The evolution of gender monitoring and its challenges: the case of Research and Innovation in Europe

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Abstract

The article delves into the European Commission's flagship initiative on gender monitoring in science and innovation, offering a responsible metrics perspective and drawing on equality policy literature. Over two decades, the initiative has evolved from competitiveness-related justifications to more transformative objectives related to equality policy evaluation, with the measurement areas and policy focus also undergoing changes. While there has been notable progress, the article points out a logic of invisibility in how dimensions and indicators are conceptualised and their data sources and interpretation. However, it also highlights a significant improvement in the information available. The article suggests that the contextualisation of the process could be enhanced to better integrate it into the policy-making cycle, a crucial area for further research. It concludes with proposals for future gender

monitoring science and innovation. The aim is to offer an encouraging vision of monitoring that counts more on who is monitored and in opening up the debates instead of closing them.

Keywords: women science, transformative metrics, gender mainstreaming,

1. Introduction

In a world of data and facts to the hegemonic male norm that becomes the measure of things, the non-existence of data on women condemns them to invisibilisation (Criado, 2019). Monitoring has been strongly promoted by various international organisations such as the United Nations and the European Union for the promotion of gender equality. Its main motivations have been to assess the results of the programmes, obtaining comparable national data over time, as well as to place gender as something that is not marginalised (Walby, 2005).

However, the profusion of indicators has not been without its critics. Feminist reticence towards the logic of generating data that is too abstract and which does not take into account women's experience or contexts should be noted. Also, the EU governance frameworks in which monitoring and equality policies are embedded have been questioned for their competitiveness and market orientation (Bruno et al., 2006; Pollack & Hafner-Burton, 2000). A prioritisation of strategy instruments, such as monitoring, has been observed, as opposed to an effort to delve deeper into the contents and multiple visions of what equality is, leading to a lack of definition of the problems and questionable performance (Lombardo et al., 2006; Pollack & Hafner-Burton, 2000; Lombardo et al., 2009; McNutt & Béland, 2015; Minto & Mergaert, 2018; Otero-Hermida & Lorenzo, 2019; Woodward, 2003)..

However, monitoring may change as it is subject to contestation, as well as being made possible by the entry of women into the scientific field (Walby, 2005; Walby & Armstrong, 2010). Both equality policies and science and innovation policies have pioneered the application of monitoring in Europe. Taking these aspects to point out their relevance, the article will analyse

the EU's flagship initiative on science, innovation and gender: the *She Figures* series, which was launched in 2003 on a three-yearly basis. While the series focuses on measuring the position of women in European science, each edition has added indicators and we will discuss trends towards other approaches that place the focus on the structural, beyond the mere presence of women.

Both monitoring and equality policies have been modifying their main objectives and problem definitions, in accordance with the different waves of feminism and the way their proposals fit into changing political contexts. In these two decades of She Figures, what are we measuring and how has it evolved? how are we monitoring and why? where does it need to go taking into account new gender proposals such as intersectionality or non-binarism and an increasingly polarised context marked by anti-gender waves? does monitoring contribute to closing debates or opening them up? We will discuss these developments with the help of the equality policy literature (Acker, 1990; Connell, 2006; Rees, 1998; Squires, 2007; Verloo, 2005) as well as responsible metrics in Science and Innovation (Gläser & Laudel, 2007; Hicks et al., 2015; Leydesdorff et al., 2016; Ràfols, 2018; Wilsdon, 2015; Wilsdon et al., 2017). Both literatures share a useful critical perspective for analysing and imagining transformative metrics (Otero-Hermida, 2022). In the background remains the concern of whether we are achieving a monitoring that is overcoming the logics of invisibilisation, providing useful data that help to observe and overcome inequality in academia and the world of innovation.

In order to do so, we will first present the evolution of equality policies and their relationship with monitoring, then we will detail the gender issues highlighted by the literature in the scientific and innovation fields, and then present the results and discussion. The conclusions will focus on pointing out possible strengths in the evolution, as well as pending aspects, raising ideas for future implementation and new research.

2. Equality policies evolution and monitoring

Equality policies have been modifying their main objectives and problem definitions in accordance with the different waves of feminism and the way their proposals fit into changing political contexts. Thus, different gender regimes have been shaping and changing (Sümer, 2016; Walby, 2020). The growing institutionalisation of equality policies has often been accompanied by the generation of transnational networks and the integration of their actors, in what is known as state feminism, (Banaszak et al., 2003; Valiente, 2005b, 2005a).. Thus, equality policies are seen as clusters that integrate different visions of how to address gender issues (Verloo, 2007). Various authors identify three main approaches to gender equality that correspond to three approaches to public policy.

Rees provides an evolutionary perspective for the European case in which it would start from a superficial treatment of gender equality (*tinkering*, 1970s) linked to equal opportunities, to continue with an adaptation to fit women's needs linked to positive actions such as quotas or female empowerment (*tailoring*, 1980s), while a third stage (*transforming*, 1990s) would point to new standards for all, both for institutions and for what is associated with masculinity and femininity and would be linked to gender mainstreaming (Rees, 1998). National spheres would replicate this evolution, as in the British case (Breitenbauch et al., 2016), while in the Spanish case each stage would begin a decade later, motivated by a late democratisation and incorporation into the European Union (Otero-Hermida & Lorenzo, 2016) (Otero-Hermida & Lorenzo, 2019). These different visions and political strategies would correspond to the predominance of different actors, with legislators in the first case, specialised agencies in the second, and in the case of *mainstreaming*, the government would be the ideal reference and participation would be extended to other actors involved in political processes (Verloo, 2007).

