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BRIDGING THE GENDER GAP IN STEM DISCIPLINES: AN RRI PERSPECTIVE

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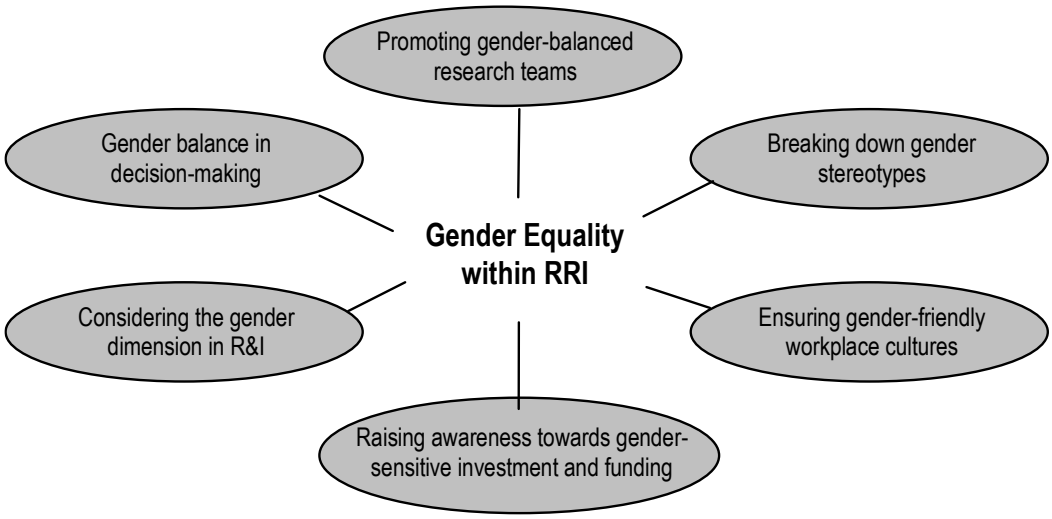
EXTENDED ABSTRACT

Over the recent years gender equality has been receiving increasing attention, both in accordance to the humanitarian perspective referring to individuals' welfare and to the Humanitarian-Development Divide (United Nations Sustainable Development Goals – SDGs and UNESCO Priority of Gender Equality), as well as in accordance to enhancing female representation in fields 'traditionally' encountered as male-dominated, namely the STEM-related disciplines. In relation to STEM, the gender gap is prominent in various fields −for instance in research and in academia─, and in Science and Technology occupations. According to She Figures 2018, Europe may be close to bridging the gender gap in the doctoral field (47,9% female doctoral students in 2016), but there are considerable differences in gender representation per field of expertise; females constitute less than 1/3 in STEM fields such as Information and Communication Technologies (ICT) and Engineering-Manufacturing-Construction (21% and 29% in 2016 accordingly). A lack of diversity exists in the labour market as well, with only 30% of women with STEM qualifications in Europe having a relevant occupation; in other words, "a significant number of them take jobs in-non related roles, representing a loss of talent and potential and economic gains" (Salinas and Bagni, 2017, p. 721). Nevertheless, female inclusion in STEM does not rely only in augmenting female representation in terms of statistical percentages. Women face other prominent problems, like formal and informal recruitment-selection procedures hindering their advancement in science and especially in polytechnic careers (Carvalho and Santiago, 2010), while gender representations, 'extra-organisational' gender roles (Mills, 1988), or role models that encourage or discourage females from engaging in STEM are issues beginning to be addressed.

Within the context of our study, gender (in)equality and related multi-layered interventions (i.e. not only referring to a higher numerical representation of women) are addressed in relation to STEM disciplines. These interventions are interrelated to some SDGs sub-objectives, to the European Commission's 'commands' for gender equality in the European Research Area (ERA), as well as to the concept of Responsible Research and Innovation (RRI). Firstly, Goal 5.B of the SDGs suggests to enhance the use of enabling technology and ICT to promote female empowerment, while the European Commission (EC) similarly introduces gender equality policy interventions in scientific fields and calls for action towards a proper integration of gender issues through specific proposals in EU Research&Innovation Programmes, namely Horizon Europe and Horizon 2020 (European Commission, 2014). This is the focal point where these European initiatives are complemented by RRI. RRI refers to tackling contemporary societal challenges by aligning the values, needs and expectations of all actors involved in R&I systems. In the view of Von Schomberg (as cited in Owen et al, 2012) and his definition of RRI, "science and innovation are envisaged as being directed at, and undertaken towards, socially desirable and socially acceptable ends, through an inclusive and deliberative process" (p.753). These socially desirable ends actually seem to have been transformed to the six policy agendas that RRI addresses; the six RRI keys. Gender equality also belongs to these keys, and acquires multiple layers within RRI (depicted in Figure 1, which was designed according to the input from RRI tools website).

