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**Research Article**

# Measuring the Cultural and Socio-economic Effects of STEMAC R & D Activities

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**ABSTRACT**

Measuring impact is fundamental to improving the social acceptability of public investment in social and cultural infrastructures, as it can provide a basis for aligning research and innovation with society's values, needs and expectations. Looking at the potential of social and cultural innovation, a specific innovation in the cultural and creative industries is increasingly the result of a complex co-creation process involving knowledge flows throughout the economic and social environment. It has therefore become increasingly clear that co-creation plays a central role within the open innovation of STEMAC R&D. However, an accepted methodology for impact assessment is still lacking. The aim of this paper is to develop and test a methodology to measure the impact of technology transfer from basic research and development to industrial application and its cultural and socio-economic effects.

**Keywords:** Co-creation; Cultural Innovation; Diversity; Innovation; Research Infrastructures; Social Innovation.

## STEMAC R&D

STEMAC stands for Science, Technology, Engineering, Mathematics, Arts, and Culture: "This approach expands on the STEAM model by including cultural studies. The inclusion of cultural studies recognizes the importance of cultural diversity, cultural heritage, and Museology and their impact on the development and application of STEM knowledge (Maegaard, Pozzo, Melloni, & Woollard, 2019). By including cultural studies in the STEM curriculum, STEMAC aims to produce graduates who are more globally aware, culturally sensitive, and able to adapt to diverse environments that bridge the Humanities with Natural Sciences" (Liritzis, 2018; Liriztis, et al., 2024).

## SOCIAL AND CULTURAL INNOVATION

Globalization has made it clear that one of the most urgent objectives is to develop policies of social and cultural innovation for the benefit of citizens - policies aimed at achieving changes in the regulatory environment that make societies both inclusive and reflective.

The *Faro Framework Convention on the Value of Cultural Heritage for Society of the Council of Europe* encourages reflection on the role of citizens in the process of defining, creating and managing a cultural environment in which communities develop (Council of Europe, 2005).

It is now time to examine the implications of innovation for redefining the ways in which the humanities and the arts have been conceived, in particular, to visualize the various ways in which they engage with cultural processes in the past, present and future.

Innovation is part of the economy because it is about money generating knowledge. There is social and cultural innovation. Social and cultural innovation is a fact of life.

Social innovation aims to directly address unmet social needs in new ways by developing or improving new products and services through the direct involvement of the people who need and use them, typically in a bottom-up process (European Commission: Directorate-General for Research and Innovation, MacCallum, Moulaert, Leubold, & Mehmood, 2017).

We know what social innovation is: it should be the backbone of all European research policies, as Marcelo Rebelo de Sousa, President of the Republic of Portugal, made clear in his memorable closing remarks at the *Opening up to an Era of Social Innovation Conference* (European Commission: Directorate-General for Employment, Social Affairs and Inclusion & Directorate-General for Research and Innovation, 2019).

Culture-based social innovation, or cultural innovation, is something real that complements social and technological innovation. It requires spaces of exchange where citizens engage in the process of sharing their experiences while appropriating the content of common goods. We are talking about public spaces such as libraries, museums, science centers, but also any place where co-creation activities can take place. It is at this level that social innovation becomes reflexive and generates cultural innovation. Insisting on reflexivity helps to raise awareness of the importance of framing issues when engaging with science and society, identifying problems and defining solutions.

## MEASURING IMPACT

Heritage-led innovation stands for culture fostering technological innovation. The syntagma is sometimes mentioned only to say that culture also needs innovation and even produces innovation: museum studies promote innovation in museography; archaeology promotes innovation in data science, which becomes data humanities; music and art promote innovation through social networks. Technology adds economic value to the heritage sector: digitized cultural material can be used to enhance the visitor experience, develop educational content, documentaries, tourism applications and games (European Committee of the Regions, 2014).

How to assess impact? STEMAC R&D users look at content providers, among which museums, science centers, libraries and research infrastructures stand out. They focus on processes triggered by themes such as cosmopolitanism, inclusiveness, mobility, migration, heritage and creativity. Content and processes are intertwined in co-creation activities. Given that a "specific innovation can no longer be seen as the result of predefined and isolated innovation activities but rather as the outcome of a complex co-creation process involving knowledge flows across the entire economic and social environment" (European Commission, 2016), the attention shiofts to co-creation, which is the "joint creation of value by the company and the customer; allowing the customer to co-construct the service experience to suit their context" (Prahalad & Ramaswamy, 2004). To this end, the Digital Commons Lab of the Fondazione Bruno Kessler has pioneered the use of data science to study the structure, dynamics and resilience of real-world systems, to carry out multi-layered analysis of online social activity and collective attention, computational modeling of individual behavior, and the development of new tools for the analysis of social networks (FBK, 2024).

