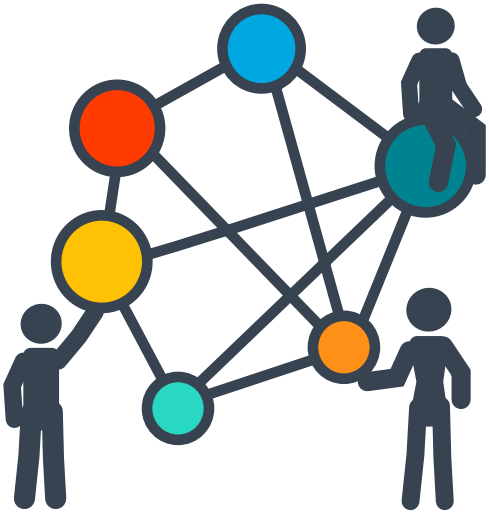
SSH-STEM networks: Bridging divides between social and technical



Alevgul H. Sorman (alevgul.sorman@bc3research.org)
Basque Centre for Climate Change, Spain

Suggested citation: Sorman, A.H., 2023. *SSSH-STEM networks: Bridging divides between social and technical.* Cambridge: SSH CENTRE.

ABSTRACT

In research, STEM and SSH fields are often seen as separate areas of study. However, in the real world, we encounter a mix of sensibilities. SSH-STEM networks can help situate knowledge among researchers and connect different actors within and beyond academia to better understand societal challenges. Bridging the SSH-STEM divide and tapping into the unique value of diverse perspectives through networks can open up new partnerships, possibilities, and innovative ways to tackle complex challenges such as the climate crisis.

SUMMARY

- Inter- and trans-disciplinary insights are required to tackle complex societal challenges, with SSH-STEM networks and team science supporting the development of these insights.
- SSH-STEM networks are a means for professional learning, development and knowledge exchange
- SSH-STEM networks can contribute to policy by producing evidence and science for policy, to business through innovation and financial support, and to communities through collective scholarship, practice and encouraging social movements
- SSH-STEM networks support cognitive diversity and encourage different forms of social learning by working with different cultural groups
- SSH-STEM networks are an important channel for science communication and bring visibility to underrepresented SSH disciplines and the work of women

KEY DEFINITIONS

Interdisciplinarity: An approach that urges unrelated disciplines to cross boundaries and create new knowledge [1].

Transdisciplinarity: An approach transcending academic boundaries and producing knowledge through collaboration with multiple actors and the broader community [2].

Communities of Practice (CoPs): A group of professionals (e.g. professional associations) collaborating around a particular area of practice [3].

Professional Learning Networks (PLNs): Networks organised around professional niches to foster learning [4] focusing on career development through exchanging knowledge, resources, and best practices.

Team Science: A collaborative approach making use of the multiple skills of researchers with various backgrounds [JL] [5][1].

1 https://guides.lib.vt.edu/teamscience

Introduction

To understand complex societal challenges such as the climate crisis, SSH-STEM networks can bring together knowledge from different fields to come up with innovative solutions, which otherwise would be unimaginable if each field operated in its disciplinary silo. SSH-STEM networks can also be used as a means to make connections and build relationships across people, uniting actors across different geographies and knowledge domains [SS].

In terms of scope, consolidating knowledge from both SSH and STEM can help tackle broader social-political and ethical concerns while also scrutinising the technical feasibility of real-world problems. **Interdisciplinarity** can encourage cross-fertilisation across disciplines while **transdisciplinarity** can encourage collaboration beyond academia with the broader community.

Networks, in general, are extremely powerful in demonstrating that one can learn so much more by collaborating with others as opposed to in isolation, especially when the emphasis is given to working within a team. From established networks, one can build new networks [JL] (e.g. research spin-offs or **Communities of Practice** (CoP)) increasing collaboration, and improving connections while sharing know-how and resources. However, developing new collaborations between individuals not speaking the same (academic) language comes with time and resources costs [JL].