The different forms of policy making relate to discussions that have taken place in feminist theory in relation to difference/sameness. Traditional approaches to equal opportunities are

limited because they imply that women achieve equality when they can reach male standards (Walby, 2005), while patriarchal values are not challenged and women would be assimilated to men (Squires, 2013). On the other hand, visions closer to cultural and radical feminism emphasise the existence of this predominant male norm, because what is sought is the reconstruction of a political environment seeking recognition of women as a non-hegemonic and distinct identity (Squires, 2013). This vision would require affirmative action and a focus on women's decision-making. Finally, views more closely linked to postmodern feminism broaden the problem beyond female exclusion to discuss conceptualisations of gender and its associated roles as the main problem.

Different authors (Booth & Bennett, 2002) and the European Commission itself (COM (96 67)) point out that these three strategies-visions are complementary and necessary, the three legs of the same policy. For his part, Squires identifies the policy with three different focuses *presence* (increasing women's numbers), *voice* (improve the articulation of women's specific concerns) and *process* (systematic approach to equality in policy-making), but he takes a critical perspective along the lines of (Fraser, 2006) or (Barry, 2002) in which *voice* is disappearing from politics. Feminist norms and practices have been transformed in this process of institutionalisation in an increasingly neoliberal context, which is accompanied by the substitution of right-based equality arguments for utility-based ones, accompanied by technocratic processes in their promotion. Thus, *presence* and *process* would be the indicators of a parity of participation, while what has been lost is the emphasis on participatory democracy, as well as the feminist action of "extending the boundaries" that opens up other worlds, linked to voice (Squires, 2007).

Squires (2007) rightly uses the case of monitoring to illustrate this loss. Both *presence* and *process* policies resort to formal indicators that make equality measurable, but tend to close the debate regarding its conceptualisation. For his part, Connell relates the predominant Western policies focused on promoting women to positions of power - which he calls *Glass Ceiling* - to

the virtue of having provided organisations with a way of studying themselves. Monitoring became routine and the quality of the data has grown. However, "The statistical margin of difference between these two categories is the measure of any gender problem" (2006: 838). This turns gender into two fixed categories of people based on a rigid biological distinction, whereas gender can be understood in a dynamic way, in which relations between women, between men and between women and men count, and change. (West & Zimmerman, 1987). The *Glass Ceiling* approach needs data to show that there is discrimination, understanding that this reflects prejudice against women, assuming that this is irrational - talent is lost - and can be solved by removing barriers to women. However, the underlying problem is not irrational bias, but rather the genderisation of organisations or the state (Acker, 1990; Burton, 2005) that regulate the lives of women and men, generating an unequal structure. Therefore, attention to other levels such as organisations, as well as aspects of division of labour, power relations or emotions would be necessary, as they construct these changing relations and identities (Connell, 2006).

New theoretical approaches associated with new questions, which could be useful for analysing the new contexts, would be along these lines. For instance, constructivist approaches focus on what effects do gender discourses have on societies and individuals, new materialist approaches bring to the table how affects are mobilized in political process (Kantola & Lombardo, 2017) and how the sociomaterialization processes that involve also how biological events and non-human are framed counts in building equality/and inequality frames and hyerarchies bringin an non-intentional but based on impact idea of agency to the table (Bennett, 2010). However, these approaches are marginal in political analysis and practice (Kantola & Lombardo, 2017). This is not the case with the intersectionality approach, which has found a place on the agenda (Lombardo & Verlodo, 2017) (Lombardo & Verloo, 2010). The *European Strategy for Gender Equality 2020-2025* (COM/2020/152 final) explicitly includes intersectionality as an objective, highlighting the possibility of better integration in policies. Its questions address how gender

interacts with other variables such as ethnicity, age or different abilities. (Crenshaw, 1989) and while most authors in the field agree on the need for it, there is limited application (Alonso et al., 2012).

3. Gender (in)equality in science and innovation

One of the best known aspects in academia is the "leaky pipeline" or the progressive disappearance of women as their academic careers progress until they end up with minimal percentages in the most powerful positions, a phenomenon that affects both feminised areas such as the humanities and masculinised areas such as engineering, physics or mathematics (citation). In turn, both dropouts and longer careers associated with the glass ceiling are factors that largely explain the gender differences in terms of scientific output and impact in terms of citations (Huang et al., 2020).