We should also measure the impact the other way around. The question is what part of social innovation is cultural innovation, and what rights can cultural innovation claim in relation to society (Koefoed, 2017)?

A preliminary answer is: (1) European cultural heritage marks our cultural identity, which is at the same time cultural diversity. (2) Assessing cultural innovation as a value-sensitive integration with technological and social innovation is the great challenge facing contemporary science and technology studies, and we need to take a closer look at it.

With regard to measuring the impact of STEMAC R&D embedded in research infrastructures, the Social Sciences and Humanities Strategy Working Group of the European Strategy Forum in Research Infrastructures "monitors and assesses the implementation of existing Social Sciences and Humanities RIs, disseminates and shares best practices of Social Sciences and Humanities RIs, and highlights and improves the potential applications in multi-disciplinary RIs. It also explores RIs contribution to innovations and knowledge transfer to society" (ESFRI, 2024).

Table 1. Research Infrastructures of the ESFRI SSH SWG (ESFRI 2024)

| N. | Research Infrastructure | Website | Active since |
|---|---|---|---|
| 1 | Council of European Social Science Data Archives | https://www.cessda.eu/ | 2006 |
| 2 | Survey on Health, Ageing, and Retirement in Europe | https://share-eric.eu/ | 2006 |
| 3 | European Social Survey | https://www.europeansocials | 2006 |

| N. | Research Infrastructure | Website | Active since |
|---|---|---|---|
| | | urvey.org/ | |
| 4 | European Research Infrastructure for Language as Social and Cultural Data | https://www.clarin.eu | 2006 |
| 5 | Digital Research Infrastructure for the Arts and Humanities | https://www.dariah.eu | 2006 |
| 6 | European Research Infrastructure for Heritage Science | https://www.e-rihs.eu | 2016 |
| 7 | European Holocaust Research Infrastructure | https://www.ehri-project.eu/about-ehri | 2018 |
| 8 | Religious Studies Infrastructure: Libraries, Experts, Nodes & Centres | https://www.resilience-ri.eu/reireearch | 2021 |
| 9 | Open Research Infrastructure for Scholarly Communication in the ERA for SSH | https://operas-eu.org | 2021 |
| 10 | Generations and Gender Program | https://www.ggp-i.org/ | 2021 |
| 11 | Growing Up in Digital Europe Coohort | https://www.guidecohort.eu | 2021 |

**CESSDA ERIC** is an umbrella organization for European Social Science data archives, which has been active since the 1970s to improve access to data for researchers and students, and to enhance the exchange of data and technologies among data organizations.

**SHARE ERIC** aims to elaborate a statistical survey of lifestyle, health, economics and social life in over fifty European countries.

**ESS ERIC** aims not only to provide an academically robust way of "knowing Europe", but also to contribute to the scientific community's endeavour to develop, test and implement methods of reliable social measurement.

**CLARIN ERIC** is a large-scale pan-European collaborative effort to create, coordinate and make language resources and technologies available and readily usable.

**DARIAH ERIC** is the first permanent European digital infrastructure for the Arts and Humanities.

**E-RIHS** creates synergies for a multidisciplinary approach to heritage interpretation, preservation, documentation, and management.

**EHRI** has trans-national Holocaust research, commemoration and education as its mission and its main challenge is the wide dispersal of sources and expertise across many institutions. EHRI overcomes such fragmentation by connecting sources, institutions and people.

**RESILIENCE** collects historical documents and current information on global theological political issues while fostering interfaith dialogue (under evaluation).

**OPERAS** is the Research Infrastructure supporting open scholarly communication in the social sciences and humanities (SSH) in the European Research Area. Its mission is to coordinate and federate resources in Europe to efficiently address the scholarly communication needs of European researchers in the field of SSH.

**GGP** provides scientists and policy makers with high quality and timely data about families and life course trajectories of individuals to enable researchers to contribute insights and answers to current societal and public policy challenges. It provides users with an open-access data source of cross-nationally comparative surveys and contextual data.

**GUIDE** is about tracking children's personal wellbeing and psychosocial development, in combination with key indicators of children's homes, neighbourhoods and schools.

