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Promoting Gender Equality in STEM-oriented Universities: Institutional Policy Measures in Sweden, Finland and Norway

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Introduction

Equal access to research-intensive careers for talented academics of all genders and backgrounds is vital to secure social justice and to ensure efficient research and knowledge production. Still, gender inequalities endure in academia. Although Sweden, Norway and Finland have been identified as forerunners in promoting gender balance in research (Lipinsky, 2013), the share of women in top academic positions in science, technology, engineering, and mathematics (STEM) remains well below the threshold for a gender balance (European Commission, 2019).

Previous studies on women's under-representation in STEM have noted that female talent is lost at every critical career transition phase ('the leaky pipeline' metaphor; Berryman, 1983; Ong et al, 2011; Liu et al, 2019). This approach has, however, been criticized for its focus on the 'supply-side' (Metcalf, 2010), linearity and inability to account for varied career paths (Xie and Shauman, 2003; Etzkowitz and Ranga, 2011). Another stream of literature notes that maths and science continue to be perceived as male domains, and the perception of scientists in STEM is predominantly male (Makarova et al, 2019). This emphasizes that women are viewed as deviating from the norm of the ideal worker (Acker, 2012). Male domination makes the lack of access to networks (Fox and Colatrella, 2006; Terosky et al, 2014) and role models more evident. In addition, intensified international competition requires early career researchers to be mobile (Herschberg et al, 2018), influencing women's chances for recruitment and promotion (Jöns, 2011).

The under-representation of women in STEM has created the necessity for national and institutional measures to promote gender equality at universities. National measures are particularly relevant in the Nordic countries which have comprehensive gender equality legislation that also applies to higher education institutions. In addition, the state may provide different incentives for universities to promote equality. Nevertheless, the effectiveness of these policies depends on both the type of measures and their implementation at university level. Previous studies on measures for improving gender balance and diversity in organizations indicate that transparency in hiring and promotion, policies that establish clear responsibility for increasing diversity within the organization, and affirmative action plans in combination with responsibility structures have the largest effects (Naff and Kellough, 2003; Holzer and Neumark, 2006; Kalev et al, 2006; Timmers et al, 2010; Dobbin et al, 2015).

Only a few studies have investigated the types of equality measures used in Nordic higher education institutions (Bergman and Rustad, 2013; Nielsen, 2017; Moratti, 2020). Nielsen (2017) analyzed the use of such measures in six Nordic universities, two each in Norway, Sweden and Denmark. Nielsen concluded that measures aimed at creating equal opportunities and revising existing organizational cultures were the most efficient in countering organizational inequalities. Based on a longitudinal study from one Norwegian university, Moratti (2020) found no detrimental effect on (rarely used) low-transparency and low-openness procedures. However, more controversial proactive measures, such as affirmative action policies, showed clear positive effects, but they have become less available due to stricter European legislation over the past decades. These results indicate a need for further studies on organizational gender equality policy that focus on types of policy in more detail.

Against this background, in this chapter we seek to investigate how the changes in the proportion of women in grade A positions in STEM-oriented universities are related to the use of gender equality measures. Grade A positions are the highest academic positions, typically full professorships. Bacchi (2009) argues that policy always makes assumptions about the problem the policy is meant to solve. In line with this, building on prior research (for example, Kalev et al, 2006; Timmers et al, 2010; Dobbin et al, 2015), we categorize gender equality measures (GE measures) according to how they seek to reduce gender inequalities. We investigated what GE measures have been used by the universities that have achieved significant positive changes in the proportion of women in grade A positions. This was done by analyzing how the proportion of women in grade A positions has developed in each university between 2000 and 2018, and by investigating if the detected variation is related to the use of these measures. We discuss which potential implications the use of specific GE measures have for the academic career progression of women.

The skewed gender distribution in STEM fields, especially in the highest academic career positions, has attracted high-profile policy attention, calling for states, research organizations and universities to take action to improve gender equality in research (for example, Council of the European Union, 2015). Against this background, we expect STEM-oriented universities to face pressing issues related to gender equality, which may be reflected in their institutional gender equality work. To our knowledge, previous research has not investigated what measures STEM-oriented universities have taken to address gender inequalities in academic careers. Thus, this study provides new knowledge on how STEM-oriented universities in three Nordic countries – Sweden, Norway and Finland – have used policy measures to support and promote gender equality among academic staff.

We define STEM-oriented universities as universities that have a high proportion of academics working in STEM fields and that have a strong research and teaching environment in those fields, reflected in a high proportion of PhD graduates in STEM fields. The study uses institutional survey data which were collected as part of the Nordic Centre of Excellence NORDICORE. The data provide a unique opportunity to compare the universities' use of equality measures, and to relate this to the changes in female representation in STEM fields.

