. (2017). Team resilience as a secondorder emergent state: A theoretical model and research directions. *Frontiers in Psychology*, 8: 1360-1367.
- Bozeman, B., & Boardman, C. (2014). *Research collaboration and team science: A state-of-the-art review and agenda*. New York: Springer.<https://link.springer.com/book/10.1007/978-3-319-06468-0>

Bozeman, B., & Gaughan, M. (2011). How do men and women differ in research collaborations? An analysis of the collaborative motives and strategies of academic researchers. *Research Policy*, 40(10), 1393-1402.

Cooper, C., Liu, Y., & Tarba, S.Y., (2014). Resilience, HRM practices and impact on organizational performance and employee well-being, *The International Journal of Human Resource Management*, 25 (17), 2466-2471, DOI: 10.1080/09585192.2014.926688

Cummings, J. N., & Kiesler, S. (2005). Collaborative research across disciplinary and organizational boundaries. *Social Studies of Science*, 35(5), 703-722.

Cummings, J. N., & Kiesler, S. (2007). Coordination costs and project outcomes in multi-university collaborations. *Research Policy*, 36(10), 1620-1634.

De Stefano, D., Fuccella, V., Vitale, M. P., & Zaccarin, S. (2013). The use of different data sources in the analysis of co-authorship networks and scientific performance *Social Networks*, 35, 370–381.

Ellemers, N. (2021), Science as collaborative knowledge generation. *Br. J. Soc. Psychol.*, 60: 1-28. <https://doi.org/10.1111/bjso.12430>

Hall, K. L., Vogel, A. L., Huang, G. C., Serrano, K. J., Rice, E L., Tsakraklides, S. P., Fiore, S.M., Salas, E., Kazak, E., Mcdaniel, S. H., (2018).The Science of Team Science: A Review of the Empirical Evidence and Research Gaps on Collaboration in Science. *The American psychologist*,73(4), p. 532-548. <https://doi.org/10.1037/amp0000319>

Hall, K. L., Stipelman, B. A., Vogel, A. L., & Stokols, D. (2017). Understanding Cross-Disciplinary Team-Based Research. *The Oxford Handbook of Interdisciplinarity*, 338.

Katzenbach, J., & Smith, D. (1993). The discipline of teams. *Harvard Business Review*, 71, 111–120.

Myers, K.R., Tham, W.Y., Yin, Y. et al. (2020). Unequal effects of the COVID-19 pandemic on scientists. *Nat Hum Behav* 4, 880–883. <https://doi.org/10.1038/s41562-020-0921-y>

Moore, M.-L., F. R. Westley, O. Tjornbo, and C. Holroyd. (2012). “The Loop, the Lens, and the Lesson: Using Resilience Theory to Examine Public Policy and Social Innovation.” In *Social Innovation: Blurring Boundaries to Reconfigure Markets*, edited by A. Nicholls and A. Murdock, 89–113. New York: Palgrave Macmillan

Stoverink, A. C., Kirkman, B. L., Mistry, S., & Rosen, B. (2020). Bouncing Back Together: Toward a Theoretical Model of Work Team Resilience. *Academy of Management Review*, 45(2), 395–422. <https://doi.org/10.5465/amr.2017.0005>

Sud, P., & Thelwall, M. (2016). Not all international collaboration is beneficial: The Mendeley readership and citation impact of biochemical research collaboration. *Journal of the Association for Information Science and Technology*, 67(8), 1849-1857.

Sugimoto, C.R., Work, S., Larivière, V. and Haustein, S. (2017). Scholarly use of social media and altmetrics: A review of the literature. *Journal of the Association for Information Science and Technology*, 68: 2037-2062. <https://doi.org/10.1002/asi.23833>

Verbree, M., Horlings, E., Groenewegen, P., van der Weijden, I., & van den Besselaar, P. (2015). Organizational factors influencing scholarly performance: A multivariate study of biomedical research groups. *Scientometrics*, 102(1), 25-49.

Wagner C.S., & Jonkers K. (2017) Open countries have strong science. *Nature* 550(7674):32-33. doi: 10.1038/550032a.

Waizenegger, L., McKenna, B., Cai, W., & Bendz, T. (2020). An affordance perspective of team collaboration and enforced working from home during COVID-19. *European Journal of Information Systems*, 29(4), 429–442. <https://doi.org/10.1080/0960085X.2020.1800417>

Wuchty, S., Jones, B. F., & Uzzi, B. (2007). The increasing dominance of teams in production of knowledge. *Science*, 316(5827), 1036-1039.

Zippel, K. (2017). *Women in Global Science Advancing Academic Careers through International Collaboration*. Stanford: Stanford University Press

Open science practices

This study uses primary data that is not publicly available due to data protection regulations.

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Competing interests

Authors declare no competing interests.

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