In the case of the United States, 40% of women versus 23% of men leave the academy after their first child. (Cech & Blair-Loy, 2019). In Europe, the most commonly cited reasons are the demands of international mobility, coupled with deficits insocial capital, high productivity demands and childcare (Nielsen, 2017). It is also worth mentioning that the term abandonment, disappearance or others are neutral compared to other approaches that are closer to filtering or systematic expulsion. The main reason for debate is precisely the gendered conceptualisation and operationalisation of what is science or what is academic excellence. The requirements of access, promotion or funding, sustained by the meritocratic discourse that attributes neutrality to them, are shown to be alien to the context of application. (Clark Blickenstaff, 2005; Samper-Gras, 2022; Samper-Gras et al., 2021). As an example, in mathematics the percentage of women has fallen drastically from near-parity ratios in the 1980s, paralleling the increase in competitiveness and labour demand in this area (Samper-Gras, 2022). To explain these phenomena, meso and micro dynamics in disciplinary fields are highly relevant. For example, in the medical sciences, where informal recruitment predominates, women are less invited to apply for professorships (Van den Brink& Benschop, 2012).

Overall, equality or open access have little relevance to academic excellence despite the importance of more responsible science in European policy discourse (Forsberg et al. 2018). The key question is whether science without a gender perspective can be good science, given the biases it can produce by not taking into account half of the population, their issues and visions while uncritically assuming certain frameworks. This is the direction European policies are taking, linking excellence and equality in order to access the funds of the current Horizon Europe science and innovation framework programme, where equality is a cross-cutting principle and objective (EU 2021/695). It is operationalised as eligibility criteria - mandatory to have equality plans monitored and resourced - and ranking and award criteria that question and assess the adequate incorporation of the gender dimension into R&I and gender balance in the teams, among other aspects. The incorporation of the gender dimension implies not only disaggregating data by sex/gender as far as possible, but also asking research questions informed by theory with a gender perspective in the designs, or when collecting, interpreting and publishing the data, also to their stakeholders, among other aspects.

For its part, the field of innovation is particularly complex. The data on the low participation of women in the field of technology, entrepreneurship and patent production are well known. Low participation limits the search for solutions and new ideas applied to meet the needs of women and other unrepresented groups. It is also globally argued that creativity and innovation stemming from diversity is limited (Tannenbaum et al. 2019). However, innovation stands out especially for the lack of active equality policies, especially in the private sector (Karaulova et.al, 2023) and the lack of gender data and studies, beyond those cited in relation to patents or innovative entrepreneurship (Alsos, Ljunggren, E. & Hytti, 2013; Otero-Hermida, 2022; Otero-Hermida, Cañibaño&Martínez, 2020).

4. Research Frame and Methods

The article questions the *She Figures* reports firstly about what are the ultimate justification and purposes of monitoring, why and for what purpose we monitor. The purposes change the frameworks and indicators selected and their clarity is central to the debate, as is the ultimate justification because by eg. Efficiency, or social justice are very different approaches that modify their directionality (Molas-Gallart & Castro-Martínez, 2007; Ràfols, 2018).The purpose changes the analytical frameworks and conceptualisations, for example of what is considered innovation, an issue that has been observed through gender monitoring, where the focus is placed on people and not on possible inputs and outputs of policies such as investments, with the conditions and contexts of the people who innovate appearing strongly (Otero-Hermida et al., 2007; Ràfols, 2018; Otero-Hermidia et al., 2020; Otero-Hermida, 2022).

A clear definition of the dimensions needed on the road to equality is also key to selecting and assessing the indicators that accompany its measurement. (Walby et al., 2008) (Otero-Hermida & García-Melón, 2018). For example: health; education; standard of living; productive and valued activities; individual, family and social life;, participation, influence, and voice; identity, expression and self-respect and legal security (Walby et al., 2008). The dimensions interrogate a key issue: data needs or those indicators identified as necessary without statistical information yet (Walby et al., 2008) (Otero-Hermida et al., 2020). Therefore, what is being measured and what policy priorities it responds to will be analysed, as well as what frameworks and understandings of equality/inequality emerge from what has been selected to be monitored, their structuring, the concepts used and the recommendations derived from the data, as well as changes over time in these aspects.

The dimensions change if the purposes and justifications for the need for gender monitoring change, for example, if it is about policy follow-up or the purpose is benchmarking between states to visualise their contributions in the EU as a whole (Otero-Hermida, 2022). As introduced above, policies are context-sensitive and have different visions. The need for contextualisation is a concern of both academic feminism and the trend in responsible metrics

for science and innovation. Indicators do not have meaning in themselves, but receive meaning in institutional practices (Leydesdorff et al. 2016).(Gläser & Laudel, 2007).. We must be cautious with the indicators that are inevitably used as a proxy, making their translations explicit, locating in the measure what the data are for, their sources and limitations (Ràfols, 2018; Saltelli & Di Fiore, 2020; Wilsdon, 2015; Wilsdon et al., 2017).

These aspects will be analysed to answer the research questions of this article: To what extent is the European Commission's *She Figures* report addressing the three dimensions of equality policies *presence, process and voice* (Squires 2013)? To what extent does its approach contribute to open or close debates about what equality in science and innovation is and how we should get there? This is a fundamental question in terms of R&I monitoring (Stirling, 2008) (Ràfols, 2018) as well as one of the questions highlighted as key in equality policies, as we have seen in previous sections.