Categorization of gender equality measures

Policies that seek to combat gender inequality in organizations can be studied from several perspectives. One approach is to investigate how the policies relate to different assumptions about men and women (Rees, 2005; Squires, 2008). Another is to analyze GE measures based on what they seek to target. Timmers et al (2010), based on Fagenson (1990), distinguish between measures that target individuals, the culture and organizational structures. In another study on the efficacy of diversity measures, Kalev et al (2006) use three broad approaches for promoting diversity: initiatives to establish organizational responsibility for diversity, initiatives to reduce bias through training and initiatives to reduce the social isolation of women and minority workers. In another study, the same team (Dobbin et al, 2015) focus on how managers are motivated to influence change by activities that influence managerial motivation for promoting diversity, activities that constrain managers' discretion to discriminate and activities that increase transparency and monitoring within the organization.

Policymakers can use different policy measures to achieve their intended goals. Here we distinguish between policies that target individuals and policies that target structures. The approach by Dobbin et al (2015) focusses on changing the behaviour of actors, while Kalev et al (2006) focus on policies emphasizing both social structures and actors. In this chapter actor-oriented policies include measures that target members of the under-represented sex, and training measures to reduce bias and stereotyping. Structure-oriented policies include measures establishing organizational responsibility and measures of preferential treatment (see Table 6.2, under the section 'Findings', for an overview of the included measures in the study).

Targeted measures

Targeted measures are actor-oriented as they aim to target members of the under-represented sex (in STEM, women) and seek to remedy their 'deficiencies' so that they advance in the prevailing career structures. Gender differences are addressed by targeting women through measures that aim to change individual behaviour and the choices made by women (although these can be influenced by societal norms and values). These measures seek to 'fix' the women through intervention strategies that support them (Kalev et al, 2006). Such measures are often based on 'deficit' analyses that assume that women lack the required knowledge or networks, or behave in ways that make them less competitive (for example not taking enough risks, not applying for promotion). Thus, women are offered targeted training, coaching, networking, mentoring and leadership programmes to help them meet the norms of the ideal academic.

Questions in the survey referring to targeted measures were about i) special funding for women to qualify for promotion; ii) the possibility for women to earn research leave in a shorter time compared to men; iii) mentoring programmes for women; iv) career development workshops for female academic staff; v) networking gatherings for female academic leaders; and vi) leadership development programmes for women.

Training measures

Training measures seek to change the culture of the organization and prevent research and teaching staff, managers and gatekeepers from holding implicit bias and stereotypes which may reproduce existing patterns of inequality (Kalev et al, 2006). Although academia is often presented as gender neutral, previous research indicates that many practices in fact privilege men (Broadbridge and Hearn, 2008). Processes of assessment, selection and evaluation are at risk of being performed by managers and gatekeepers who hold stereotypes of men and women (Fagenson, 1990). Thus, training measures target the norms and values of staff in an organization, especially department heads and members of recruitment and promotion committees.

Questions in the survey encompassed i) diversity training for academic staff; ii) diversity training for department heads; iii) diversity training for hiring or promotion committees; iv) sexual harassment training for academic staff; v) written instructions for hiring or promotion committees about gender and diversity bias; and vi) promotion of equality as part of the qualification for department heads.

Organizational responsibility measures

This first category of measures among the structure-oriented policies includes measures to support organizational responsibility in gender equality work. These are warranted because even if a policy sets out the direction for change, this can be lost on the way if the policy is decoupled from the overall goals and objectives of the organization. Based on the ideas of Max Weber, Kalev et al (2006) argue that decoupling is likely to occur when there is a lack of structures of responsibility, such as a diversity office or expert to monitor progress. If diversity efforts become everyone's responsibility, they risk becoming no one's primary responsibility and policy might become decoupled from practice. If organizations fail to assign responsibility for diversity goals to a specific office or person, these goals risk being lost when line managers need to meet competing demands from scholars (Kalev et al, 2006). Weber's recommendation is to assign responsibility for setting goals, allocating means and evaluating progress, which Kalev et al (2006) interpret as actions plans, internal monitoring and the introduction of diversity committees.

Policies that seek to make structural changes in organizations aim to change the way rules, structures, decisions and processes are organized, for example by increasing representation or transparency within the organization. This may mean transparent procedures for workload allocations and promotion criteria (Probert, 2005) or official publishing of positions for recruitment (van den Brink, 2010). A number of policies representing organizational responsibility in promoting gender equality, such as the requirement to have a gender equality plan and salary reviews by sex, are part of the legislation in the Nordic countries.