SSH-STEM networks can be considered **Professional Learning Networks (PLNs)** operating in the world of science, policy and practice that brings together knowledge to promote **inter-** and **trans-disciplinarity.** Networks of SSH-STEM specifically, can help consolidate both theoretical and practice-oriented understandings to tackle current-day challenges [SS].

Within the policy domain, SSH-STEM networks are important for the European Commission (EC) to tap into evidence and science for policy [6] from different disciplines. (e.g. The SET Plan (Strategic Energy Technology Plan) [7] or the EU's climate neutrality goal [8]) which can eventually be adopted across countries located far from one another, both geographically and in terms of ambition.

From a business perspective, SSH-STEM Networks can serve as a hub for talent development, support financing or provide access to funding from new emerging partnerships. Also, the potential of STEM-SSH collaborations can lead to social, technological, or product innovation, thus opening space for new products, services, or processes.

In terms of community, SSH-STEM Networks can promote cross-fertilisation across members and support social movements and protests steered by collectivism. In this sense, scholarship and practice originating from SSH-STEM can stimulate a push for social or cultural change, that would not otherwise see the light of day, resulting in popular mobilisations [SS]. In this regard, SSH-STEM networks can help initiate some of that momentum and dynamism required for transformations for tackling pressing societal challenges.

This literature brief looks into the potential of bridging the SSH-STEM divide by bringing together scientific and practical knowledge to promote inter- and trans-disciplinarily via collaborative networks. The insights presented are informed by academic and grey literature, and interviews conducted with two expert academics[1].

Current Understandings

Significant Findings to Date

In the popular imaginary, STEM has links with the "real world" associated with universal and objective science, while SSH research is more oriented to policy, trying to understand subjectivity and plural interpretations of how things work [JL]. However, such an overly rigid demarcation of SSH versus STEM can result in an artificial divide. In the real world, problems are not so clear cut as in research and academia, rather, we encounter a **mix of these sensibilities** [SS].

Knowledge generated through SSH disciplines is *differently* useful to STEM disciplines [9]: SSH research creates social value [10] and within SSH-STEM networks these relationships can prosper in terms of their **different but equally valid contributions** to science and our understanding of the world.

Despite the ancient origins of SSH, especially the Humanities (e.g. philosophy), concerned with the art of asking questions, dialogue [JL] and the genuine quest for knowledge, until recently, in energy research specifically, there was an **underrepresentation** of SSH disciplines and methods and a lack of interdisciplinarity and women authorship in the field [11]. Moreover, the contribution of humanities research within SSH is also not on par with the social sciences nor appreciated to its fullest potential [JL]. Yet, increasingly within EC projects calling for interdisciplinary and socially-relevant research and innovation, SSH is becoming a key component (See for example [12]) as well as commitments to promoting gender equality [13]. SSH-STEM networks can indeed be a mechanism to bring the advantages and complementarity of SSH research into view and mainstream the role and contribution of women in this respect.

There are, however, different features across SSH and STEM that can emerge such as challenges related to funding, expected outputs and different timescales in producing outputs.

At present, in terms of funding and support, inter and transdisciplinary collaborations, forming the essence of SSH-STEM Networks are **limited by funding of project cycles** (typically 3-5 years) which leads to temporal and disciplinary fragmentation [SS]. There are differences across SSH and STEM disciplines in terms of achieving research outputs, as well as creating visibility across SSH and STEM research that may not particularly be achieved in short temporal scales but are rather experienced over broad social-cultural processes [14]. Moreover, building robust and working relationships across actors takes time and resources, especially if these relationships and new networks are classified as creative, novel and transdisciplinary [JL].

Another point is that in **SSH-STEM knowledge generation**, SSH is generally underfunded. For example, Overland and

1 Interview contributions to the literature brief are indicated through bracketed initials

Sovacool [15] show that **only 0.12% of all research funding[2] and 5.21% of all funding for climate change, was spent on the social science of climate mitigation.** This being a foremost priority, can be channelled through SSH-STEM networks for making a scientific impact and highlighting the need for additional funding.