In order to approach these questions, the analysis technique used was qualitative and the Atlas.ti software was used as a content analysis tool. A total of 15 documents were analysed, including the main documents, policy briefs and methodological annexes in the editions that included them [Table 1 near here]. The process of constructing the codes was initially deductive, focusing on two main areas: 1. What and why are the reports measuring; 2. Subsequently, it has been completed inductively. The first coding proposal is based on the main categories set out in the 2003 report, adding new ones as the different documents have been analysed. Finally, agrregate categories such as “ultimate justitication and purposes”, “policy focus” and “measurement topics” have been defined that encompass our empirical themes, iterating between data and the cited literature through axial coding. Those agrregate codes serve to squematize the results presentation in the following section [Table 2 in page 15].

4. Results & Discussion: European Commission's *She Figures* Evolution 2003-2021

In this section we present a panoramic of the evolution to attend to the above research questions. By way of introduction we note that the changes are not merely additive - adding more issues and indicators - but that there are shifts in substance.

4.1 The use of key concepts

First, we look at the different concepts used in the different editions.

Table 1. Evolution of gender concepts. She Figures 2003-2021

	2003	2006	2009	2012	2015	2018	2021
Growing gender concepts*.							
Gender dimension in research			1	1	51	27	177
Gender equality	6	1	1	11	60	85	11
Gender parity					4	11	65
Gender quota							10
Gender-balance	2	3	5	5	23	14	116
Gender-sensitive						2	28
Female(s)	16	47	209	286	11	321	267
Under-represent	9	12	19	16	56	10	65

ation							
Man/Men	279	169	216	376	641	1058	1442
Sex	129	50	55	73	184	482	480
Woman/men	487	257	378	551	1097	1717	2774
Declining gender concepts							
Critical-mass	5	4					
Gender pattern	1	1	1				
Intermittent gender concepts							
Domestic work				2			
Equal opportunities			1				27
Equal representation			1	1	1		4
Gender inequality			3		1	5	7
Gender perspective	1					3	26
Gender roles					1		5
Gender stereotypes			3			2	21
Work-life balance	1	1	0	5	12	6	19
Stable gender concepts**							
Gender bias	3	3	1	1	3	7	26
Horizontal segregation	8	5	1	6	6	11	18
Vertical segregation	8	3	8	18	3	10	16

Imbalance	2	7	8	12	3	3	22

(Source: made by the authors)

*We consider as growing concepts those that have been used since 2003 and whose use has increased by more than 30 mentions between the lowest and highest value of the 7 editions, as well as those that did not exist in the first publications and have been added over the years.

**We consider stable concepts to be those that have remained within a range of less than 30 mentions between the lowest and highest value across all editions.

We note that some have remained stable over time, such as horizontal and vertical segregation, while there has been a great deal of intermittency in concepts considered key, such as "equal opportunities" or "work-life balance", and related such as "domestic work". The idea of "gender equality" is augmented, while the other side of the coin, "gender inequality", is absent in some editions. We also note the disappearance of some, such as "critical mass". This concept has a critical and demanding implication as it appeals to the need for a minimum number of women for there to be effects and for women not to be rendered invisible or tokenised by the masculinised environment. However, better numbers or presence alone does not necessarily bring about change as seen in feminised areas, and other issues such as leadership or critical actors need to be addressed (Childs & Krook, 2009; Etzkowitz et al., 1994; Grey, 2006).

It is important to note the decreased experiments in both "women" and "sex" use, while the length of the reports had augmented in each edition. Again, both concepts are used widely in the latest edition. A compromise solution to the conflict plaguing the feminist movement is observed, following the main policy lines. The *European Strategy for Gender Equality 2020-2025* (COM/2020/152 final) explicitly addresses the diversity of the categories of men and women in terms of sex, gender identity, gender expression or sexual characteristics. It integrates the claims of those who do not accept the category sex and embrace the fluidity of

categories and non-binarism, offering a door to heterogeneity, while continuing to support the female subject as the central element, where gaps and violence lie (Jabazz, 2023).

4.2 Why and what is *She Figures* monitoring?

Table 2. She Figures Evolution 2003-2021

	2003	**2006**	**2009**	**2012**	**2015**	**2018**	**2021**
Title of the report	*She Figures. Women and Science Statistics and Indicators*	*She Figures 2006 Women and Science Statistics and Indicators*	*She Figures 2009. Statistics and indicators on Gender Equality in Science.*	*She Figures 2012.Gender in Research and Innovation*	*She Figures 2015*	*She Figures 2018*	*She Figures 2021. Gender in Research and Innovation Statistics and Indicators*
Ultimate justification. Why monitor?	Success of ERA and Equality and women's equality (decision-making and change the field)	The success of ERA and Economic Competitiveness	Economic and societal improvement	Equality/inequality (for women researchers opportunity to contribute, unused potential) quality of research and innovation	Equality as part of the R&I policy	Equality (women's concerns, "all talents in plaly"), scientific excellence, global challenges.	The need for women's participation for a full and more sustainable recovery from the COVID-19 pandemic.