The organizational responsibility measures included in the survey were i) office or full-time person devoted to equality/diversity; ii) a standing gender equality committee or equivalent; and iii) written procedures for discrimination or sexual harassment grievance for academics.

Preferential treatment measures

Our second category of structure-oriented policy focusses on organizational structures which can influence individuals' entry and promotion in academic careers (Ragins and Sundstrom, 1989; Fagenson, 1990). Existing organizational structures and institutions are not gender neutral but favour one gender (usually men) in a variety of subtle and often invisible ways. This calls for policies that seek to enhance equality among historically excluded groups with the help of preferential treatment. It should be noted that affirmative action in the manner in which it is understood and exercized in the US, for example, is not in use in the Nordic countries. Through deconstruction and redistribution, preferential treatment measures tackle deeply rooted organizational cultures and work to increase the participation of the under-represented group while trying to even out the imbalance (Rees, 2005). In international studies preferential measures have proven to have limited effect (Holzer and Neumark, 2006; Kalev et al, 2006), but a study in Norway proved them effective (Moratti, 2020). Such measures may entail recruitment and promotion procedures in favour of women, for example earmarking funding for the under-represented sex, or organizational incentives to recruit women academics.

In our survey, preferential treatment measures included i) promoting the use of proactive measures to increase the proportion of the under-represented sex among academic staff; ii) use of invitation procedures to professorships to increase the proportion of the under-represented sex; iii) earmarking of funding to support hiring members of the under-represented sex; iv) use of nationally granted money to develop GE measures; and v) special funds for start-up packages to support hiring women faculty.

Methodological underpinnings of the study: Case selection

We define STEM-oriented universities as institutions that fulfil two criteria.[1] First, they have a high density of academics working in STEM fields, which we measured based on the proportion of grade A positions located in STEM fields. Second, STEM-oriented universities have a strong research and teaching environment in STEM fields, which we measured based on the proportion of PhD graduates in the university that were in STEM fields. We calculated these proportions using data from the official databases for statistics on higher education in Norway, Sweden and Finland (DBH, Statistics Sweden, Vipunen Database).

To be part of the dataset, at least 45 per cent of grade A positions in the university had to be in STEM and at least 55 per cent of PhD graduates had to be from STEM fields. We calculated the grade A proportions using university-level data from 2018. As there is some yearly fluctuation in the number of completed PhD degrees, we calculated these proportions with university-level data from 2018, 2019 and 2020 for Norway and Finland, and for 2018 and 2019 for Sweden and used the average proportion from these years. It should be noted that as we used proportions of grade

A positions and PhD graduates for each university in defining STEM-oriented universities, the dataset mostly comprises technical universities and universities specializing in natural sciences. Thus, the analysis excludes comprehensive universities that have extensive natural science faculties, because STEM fields are not dominant in these university organizations.

Based on these criteria, nine universities in the three countries qualified as STEM-oriented universities in 2018. Of these, eight participated in the NORDICORE study and are included in this dataset. Three of these are located in Sweden, two in Norway and three in Finland.

Data and method

The study uses organizational survey data on Swedish, Norwegian and Finnish STEM-oriented universities' gender equality and diversity policies. For the collection of the survey data, we targeted all institutions in Sweden, Norway and Finland which in 2018 had a legal status as universities. For this study, we employ data from the eight STEM-oriented universities.

We collected the survey data between 2018 and 2020 in phone interviews (including Skype/Zoom) and face-to-face interviews. Most respondents to the survey were human resources (HR) personnel (for instance, HR directors or administrators) or equality coordinators. In many cases, especially in large institutions, we interviewed several people. The survey included questions on universities' formal central-level policies and measures to promote gender equality and diversity and the timing of policies (start and end year of each policy). Due to increased institutional autonomy and the strengthening of the central governance of universities, we expected policies on the institutional level to be important (cf. Enders et al, 2013; Hansen et al, 2019).

The survey was strongly inspired by the work of Alexandra Kalev and Frank Dobbin, who have studied diversity management in the US. The research group worked together to develop the survey and to collect and analyze data. This enabled us to verify consistency in the interpretation of questions across the countries and institutions. The individual survey questions represented binary variables, where the main response alternatives were 'yes' and 'no' (with the option to respond 'I don't know' and 'I don't want to answer'). When respondents were not able to answer questions, they were asked to consult colleagues or institutional records.

For the analysis, we chose the variables (20 in total) which, according to our estimation, represent the analytical categories presented earlier. The analysis was based on the frequency of the measures by university and graphic illustration of the results. We excluded measures derived directly from national legislation from the analysis. That is, the analysis only included measures that the universities had voluntarily chosen to use to promote equality.