Online networking has shown its central role in creating connections and providing information in many relevant ways [SS]. With the digital revolution, SSH-STEM networks have emerged as online PLNs, along with less formally structured, online social networks and social media as a means for social learning. However, online social networks may also create eco chambers, promote populism, and polarisation, therefore need to be moderated and managed well in line with ethical commitments.

Emerging Practices

In this section, emerging and best practices from science, policy and praxis are explored highlighting several core values in knowledge generation as well as success stories from examples on the ground.

Collaborative networks are a crucial means to bridge STEM and SSH, uniting experts from different fields, and from theory and practice, to work on common goals. **Transparency**, the **democratisation of science** and **open access to knowledge** in SSH-STEM networks are important values [SS], encouraging fairness, accountability and responsibility in societies in terms of Open Science and Responsible Research and Innovation [16]. Within SSH-STEM networks, transparency and the ways in which knowledge is created [17] need to be promoted, which, in turn, feed back into more meaningful collaborations.

Calls for "**reflexive science**"[3] within meaningful SSH-STEM collaboration and networks are emerging as a means for cultivating a shared interest in theoretical and practical-political challenges [18]. For example, **success stories** in SSH-STEM collaboration and numerous Horizon Projects have been documented by the transnational network Net4SocietyHE (N4SHE) for Culture, Creativity and Inclusive Society" (Cluster 2)[4]. These success stories emphasised the added value of integrating SSH in their project's design and implementation as well as visibilsing the evident contribution from SSH partners specifically. Similar efforts can be undertaken for Climate, Energy and Mobility (Cluster 5) in the Horizon Europe Programme.

Another event from Ireland[5], for example, focusing on SSH and interdisciplinarity, concluded the need for diversifying international contacts in a post-Brexit seeing via networks, highlighting the challenge of being included in a network for the first time while also underlining the need for building trust, overcoming language barriers, as well as including early career researchers in the process.

Within the EC there has already been a great learning process of embedding interdisciplinarity within project calls. However, especially within the Horizon Programme, transdisciplinarity must be further encouraged [JL], especially in SSH-STEM networks engaging with actors beyond academia. In transdisciplinary research and application, it is possible to learn from best practices that are already happening on the ground such as **citizen assemblies6**, **low-traffic neighbourhoods7,** or **transition town8 movements** [SS]. These can be listed as exemplary practices that can be elevated into SSH-STEM networks in terms of learning, organisation, motivation and mobilisation.

SSH-STEM networks moreover are gateways for **science communication** and **visibility**. SSH-STEM networks, harbouring multiple actors from science, policy, practice, business and the wider public can support, promote and disseminate energy, transport and climate-related science and knowledge for transformative change.

Future SSH Priorities

In terms of organisational structure, within SSH-STEM networks, there must be an evaluation of group dynamics and balances assuring representation of all actor groups for **inclusion, diversity, equity** and **access** (IDEA). The inclusion of researchers at different career stages should be ensured, especially calling for the **inclusion of Early Career Researchers** (ECRs), as they have different understandings, and are not locked into a particular vision, methodology, or framework [JL][9].

The presence of **women in leadership positions** within SSH-STEM Networks, project work and activities is also vital. While this is emerging, it is not yet mainstream [JL]. For example, the number of applicants for research funding in R&D in the EU shows gender inequalities: the ratio of men to women in the social sciences is 1.1:1; in Humanities is 1.2:1; in Natural Sciences 2:1 and in Engineering and Technology is 3.1:1[10] [13]. Gender equality currently in R&D in the EU, although encouraged, is far from being achieved. Therefore SSH-STEM Networks can be a key **leverage mechanism** in supporting women in this process while also making their contribution to the scientific world more visible.