Purposes. For what?	Informative and neutral data for benchmarking	Informative in employment situation of men and women, for benchmarking and to also detect and evidence gender imbalances. Further policy intervention.	Informative of the situation of men and women, evidence imbalances, and tracking progress.	Informative of the situation, of men and women, awareness-raising	Informative of the situation of men and women (also experiences), checking progress, best research and researchers' achievement.	Informative of the equality situation, examine the impact and effectiveness of implemented polices	Informative on equality objectives and helping take action for systemic change.
Targets. For whom?	Scientists, researchers, policymakers and human resource managers concerned by women and science	Not mentioned.	Policymakers, researchers, teachers, students, and parents who share a vision of a democratic, competitive and technologically advanced Europe.	Citizens, policymakers, stakeholders, researchers and their employers.	Policymakers, research organisations and anyone working or interested in European research and innovation.	Policymakers, researchers and anybody with a general interest in these issues	Research funders, policymakers, university deans, researchers, innovators, educators and students
Structure (Measurement Dimensions?)	Chapter 1: Setting the scope Chapter 2: Scientific fields Chapter 3: Seniority Chapter 4: Setting the scientific agenda				Chapter 1: Introduction Chapter 2: The pool of graduate talent Chapter 3: Participation in science and technology (S&T) occupations Chapter 4: Labour market participation as researchers Chapter 5: Working conditions of researchers Chapter 6: Career advancement and participation in decision-making Chapter 7: Research and innovation outputs		

Policy focus of the indicators							
Presence (increasing women's numbers)	58	38	55	56	74	92	90
Process (systematic approach to equality in policy-making)	-	-	-	-	3	2	2
Voice (the articulation of women's specific concerns and expanding the boundaries of the system)	-	-	-	-	2	2	4
Measurement topics							
Authorship					9	24	10
Career	11	10	6	13	16	14	19
Decision-making	2	1	8	3	3	4	9
Employment	12	4	10	6	8	8	10
Employment conditions					1	2	4
Field distribution	12	6	14	11	13	9	
Funding success	2	1	2	2	2	2	2
Gender dimension in research					2	2	3
Intersectionality in research							1
Inventorship					3	5	5
Mobility				1	2	1	2
Organisational measures					3	2	2
Pay-Gap		2			2	2	

Methodological Notes (M.N) & Handbooks	M.N	M.N	M.N	M.N	M.N	M.N+ Handbook	M.N+ Handbook
Other monitoring process details (eg:stages, stakeholders and participants, rationales, quality criteria)	-	-	-	-	-	Many details on the indicators, rationales, and criteria but scarce on the participants and the policy process	Many details on the indicators, rationales, and criteria but scarce on the participants and the policy process

The pool of future scientists	6					4	3
R&D expenditure per researcher		2	2	2	2	2	2
Distribution sector	13	12	13	17	13	15	23
Self-employment							1
Work-life balance				1			
Contextualization							
Policy recommendations & Policy Briefs	-	-	Policy implications	-	-	-	Policy recommendations for different actors; Supplementary policy briefs on specific topics (7)

(Source: made by the authors)

The ultimate justification is why we monitor and is related to different purposes or what for. There is a transition from utilitarian justifications centred on the competitiveness and success of the European Research Area (ERA) to a justification of equality *per se*, *which is* more present in the latest editions. Equality is also presented in different ways. Focused on *voice* as decision-making and field configuration (2003), as something related to women's concerns but also to unused potential and talents (2009, 2018), or equality as something intrinsically pertaining to science policy and excellence (2015, 2018).

In parallel, it starts with two purposes of benchmarking and "neutral" reporting. This governance approach in which monitoring is key has been considered limited, as benchmarking linked to soft measures replaces more ambitious approaches such as legislation (Borrás&Jacobsson, 2004) (Bruno et al. 2006). Incrementally, other purposes such as awareness raising and evidence of biases are added, ending with purposes linked to the evaluation of policies for systemic change. In general, the report starts from a neutral approach, but from 2012 onwards, it assumes that change will not happen on its own and focuses on the need for policy change. For this reason, the latest editions include policy recommendations and thematic policy briefs (in 2021), and the report is full of examples of good practice.

Having a perspective of what for and why, we will now look at what we are measuring. The dimensions that are considered necessary to be measured are not specifically mentioned in the report and must be inferred from its chapter structure, which offers little information. Therefore, we will first look at the issues for which there are indicators. We see a long list in which indicators on *employment* (eg: ratios of scientific population to total employment) and *careers* (eg: distribution of pre-doctoral positions, senior positions) with numerous breakdowns in terms of field distribution (eg: STEM, Social Sciences) and sectors (eg: governmental, entreprenurial or private), whose relevance is key as we have previously discussed, are undoubtedly predominant. Also, from the outset, information is provided on some of the dynamics of equality/inequality in meritocratic environments, such as the *pay gap*, or the *success gap in submissions to funding calls*. Indicators have also been added on topics such as authorship, mobility, or the gender and intersectional dimension in H2020 projects. However, aspects such as decision-making (eg: gender rates of the heads of institutions) or, especially, employment conditions are scarcely measured. In this respect it is worth noting that there is only one indicator referring to *work-life balance* in 2012 which is not repeated in subsequent editions. The balance between the public-masculinised and private-feminised dimensions is one of the most cited aspects in both gender theory and equality studies in science policy.