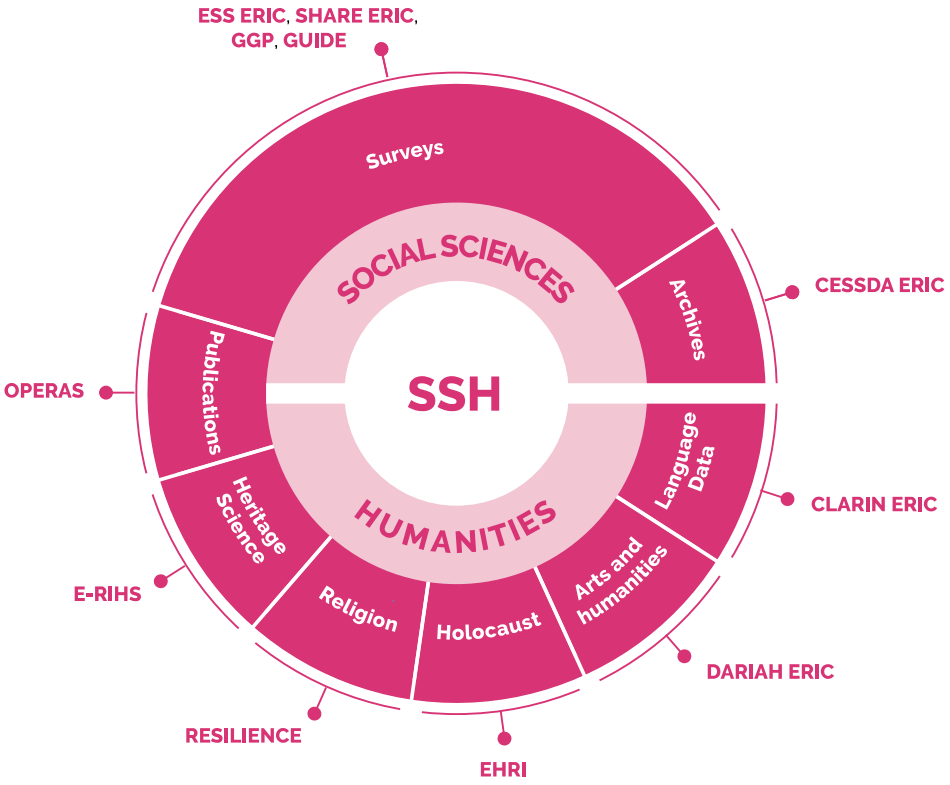


Figure 1. ESFRI Landscape Analysis 2024 (ESFRI, 2024)

## INDICATORS

The first set of indicators considers the number of institutional change measures (European Commission, 2015). Evidence-based policies for multi-level reforms of the regulatory environment make open innovation actually possible and are the basis for assessing cultural innovation as a value-sensitive integration of technological and social innovation (Pozzo, Filippetti, Paolucci, & Virgili, 2020).

Access is obviously the basis for developing the second set of indicators. "Measuring the number of users of knowledge produced per discipline within the humanities can be seen as a murky concept, especially since cross-disciplinary research is becoming more widespread" (Pozzo et al., 2020, p. 428).

The third set of indicators assesses participatory open science practices, which, due to the nature of the networked publics involved and the established structures between and within institutions, pose new challenges, but also new opportunities and practices for understanding and defining our common goods (Pozzo et al., 2020). The most urgent goal is to overcome barriers to participation and obtain valuable input from citizens:

We need to look into different types of participatory practices online in relation to the cultural heritage domain and into different levels of interaction. Possible sites of analysis could be the interaction between participants, the participation in the work by different stakeholders, the potentially privileged levels of interaction with the metadata, or tensions in the agency of the participants in relation to the task (Politics of Metadata, 2024).

Given that cultural innovation is about co-creation, the fourth set of indicators is about measuring co-creation by analyzing user data (Pozzo et al., 2020). Controlling levels of access, transparency, secrecy, proximity, connectedness, alienation. The Politics of Metadata Forum provides an interdisciplinary overview of current research on metadata, participation and digitization of cultural heritage. It proposes the following activities: (1) Relation between control dynamics and power relationships outside the technology framework; (2) Differentiations in entry/exit points to the platform; (3) Tensions between individual scoring systems and collective sharing processes; (4) Photo tagging behaviours across languages (Politics of Metadata, 2024).

Ultimately, cultural innovation achieves impact by influencing individual processes of reflection and collective processes of inclusion through the "social process of sharing one's own reflection in participatory co-creation.

## CONCLUSION

STEMAC R&D open innovation aims at a breakthrough for the integration of society in science and innovation. The mission of Horizon Europe, the current Framework Program for Research and Innovation of the multiannual financial period 2021–2027, is to promote research on the conditions of the possibility of systemic changes to implement the twin ecological and digital transitions. With the next Framework Programme for Research and Innovation for the multiannual financial period 2028–2035, we expect to see a change in mindset with implications for urban development and regeneration.

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## ETHICAL DECLARATION

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