Findings

Table 6.1 provides an overview of the proportion of women in grade A positions in the studied universities. It presents the situation in the universities at three time points (2000, 2010 and 2018) and visualizes the pace of development in the 2000s and 2010s.

Table 6.1: Proportion of women in grade A positions in the studied universities in 2000, 2010 and 2018

University	Total FTE/share of women	2000	2010	2018	Factor change of the proportion of women	Absolute change of the proportion of women (pp)
SE1	Total FTE	57	98	150		
Univ with significant changes	women %	2.6	14.9	25.2	9.6	22.6
NO1	Total FTE	485	597	782		
Univ with significant changes	women %	8.5	19.0	25.6	3.0	17.1
SE2	Total FTE	132	182	214		
Univ with significant changes	women %	6.7	8.0	16.6	2.5	9.9
SE3	Total FTE	194	288	308		
Univ with significant changes	women %	11.1	20.8	24.0	2.2	12.9
NO2	Total FTE	110	128	194		
Univ with significant changes	women %	12.9	17.3	25.6	2.0	12.7
FI1	Total FTE	264	338	243		
Univ with small changes	women %	10.2	0.2	15.0	1.5	4.8
FI2	Total FTE	52	80	74		
Univ with small changes	women %	11.5	18.0	15.0	1.3	3.5
FI3	Total FTE	106	146	94		
Univ with small changes	women %	4.7	7.6	5.6	1.2	0.9

Note: The dataset includes two universities which merged during the timeframe of the analysis. Figures for years prior to the mergers were calculated with data from the former pre-merger institutions.

In Table 6.1, the overall change in the proportion of women for each university is presented in factor and absolute terms. In the table, the order of the universities is set according to the factor change of the proportion of women. It should be noted that the starting point in 2000 differed in the eight universities: the universities had an average of 8 per cent women in grade A positions, however, with variation from 3 per cent to 13 per cent. In 2018, the universities had reached an average of 19 per cent of women in grade A positions, again with significant variation from 5 per cent to 26 per cent. It should also be noted that in the Swedish and Norwegian universities, the number of grade A positions increased, whereas in two of the Finnish universities, it decreased.

Based on the size of the change in grade A positions (in both factor and absolute terms), we composed two groups of universities. In the first group, the proportion of women increased significantly between 2000 and 2018. The group includes five universities (SE1, NO1, SE2, SE3 and NO2). In the second group, changes were smaller or ambiguous. The group includes three universities (FI1, FI2 and FI3). It is notable that the universities in the two groups are located in different countries: universities with high-level changes are located in Sweden and Norway, whereas all universities with low-level changes are located in Finland. The differences may partly reflect national regulation and activity in gender equality work, such as higher education legislation with different emphasis on gender equality issues (Borchorst et al, 2012).

This study focusses on how the variation in grade A positions is related to the differences between universities in gender equality activity. Based on previous literature, we expected some measures at the organizational level to be more effective than others in promoting equality.

Table 6.2 displays the use of GE measures per university by the analytical categories presented above. The order of the case universities is defined according to the overall activity in gender equality work for each university. The universities range from left to right from those with higher levels of activity in gender equality to those with lower levels of activity.

STEM-oriented universities in the three countries vary considerably in the use of organizational GE measures. Table 6.2 shows the pattern involving the use of measures and the scale of change in grade A positions. Active use of GE measures seems to be related to significant changes in the proportion of women in grade A positions between 2000 and 2018: the universities which witnessed the biggest growth of women had, on average, used a variety of measures to promote gender equality. By contrast, the universities with a low use of GE measures all belong to the group with small changes in the proportion of women in grade A positions.

When looking at the GE measures per category, the three measures that reflect organizational responsibility were used most widely. For example, all universities had gender equality and diversity committees. There is more

Table 6.2: The use of GE measures in STEM-oriented universities

	Universities							
	NO1	**SE1**	**SE2**	**NO2**	**SE3**	**FI1**	**FI3**	**FI2**
Targeted measures								
Funding for women to qualify for promotion								
Research leave for women in a shorter time compared to men								
Mentoring programme for women academic staff	(X)							
Promotion or tenure workshops for women academic staff								
Networking gatherings for women academic leaders								
Funding for women academics' participation in leadership development programs								
Amount	5	5	3	0	0	0	0	0
Training measures								
Diversity training programme for academic staff								
Diversity training for department heads								
Diversity training for hiring or promotion committees								
Sexual harassment training for academic staff								
Written instructions for hiring or promotion committees about gender and diversity bias								
Promotion of equality part of the qualification for department heads								
Amount	4	2	2	2	1	2	0	0