However, it is not measured, there is no data. This does not mean that it is not present in the report, as there are many "tip boxes" on work-life balance and its necessity is mentioned in numerous policy recommendations. However, if we monitor for systemic change and for the purpose of policy evaluation... how can we assess the impact of the (absence) of work-life balance on the lower female presence, as well as observe the effectiveness of the measures if there is no data? Are we incorporating women's concerns and/or expanding the system boundaries or merely reproducing the framing?

This question leads us to the next level of analysis, the policy focus of the selected indicators. As presented before, Squires (2007) identifies three different focus of equality policies. The first, ***presence*** (increasing women's numbers) represents almost all the She Figures's indicators. The second, ***process*** (systematic approach to equality in policy-making) includes just a couple indicators oriented to detect organisations with equality plans and measures and its communication in websites in the latest editions. Finally, we only find a couple of indicators related to ***voice*** (improving the articulation of women's specific concerns and expanding the boundaries of the system), such as gender and intersectional dimension in H2020 projects. All three policy foci are necessary as cited in the first sections, but we observe a strong imbalance.

Also, after two decades of monitoring, the environment has changed. New times of negationisms make the awareness raising purpose and presence indicators still crucial and shall not be diminished; but we have observed a clear evolution towards policy evaluation desired uses of the monitoring. That may imply that may imply to direct the target of measurements on the R&I actors such as funding agencies, research institutions, and not in women. As we have discussed, the gender equality problems are not funded merely on "irrational biases" or stereotypes, but the organisations are genderized in a way that may expel women, non-binay and non heteronormative options and their perspectives, so a focus on the organisations is needed (Connell, 2006).

4.3 Shapshots in Mobility, Innovation and Intersectionality: translations and implications

We cannot take all the *She Figures* issues into account in detail, but as previously stated, taking care of the translations or operationalization of the indicators is essential for responsible metrics and equality, so we will delve into a few defined as policy priorities.

Intersectionality is included in She Figures 2021 as an exploratory indicator devoted to measuring its integration in Horizon 2020 projects, with the purpose of discussing it in the future. The need is clearly mentioned, as well as its proposed sub-dimensions (disability, sexual orientation, vulnerable population, socioeconomic, among others) so we can have good expectations about the incorporation of more varied voices on gender. We must nevertheless pay attention - in order not to reproduce it - to the fact that intersectionality has been used in practice by reducing attention and resources towards women, treated as a minority among many other variables of diversity (Walby et al., 2012). Also, to renew the focus on anti-discrimination approaches and individual protection via legal means (Bustelo, 2009) or on "identity" versus other aspects such as redistribution of power or wealth (Squires, 2007).

Mobility was one of the main incorporations when the policy shift started in 2012. It is a highly valued aspect of the research curricula as pointing to research excellence and is a policy priority of the European Research Area (EU Council, 2021). It was defined as international mobility of minimum of three months in the last three years (She Figures, 2012 pp 43). Data shows very significant differences, with relevant implications "Besides age, part-time jobs and mobility are possible explanations for gender differences in scientific employment" (She Figures, 2012:34)

Globally, mobility is seen as both an opportunity and a pressure that can produce disadvantages in their careers given increased care responsibilities (Xie and Shauman 2003; Ackers 2008;

González Ramos and Malpica-Lander 2013; Zippel 2011). Also, other gendered aspects emerge. The most mobile research staff have not been the most productive, but there are differences in the mobility patterns of women and men, while mobility has increased, possibly because it has become a career requirement. Women showed more international mobility than men, although the frequency of their visits was shorter, their destinations were closer to home and occurred at earlier ages and stages in women's careers, especially in their 20s and 30s (Cañibano et al., 2008). The lowest proportion of female mobility was at the postdoctoral stage (Cañibano et al., 2008).

In later editions of *She Figures*, the narrative changes, disaggregating and noting that the mobility deficit affects only the most senior women, while in pre-doctoral stages there is hardly any difference between women and men. A tip box is included in this line of thinking, including examples of universities that encourage international mobility in postdoctoral grants and stipends to cover childcare costs during mobility (She Figures, 2021, pp 162). The period considered as "mobility" is extended: a minimum of 3 months during the PhD and in the postdoctoral stages as a minimum of 3 months in 10 years (She Figures 2021, Handbook).

It could be debated whether mobility could be better understood by other thresholds given that women tend to have shorter stays (Cañibano et al., 2008). Another sensitive issue is that while the indicators disaggregate only bewtenn pre-doc and afterwards, postdoctoral stage undrestood only as the immediate period after phd is more vulnerable than other posterior and more stable stages in the career and coincides in many cases with stablishing an own family. At the same time, postdoc stage may mark a directionality according to the pattern observed in the "leaky pipeline", as is when the descendent rates of women begin. At this stage, care responsibilities tend to increase, while it is in the immediate post-PhD stages - and not so much

in more senior stages - that mobility has more weight in the calls for applications, as in the case of the prestigious EU Marie Sklodowska-Curie grants.

