2. STIR

The Socio-Technical Integration Research (STIR) was developed by Erik Fisher, from Arizona State University (USA). At present only those embedded humanist can apply the STIR method who was trained by Erik Fisher. Thus the results of the STIR studies in different countries are comparable, as they are carried out according to the same methodology without any information distortion.

The **main aim** of the method is to strengthen cooperation between social scientists and natural scientists and to integrate social considerations into the daily work of natural researchers. Its main objectives are to identify and compare external expectations and demands for laboratories to engage in responsible innovation, to assess and compare the current responsiveness of laboratory practices to these pressures, and last but not least to investigate and compare how interdisciplinary collaborations may assist in elucidating, enhancing or stimulating responsiveness (https://cns.asu.edu/research/stir).

Regarding the **process of the method**, first the STIR investigator solicits the actively participating researchers ("high interaction" persons) and control researchers ("no interaction" persons) to participate in the STIR investigation. The STIR investigator is embedded in the daily operation of the natural science research group. The STIR investigator visits the laboratory 2–3 times per week for **12 weeks**, observes the research activity of the participants, their attitudes, and their decision points through continuous interactions. A STIR investigator communicates only with the actively participating researchers, but never expresses his/her own opinion or controls the thinking of the participants. At the beginning and the end of observation, the STIR investigator carries out an interview with the controls and the actively participating researchers both, and studies how the interdisciplinary interactions help the enhancement of social and ethical aspects over research work. To identify these aspects, the embedded humanist asks the same questions during the **pre- and post-study interviews**. Then the STIR investigator records the results in a qualitative and quantitative form, then, summarizes the qualitative results in a narrative form and/or in a form of table.

Thus **the main steps** of using the tool in practice can be described as follows:

1. Invitation letter: Embedded humanist asks for scientist to participate in the research
2. Embedded humanist solicits "high interaction" and "no interaction" persons
3. Pre-study interview

4.12 weeks interaction and observation

5. post-study interview,

6. recording and summarizing the results with the help of decision protocol

Initially the **main target group** of the STIR was the academic sector, but nowadays business sector has an increasing role too. STIR has been mostly applied in the academic field among scientist working in the laboratory. However nowadays business sector is also a significant target group of STIR. The proportion of applications in the academic sector is about 70%, while this proportion in the business sector is about 30%.

The STIR method has been tested in over 30 laboratories around the world, with similar results. These countries are for instance: the United States, the Netherlands, Denmark, the United Kingdom, Spain, Belgium, China, Japan, South-Korea, France, Sweden, Germany and Hungary.

The **main strength** of STIR is its flexibility, as STIRers have the opportunity to adjust the conversations during the 12 weeks. Its another strength is that as the task of the STIR investigator is not to teach scientist in the lab, he/she only tries to broaden their way of thinking to be able to respond to the complex societal dimensions of their work. Thus STIR is not just about learning, it is about modulating the way of thinking in long term. The STIR investigator tries to broaden the way of thinking of scientists in order to be able to take into consideration all of the RRI keys (ethics, gender equality, public engagement, governance, open access, science education) in daily work. The concerned topics depend on the creativity of the STIR investigator. If he/she raises up a topic (hopefully he/she will do) then the STIR method is suitable to address these keys. Potential outcomes from STIR studies can be: skill development, learning, human capital, changed behaviours, practices, design and research pathways; and increased trust.

On the contrary the biggest **weakness** that prevent generalisation is that the STIR method can be applied only by those who were trained by Erik Fisher. Moreover the qualification of the embedded humanist and the personality of the researcher can hardly influence the concerned topics. There is still no solution for assessing the personality of researchers, in order to conduct the research according to his/her personality. Thus, the efficiency of the method can be significantly reduced by a researcher who has an unsociable personality.

The **greatest challenge** that we have to face with when applying STIR is that the original method was developed and tested in developed countries, so that methodology

development is needed in order to be able to adapt STIR method to the innovation environment of less developed countries. Furhermore, sometimes it is not easy for social and natural researchers to cooperate as their way of thinking can be different. Thus first they have to find the common language to cooperate. Natural scientists may feel frustrated by the fact that a social scientist observes their work and ask lots of questions. Moreover STIR investigators may have difficulties in motivating natural scientists to participate in the STIR investigation and maybe not every social scientist is able to evaluate the changes happening during the conversations. The longer-term challenge is to spread the method as widely as possible, which also requires methodology development, including generalization.

According to the STIR lifecycle, by 2020 the method will be applicable for anyone with social science degree (not just those who are qualified by Erik) to carry out midstream modulation in any natural science laboratory by following a list of points.

Webpage of the tool: https://cns.asu.edu/research/stir

Some publications, reference, links that describe the tool:

- Fisher, E. and Maricle, G. (2014). Higher-level responsiveness? Socio-technical integration within US and UK nanotechnology research priority setting. Science and Public Policy, pp. 1–14
- Fisher, Erik and Daan Schuurbiers. 2013. "Socio-technical Integration Research: Collaborative Inquiry at the Midstream of Research and Development."*Opening up the Laboratory: Approaches for Early Engagement with New Technology*, ed(s). I. van de Poel, M.E. Gorman, N. Doorn and D. Schuurbiers, 16:97-110. Wiley-Blackwell.
- Fisher, E. (2015): Socio-Technical Integration Research. Training Workshop (Day 2), Training Material. Arisona State University.
- Fisher, E. – McTiernan, K. – Polagye, B. – Jenkins, L. (2016): Integrating Socio-Technical Research with Future Visions for Tidal Energy. Paper. George Washington University.
- Fisher, E. (2007): Ethnographic invention: Probing the capacity of laboratory decisions. NanoEthics, 1, 2, pp. 155-165.
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- Fisher, E. – Schuurbiers, D. (2009): Lab-scale intervention. Science & Society Series on Convergence Research. EMBO Reports, 10, 5, pp. 424-427.
- Fisher, E. & Mahajan, R. L. (2006): Midstream modulation of nanotechnology research in an academic laboratory. Paper presented at the American Society of Mechanical Engineers International Mechanical Engineering Congress and Exposition, Chicago.
- Flipse, S. M. & van der Sanden, M. C. A & Osseweijer, P. (2013): Midstream modulation in biotechnology industry: Redefining what is 'part of the job'of researchers in industry. Science and Engineering Ethics, 19(3), 1141-1164.
- Flipse, SM. & van der Sanden, MC. & Osseweijer, P. (2014): Improving industrial R&D practices with social and ethical aspects: Aligning key performance indicators with social and ethical aspects in food technology R&D. Technological Forecasting and Social Change, 85, (June 2014), 185-197.
- Lukovics, M. & Fisher, E. & Udvari, B. (2016): A felelősségteljes innováció iránti fogékonyság fejlesztése a gyakorlatban. [Improvement of sensitivity towards responsible innovation in practice.] Marketing & Menedzsment, 50(2), 3-18.
- Lukovics, M. & Fisher, E. (2017): Socio-Technical Integration Research in an Eastern-European Setting: Distinct Features, Challenges and Opportunities. Society & Economy (forthcoming)
- Lukovics, M. & Flipse, S. M. & Udvari, B. & Fisher, E. (2017): A Responsible Innovation Tool in a Different Innovation Environment: the Case of Socio-Technical Integration Research in Hungary and the Netherlands. Technology in Society (under review)
- https://cns.asu.edu/research/stir/howto