Figure 1.RRI and Gender Equality



Source: RRI tools website

Currently, several RRI initiatives foster female inclusion in STEM disciplines, and are related to projects implemented mainly during Framework Programme 7 (FP7) and Horizon 2020 (H2020). These projects set gender equality as a priority in various Research Performing Organisations (RPOs) with a STEM expertise, and proceed to the development of self-tailored Gender Equality Plans (GEPs). The GEPs aim to institutionalise gender equality, trigger structural transformations in the RPOs and reach a broad knowledge transfer which contributes to meeting various ERA objectives (e.g. priority 4).

In a similar line of argument, the present study delves deeper into RRI initiatives towards gender equality, and examines FP7 and H2020 EU funded projects that foster gender diversity and female inclusion in STEM-related RPOs. Emphasis is on the RRI key of gender equality as opposed to the other keys, since it constitutes an emerging issue reflecting contemporary concerns. It is actually a multifaceted issue, as gender equality is not just a number problem and complementary activities should be implemented for 'changing' the scientific status quo. The aim of this study, therefore, is to critically analyse the innovation practices implemented within EU Gender Equality projects. While examining various RRI projects (approximately 80) included in the two major calls of FP7 and H2020, five Gender Equality projects have been selected through a two-stage selection procedure including criteria like *innovativeness*, *stake*, *transparency* and *impact*, and these projects have been further and more critically analysed: *EQUAL-IST*, *STAGES*, *GENERA*, *GEECCO* and *PLOTINA*. The subsequent aim is to identify tendencies ('mega trends') in the actions of European RPOs, when ameliorating their intimate mechanisms by developing new structures ensuring gender equality. It is worth highlighting that these projects have been considered as a source (a 'container' of practices) and the practices as the units of a qualitative analysis. Following the arguments of Braun et al and their six-step framework for conducting a qualitative analysis (2019), we refer to a reflexive thematic analysis of the data collected with an inductive orientation; the processes of coding and theme development have taken place by employing the NVivo software (Version 12; QSR International Pty Ltd, 2018) and the codes/themes developed have been directed by the content of the

data. Patterns and regularities were afterwards identified for reaching certain conclusions. Finally, the thematic analysis has been clustered with an essentialist framework (Braun et al, 2019), where one can report an assumed reality evident in the data; the trends/tendencies detected are an assumed reality evident within the practices promoting gender equality in the scientific field.

Ultimately, this study investigates promising interventions towards gender imbalance in STEM fields –as it has also been suggested by Gorvacheva et al (2019) in terms of future research in the corresponding topic− and thus functions as a 'mapping' tool depicting the European conditions and endorsing the successful RRI practices for 'gendering'[1] the STEM disciplines. However, it has a twofold contribution; it additionally draws valuable conclusions that resemble a set of suggestions and can be employed as such, for aiding STEM-related European actors in genuinely establishing gender equality in R&I processes. In a few words, these conclusions/suggestions, being based on the patterns detected, refer to the contextualization of RRI and the need to develop self-tailored GEPs, to the most common lines of intervention of the GEPs –namely encouraging female leadership in science, measures against horizontal segregation, (early) career development, work-life balance, training towards gender issues and gender-neutral communication, gendering scientific contents and methods etc.− as well as to co-creation processes that accompany the GEPs (e.g. collaborative platforms). Reference is also made to the impact (both internal and external) of the GEPs, and to whether it can contribute to restoring the principles of universalism and meritocracy in scientific ethos.

Therefore, the above process −if encountered holistically− can lead to organisations and STEM-related disciplines that are aligned to contemporary societal concerns, and are truly response-*able* (i.e. able to provide responses to emerging situations and challenges) through innovation and *re*-search (i.e. continuous search). Of equal importance is that the new emerging definitions of smart societies can be enhanced; smart societies should not just embrace technology but also tackle societal ills (Haupt, 2017) in the way these are represented within the SDGs −and as mentioned gender equality is included in these goals. Finally, smart societies need a paradigmatic shift, while the term 'paradigm' refers to the common techniques and values that members of a scientific community share (Kuhn, 1962; Agamben, 2009), and the definition of the paradigmatic shift connotes a fundamental change in the basic concepts and experimental practices of a scientific discipline (Kuhn, 1962). Thus, gender-related practices within STEM disciplines shall replace the basic concept of males dominating this field and genuinely bring this shift, which actually refers to socially desirable ends and behaviors.

KEYWORDS: STEM, RRI, Gender Equality, Gender Equality Plans, EU aspirations, Smart Societies

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[1] According to the European Institute for Gender Equality (EIGE) when drawing on Šribar et al (2015), *gendering* is defined as the process of integrating the gender perspective into the understanding and construction of persons, phenomena, reflections, relationships, sectors of action, societal subsystems and institutions.

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