Table 6.2 cont.: The use of GE measures in STEM-oriented universities

	Universities							
Organizational responsibility measures								
Office or full-time person devoted to faculty equality/diversity								
Standing gender equality or diversity and equality committee								
Procedure for discrimination or sexual harassment grievance for academic staff					(X)			
Amount	3	2	3	2	3	2	2	2
Preferential treatment measures								
Proactive measures to increase the prop. Of the under-represented sex among academic staff	(X)							
Invitation procedures to professorship to increase the prop. Of the under-represented sex				(X)				
Earmarking, funds or faculty lines to support hiring members of the under-represented sex								
Granted money to develop gender equality measures								
Special funds for start-up packages to support hiring women academic staff								
Amount	5	3	2	4	1	0	1	0
All measures (count)	17	12	10	8	5	4	3	2
% of measures (20 in total)	85	60	50	40	25	20	15	10

Note: Dark grey indicates that the measure was in use in 2018. Light grey indicates that the measure was used, but then stopped. (X) indicates that the measure was used, but it is not known whether it was in use in 2018. Black indicates missing data.

variation in the use of targeted measures, training measures and preferential treatment measures. It is clear that while all the universities used organizational responsibility measures, the universities with significant changes in the proportion of women more often also used preferential treatment measures and targeted measures for women in promoting equality. The universities with only small changes, all located in Finland, used preferential treatment and targeted measures marginally or not at all.

Table 6.2 also displays which measures were in use in 2018 and which had been in use but were discontinued. Overall, there was a clear upward trend in GE activity. However, there was a distinction between the measures that were used only temporarily and measures which seemed to be longer-lasting. Once adopted, the training measures and the organizational responsibility measures represent enduring structures for universities' equality work: the majority of universities which had adopted these measures continued to use them in 2018. In contrast, the use of targeted measures and preferential treatment measures was more temporary in nature. For example, the use of the strongest version of preferential treatment, earmarking, was discontinued in many Swedish and Norwegian universities as it was considered discriminatory towards men after being ruled out by the European Court of Justice in 2002 and 2003 (Lerwall, 2001; Husu, 2015).

Conclusions and discussion

Our analysis shows that the STEM-oriented universities which saw the biggest growth of women in grade A positions between 2000 and 2018 used or had used, on average, a variety of measures to promote gender equality. In contrast, the universities with small changes used fewer measures. It is striking that the universities which had significant positive changes in the proportion of women in grade A positions had on average been more active in using preferential treatment measures and targeted measures. The connection between preferential treatment measures and targeted measures on the one hand and female representation on the other is interesting because these measures reflect politically controversial intervention strategies to promote equality.

All studied universities used measures that aim at strengthening organizational responsibility via institutional gender and diversity committees and internal procedures to report on discrimination or sexual harassment. Measures aimed at strengthening organizational responsibility seem to form the institutional base for STEM-oriented universities' equality work. However, when compared to preferential treatment and targeted measures, their influence (without simultaneous use of other measures) is questionable. Case university SE3 is an exception, with only minor use of preferential treatment and targeted measures and still significant growth in the proportion of women in grade A positions.

The use of equality measures by the STEM-oriented universities increased over time. However, we also saw differences in the type of measures used and their longevity. Training measures and measures that aim at strengthening organizational responsibility represent universities' enduring gender equality structures, whereas activities in preferential treatment and measures for women were, in many cases, used only short-term. Overall, the use of targeted measures for women and preferential treatment was uneven across the universities. This calls for discussions on the operationalization and implementation of gender mainstreaming and future strategies for GE measures in Nordic STEM-oriented universities to change still-persistent gender inequalities.

We cannot make any causal conclusions about the relationship between the use of GE measures and the differences in the outcomes in grade A in this study because the adoption of measures is endogenous (that is, the adoption of measures may be related to university-specific characteristics that affect the gender balance). Also, we did not include any data on other variables that might affect the gender balance, such as the gender distribution among PhD graduates or academic staff other than professors in the case universities. Still, the findings point to interesting hypotheses for further research that seek to study what works when pursuing tangible changes in the highest academic career positions in STEM-oriented universities.

Note

[1] STEM refers to science, technology, engineering, and mathematics. The exact definitions of STEM fields or disciplines vary by national context and organization (see, for example, Koonce et al, 2011). In this chapter, we incorporate the fields listed under 'natural sciences' and 'engineering and technology' in the OECD Classification of Sciences as STEM fields.

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