Within SSH-STEM networks, it is also important to boost work with different cultural groups promoting the IDEA principles to address structural inequities. There are many different cultures inside Europe which manifest in many different ways of learning and working together [JL] – an important dimension of social learning in SSH-STEM networks while

2 Overland and Sovacool 2020 analyse research grants from 1950 to 2021 covering 4.3 million awards with a cumulative budget of USD 1.3 trillion with funding awarded by 333 organizations from 37 countries

3 Linked to WP5 of SSH CENTRE Project

4 https://horizoneuropencpportal.eu/store/success-stories-ssh-stem-collaboration

5 Event co-hosted by Enterprise Ireland (EI), the Irish Marie Skłodowska-Curie Office (IMSCO), and the Irish Universities Association (IUA) titled: "SSH and Interdisciplinarity in Horizon Europe" on May 25th, 2022 See: https://www.iua.ie/wp-content/uploads/2022/07/SSH-and-Interdisciplinary-in-Horizon-Europe_Opportunities-barriers-and-useful-support-Workshop-Report_July-2022.pdf

6 https://europeanclimate.org/stories/the-growing-traction-of-climate-citizens-assemblies/

7 https://www.lowtrafficneighbourhoods.org/

8 https://transitionnetwork.org/

9 Linked with Knwoledge Brokerage with WP3 of SSH CENTRE Project

10 These ratios have been obtained from reference [13] She uses figures from Gender in research and innovation: statistics and indicators in Annex 7.18 and 7.19 for EU-28 Applicants

embracing cognitive diversity. For this purpose, collaboration and education can be harnessed to support **the four R's—Respect, Relevance, Reciprocity, and Responsibility** [19] which can reform the way higher education institutions work, promoting further inclusion and diversity. These features ultimately increase problem-solving capabilities, creativity, and greater innovation: core values also promoted by STEM-SSH networks.

Takeaways

Takeaways for Research and Academia

- SSH-STEM networks provide a space for **collaborative learning** as professional learning networks and can provide opportunities for team science and work in terms of **policy, business** and **community**
- Embrace **reflexivity and transparency** and the **democratisation of science** within SSH-STEM networks as an important value to achieve Open Science and Responsible Research and Innovation
- Promote principles of **inclusion, diversity, equity** and **access** (IDEA) within SSH-STEM organisational structures to include Early Career Researchers, and different cultural groups and engage with actors beyond academia
- SSH-STEM networks can help initiate **momentum for community support** steered by knowledge, collectivism, mobilisation and sociocultural change
- Learn from **best practices** that are already happening on the ground (e.g. citizen assemblies or transition towns movements) and **elevate lessons learned** into SSH-STEM networks and organisation

Takeaways for the European Commission

- Recognise the **time, resources**, and **effort** required for building **SSH-STEM networks** and inter and transdisciplinarity which should be reflected in terms of project funding, length, and expected scientific output
- Acknowledge SSH-STEM networks as important means for generating **evidence** and **science for policy**. Such networks can **raise ambition** in terms of climate/energy/mobility targets and **draw actors closer together**
- Direct efforts to shine the spotlight on the **contribution of SSH partners** while making the added value of **SSH** in project design and implementation **more visible**
- Take advantage of SSH-STEM networks as **hubs for talent** and business **development** for social, technological or product innovation. Encourage SSH-STEM networks for businesses to boost innovation
- Encourage **inclusion, diversity, equity** and **access** (IDEA) in funding opportunities as well as promote **transparency**, the **democratisation of science** and **open access to knowledge**
- Tap into SSH-STEM networks for encouraging **women leaders** for **gender equality** and supporting collaborations between different **cultural groups** for **inclusivity** and **cognitive diversity.**

Acknowledgements

We are grateful for the insights provided by the two interviewees who informed the literature brief – Dr Siddharth Sareen [SS], University of Stavanger (UiS) and Dr Jenny Lieu [JL], TU Delft.

We also would like to thank Marten Boekelo, Ruth Mourik (DuneWorks) and Davide Natalini (Anglia Ruskin University) for reviewing this literature brief.

This literature brief is part of the SSH CENTRE (*Social Sciences and Humanities for Climate, Energy aNd Transport Research Excellence)* project which has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101069529 and from UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee [grant No 10038991].