The key question is what the purpose of mobility is and why it is so important in careers, as moving countries has no meaning in itself. It has been criticised that mobility is becoming a professional metric of internationalisation and an accepted rite of passage, which is however dissociated from knowledge transfer and networking (Ackers 2008, 2013). It is a proxy, and so, for example, would it be preferable to monitor and promote scientific collaboration policies? Of course these questions would also be gendered as women and men tend towards different patterns of collaboration (Bozeman & Gaughan, 2011) women tend to establish links between more diverse actors, which could be interesting for transfer and the relationship with non-academic actors (Díaz-Faes et al., 2020). These aspects are not visible if we appeal to the simplest metric in terms of available data, such as the number of collaborations understood as co-authorships in articles, available in the latest editions of *She Figures*.

When talking about gender, using merely available data can be problematic. Turning to the **innovation** topic, its conceptualization is highly gender biased, as previously introduced (Alsos, Ljunggren, E. & Hytti, 2013). Available data on innovation monitoring present it as synonymous with technology operated in a market environment, excluding other conceptualisations that include social or public innovation (Otero-Hermida, 2022; Otero, Cañibaño&Martínez, 2020). The latest editions of *She Figures* introduce a critical mention in this sense (She Figures, 2021, policybriefs, p 57). However, the data mirrow the reductionist approach, including data on digitalization an entrepreneurship and identifyin data needs in leadership and venture capital funding (She Figures, 2021, Policybriefs, p. 59). No data need is mentioned regarding social or public innovation - where women may be much more present. Considering so, even if the "problem" is cited, it is not adressed.

4. 4 The monitoring process and its contextualization

She Figures has radically improved the data contextualization in the latest editions (2018, 2021) with the publication of handbooks exceeding two hundred pages. They include information on the rationale for each indicator- an explanation of why it is needed- and its precise definition, its computation method, data source, and crucially, specifications, comments and critical issues, such as the changes across the editions or the limitations, for instance, of the bibliometric data used.

Regarding the sources, most of the data come from Eurostat, the statistical body of the EU as well as from the work of the Statistical Correspondents of EU members and associated countries that provide data such as the gendered composition of scientific boards. In 2012 they began to incorporate data from sources in line with the new questions, from projects such as The MORE Surveys are part of the Mobility and Career Paths of Researchers in Europe (mobility), Web of Science database (2015) (gendered authorships and content) or EU Open Data Portal (data about gender dimension and intersectional aspects integration in EU funded projects). Some gender-knowledge based projects such as *Hypatia* are cited, but are used to provide insights in the indicators rationales and no uses as data sources are detected.

Crucially, relevant information on the monitoring process appears, and it is indicated that it includes in-depth consultations with key stakeholders, also for the selection of new indicators (pp She Figures, 2021, pp.172). Its relevance is addressed by steering groups discussions, mapping of state of the art and identification of new indicators (pp.173). However fundamental questions remain uncertain, such as who are the stakeholders involved beyond the ERA Committee Standing Working Group on Gender in Research and Innovation. The policy briefs - very relevant as are the interpretations of the data for policy - are presented as independent reports signed by large consultancies. The handbook also offers a section talking about the

"History and background of the She Figures", but only the starting actor (The Helsinki Group on Women in Science in 1999) appears. For these reasons, the report somehow remains a 'technical black box'. Also, after two dechades the targets of the report appear to be policymakers, researchers and their employers, as well as “anybody with a general interest” (She Figures, 2018, p.216). A reflection shall be made of its actual uses by those or other potential actors, an aspect we discuss more in the next section.

5. Conclusions

5.1 Detected challenges and further research

The evolution of the EU Commission's flagship initiative in gender in R&I monitoring *She Figures* shows effort both in contextualization and in expanding the measurement policy focus beyond women's *presence*, incorporating *process* and *voice* indicators even though in limited quantity. Its justification has shifted from competitiveness to equality, and its purposes have from providing information, to awareness raising to finally situate the main purpose in policy evaluation. However, different framing shall imply different data. *Voice* also implies expanding the system boundaries (Squires, 2007), and as the innovation or mobility snapshot shows, *She Figures* is still not there. With the current data, it may seem that women barely innovate, while they may be more present in social and non-tech, public and non-entrepreneurial environments, that are not measured. Another conceptualisation are needed, but the problem is not addressed as is not considered a data need. Although the intention is to make visible, many aspects of great relevance remain invisible.

After two decades, a general debate about the dimensions and sub-dimensions we specifically want to measure is needed. Those are not clearly stated in the reports, and some crucial aspects,

such as work-life conciliation, are not measured while being at the basis of all other challenges such as vertical, horizontal segregation, gender pay-gap or mobility. This is a well-known problem. EU equality policies have been shaped by economic policy and equality has been understood primarily as the incorporation of women into the labour market, which has neglelcted other visions of equality and certain vital contents such as the feminised private and reproductive sphere (Lombardo, 2017; Walby, 2004, 2005). Also, the R&I contexts have changed in the last twenty years. The competitiveness and the productivity requirements have increased, so we may need different questions. For instance, who is delivering care is the matter we want to measure, or shall we inquire how the hyper-competitive environments are producing gendered impacts and affecting negatively researchers work-life balance? We can produce policies for fixing women careers reducing their care involvement, or to favour researchers balance as a social need instead. Which problems are we going to monitor?