References

[1] Stock, P., & Burton, R. J. (2011). Defining terms for integrated (multi-inter-trans-disciplinary) sustainability research. *Sustainability*, *3*(8), 1090-1113.

[2] Klenk, N. (2018). From network to meshwork: Becoming attuned to difference in transdisciplinary environmental research encounters. *Environmental Science & Policy*, *89*, 315-321.

[3] Creating Communities of Practice, The Edmonton Regional Learning Consortium (ERLC) https://www.communityofpractice.ca/

[4] MacDonald, K., Diamond, F., Wilkinson, J., Sum, N., Longmuir, F., & Kaukko, M. (2022). Creating spaces of learning in academia: fostering niches for professional learning practice. *Studies in Continuing Education*, *44*(2), 266-283.

[5] Bennett, L.M. and Gadlin, H., 2012. Collaboration and team science: from theory to practice. Journal of investigative medicine, 60(5), pp.768-775.

[6] Saltelli, A. and Funtowicz, S., 2017. What is science's crisis really about? Futures, 91, pp.5-11.

[7] Dufour, E., Lisi, V. and Robison, R. 2019. A guide to the SET-Plan: Including the role of the Social Sciences and Humanities. Cambridge: Energy-SHIFTS.

[8] COM. 2018. 773 final, 'A Clean Planet for All' https://ec.europa.eu/transparency/regdoc/rep/1/2018/EN/COM2018-773-F1-EN-MAIN-PART-1.PDF

[9] Foulds, C., Royston, S., Berker, T., Nakopoulou, E., Bharucha, Z. P., Robison, R., ... & Živčič, L. 2022. An agenda for future Social Sciences and Humanities research on energy efficiency: 100 priority research questions. *Humanities and social sciences communications*, *9*(1), 1-18.

[10] Olmos-Peñuela, J., Benneworth, P., & Castro-Martinez, E. 2014. Are 'STEM from Mars and SSH from Venus'?: Challenging disciplinary stereotypes of research's social value. *Science and Public Policy*, *41*(3), 384-400.

[11] Sovacool, B.K., 2014. What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda. Energy Research & Social Science, 1, pp.1-29.

[12] Sonetti, G., Arrobbio, O., Lombardi, P., Lami, I.M. and Monaci, S., 2020. "Only Social Scientists Laughed": Reflections on Social Sciences and Humanities Integration in European Energy Projects. Energy Research & Social Science, 61, p.101342.

[13] European Commission, Directorate-General for Research and Innovation, *Horizon Europe : gender equality : a strengthened commitment in Horizon Europe*, Publications Office, 2021, https://data.europa.eu/doi/10.2777/410001

[14] Geels, F.W., 2010. Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Res. Policy* 39 (4), 495–510.

[15] Overland, I. and Sovacool, B.K., 2020. The misallocation of climate research funding. Energy Research & Social Science, 62, p.101349.

[16] Turnhout, E. 2022. A Better Knowledge Is Possible Transforming Science And Technology For Justice, Pluralism, And Sustainability. Inaugural Address - 14 October 2022. University of Twente. Available Online: https://www.utwente.nl/en/academic-ceremonies/inaugural-lectures/booklets/booklets-2022-2023/inaugural-booklet-professor-esther-turnhout-14-october-2022.pdf Accessed on 04/01/23

[17] European Commission, Directorate-General for Communication, Directorate-General for Research and Innovation, *Responsible research and innovation (RRI), science and technology : report*, Publications Office, 2013, https://data.europa.eu/doi/10.2777/45726

[18] Strand, R. (2019). Striving for reflexive science. *Fteval Journal for Research and Technology Policy Evaluation*, *48*(48), 56-61.

[19] Kirkness, V.J. and Barnhardt, R., 1991. First Nations and higher education: The four R's—Respect, relevance, reciprocity, responsibility. Journal of American Indian Education, pp.1-15.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101069529 and from UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee [grant No 10038991].