Monitoring is a policy instrument that have been used to close the debates (Stirling, 2008; Squires 2007). So the other crucial question of the article is To what extent does She Figures contribute to open the debates about what is equality in science and innovation and how should we get there? The process of contextualising each indicator is much improved. However, the information about the key actors and the process is too general. It is difficult to understand who is involved in both the selection and conceptualisation of new indicators and the interpretation of the data. For these reasons, the report still has "black box" overtones. (Latour, 1999). Its connections have been diluted and its historicity is limited, as these are its relationships, which are what make up the fact-data itself, and which make it possible to follow the thread of the translations that are made and why.

The remaining challenges lie mainly in the complex policy process involving monitoring. The purposes of motivation have changed to pursue and evaluate systemic change. However, the data sources and their conceptualisations remain largely unchanged. One cannot "genderise

the data" without genderising its definitions, as seen in the case of mobility or innovation described above. Some new sources such as European projects have been added, but no gender specific projects appear to be data sources, which might help. In any case, to evolve from *tinkering* to *transforming* (Rees, 1998) a re-thinking to the monitoring process may be needed, as well as to clarify the inclusion of other actors beyond experts and specialised agencies.

Generally, little is known about how to introduce new questions into the public data, as well as the final uses of the indicators by the diverse actors (policy makers, research institutions, researchers, others...), that may differ from the reports stated intentions. Further research may deliver new insights into the *policy life-cycle of monitoring* (Otero-Hermida, 2022). It involves further empirical research on 1. how are the monitoring pannels generated, what are the underlying purposes and values who participates in the development of the panels, who participates in their collection, among others. 2. How they are used: who puts them on the table, at what tables for what kind of decisions, how they are accompanied by other non-quantitative views, how they inform and/or close debates, what is the focus of work, do they justify policies or others. 3. How their usefulness and limitations are assessed and their continuity or substitution in new political cycles and how new questions and indicators are included.

5.2 Imagining new monitoring paths: new contexts, new insights

These findings and discussion encourage us to propose a reflection about how the monitoring process can be understood as part of a systematic and open approach to equality. We have discussed that in the current context the denialism of gender inequality has increased with the emergence of anti-feminist movements on the far right and their growing institutionalisation. This phenomenon situates gender as a key aspect of anti-democratisation waves (Lombardo et al., 2021). Indicators of presence for awareness-raising purposes are still necessary. The question is not so much to replace the policy focus as to find a balance between presence,

process and voice. In this sense, the purposes of monitoring the effectiveness of policy may need further reflection, and we propose some aspects that maybe useful.

- First, we cannot perform evaluations only by monitoring, but monitoring is a possible tool employed in evaluation, among others needed such as qualitative work. This may be overlooked in *She Figures*, posing expectations difficult to reach. Other oingoing evaluation initiatives and how they are related to She Figures can be mentioned, to clarify the actual utility of the report and to provide a comprehensive picture of the phenomena.
- Second, a debate about the dimensions to be measured in a clearer and broader policy process as discussed above is necessary after twenty years. In this debate it would help to reflect on the relationships between these dimensions. We have previously used the example of work-life balance above others. The relationships are multifactorial and multi-criteria, an aspect that has been worked out in some methodological approaches to monitoring (Sánchez-López et al., 2023). This would help in our opinion in the debates about the mutual need between *presence*, *process* and *voice. The* debate could also be extended to how other dimensions of responsibility in science and innovation influence the development of gender equality, as connections between aspects such as public engagement, science communication, ethics or openness have been observed (Mejlgaard et al., 2018).
- Third, more data on national measures, which would help to understand the large differences between countries, would be necessary to monitor policies.
- Fourth, indicators could be devised to monitor specific actors, such as funders, ministries, companies or others. If the purpose is policy evaluation, such a development would be desirable and there are precedents in EU monitoring initiatives in Open Science (European Commission, 2020).
- Fifth, insights in gender monitoring from other measurement levels such as teams (Humbert et al., 2021), scientific congresses (Corona-Sobrino et al., 2020) or centres (Sánchez-López

et al., 2023) may be of interest as integrate aspects such as age, care responsibilities, marital status, edication, ternuer, seniority or contractual position among others. This integration in a specific context may help to address the neccesary dynamism of gender discussed in the first section.

With these questions we would address a fundamental issue: that the focus of the evaluation should be on institutions and their gendered structures. The current focus on women and the aforementioned biases in data availability can shift the focus, almost unintentionally, to proposing measures to "fix women", forgetting the environments and conditions in which we work.

One last key aspect remains to be mentioned, and that is ultimate justification, equality. The question would be what equality? Policies are packages of different visions. When imagining new issues, it would be interesting to have actors representing other perspectives, those that are not currently reflected in current policies. The exploration of intersectionality could provide the insights needed to understand the heterogeneity of women, men and non-binary people in science and innovation. Other concerns linked to visions that are not very present in policies, such as new materialist or ecofeminist approaches where affect and care are key, could add interesting insights, among other possible ones. For example, drawing attention to the sensations provoked by the situations experienced. There are already gender equality monitoring panels in science in Europe that propose perception indicators (EU Expert Group, 2015), so we are perhaps not so far away from addressing the key issue of incorporating the views of those who are monitored.

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