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Article

Setting up a dynamic framework to activate gender equality structural transformation in research organizations

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Abstract

The need to redress persistent gender inequality in senior and decision-making positions in science through structural measures is increasingly recognized both in academic literature and policy-making. Based on the experience of a Danish university implementing a structural gender equality action plan, we present a dynamic framework to activate structural change and argue that for such interventions to be effective, it is necessary that they acknowledge and operationalize the notion of complexity as their frame of reference. The notion of complexity proposes a nonlinear relationship between inputs and outputs of policy measures, where impact depends on the interaction of a multitude of variables strongly related to context. Following this approach, the framework tested and discussed herein is characterized by a holistic view of structural change, encompassing multiple targets and areas of intervention, a multidimensional notion of power and a strong focus on local change dynamics, that is, activation processes, agency mobilization, structural resistances, and impact-producing factors.

Key words: gender equality; structural change; dynamic framework; research organizations; complexity approach

1. Introduction

While there is a multitude of studies focusing on the sources of gender inequality in senior and decision-making positions in science, little research has been carried out on the efficacy of the measures to address them (Kalev et al. 2006). Timmers et al. (2010) state that, despite the fact that many universities implement gender equality (GE) policies, the lack of information on the efficacy of the implemented measures is striking. Research, in particular, on recommendations for concrete actions on how to effectively address structural and cultural barriers, is highly needed (Bailyn and Fletcher 2007; Czarniawska 2006; Nielsen 2015). Studies show that progress is slow at best, despite measures to achieve gender-balanced organizations, since 'gender equality policies are developed in a context where theory is thin and actions are based on the common sense of practitioners' (Benschop and Verloo 2011: 278).

In this paper, we first review the evolving theoretical approaches to GE policies in universities and research institutions and briefly discuss to what extent these approaches are integrated into current practice. Then, we outline a theoretical framework developed to facilitate change toward GE in universities, which aims at integrating the developments of the reviewed approaches. The framework was developed as part of the STAGES project, funded by the European Commission (EC) under the Seventh Framework Program for Research and Technological Development and co-funded by the Italian Government (Department for Equal Opportunities). The project entailed a comprehensive implementation of tailor-made action plans aimed at transforming structures and culture at five European universities and research institutions and making the organizations more inclusive for female researchers and decision-makers. Following the presentation of the framework, the results of a 4-year implementation process applying it at a large Danish university are presented and discussed, as well as their implications for the framework itself. Lastly, we conclude highlighting the need for strategies integrated at multiple levels to achieve organizational transformation, as well as the need to focus on the dynamics of the involvement of different stakeholders, in the framework of an approach taking complexity as its frame of reference.

2. From individual to structural perspectives

In the literature, there are three complementing perspectives and approaches that address the low shares of women at the highest academic positions, namely (1) individual, (2) cultural, and (3) structural or institutional (Timmers et al. 2010).

The key tenet of the individual perspective is the gender-centered approach (Fagenson 1990), which attributes underrepresentation of women at the higher ranks in organizations to differences between women and men as to psychological characteristics, personality, socialization, or career orientation. A 'fixing the individuals' approach, such as mentoring, training, and coaching of women, dominates such programs (Kalev et al. 2006).

With time, however, the fact that it is the very structure of academic organizations which reproduces gender stereotypes privileging male faculty (Benschop and Brouns 2003; Priola 2007; van den Brink and Stobbe 2009) has been increasingly acknowledged. Gender inequalities are persistent due to 'culture, processes and practices that constitute the structural systems of contemporary organizations and therefore are taken for granted and mostly left unchallenged' (Parsons and Priola 2013: 580, see also Bagilhole and Goode 2001; Gherardi and Poggio 2007; Meyerson and Tompkins 2007). Both university leadership and faculty members have for a long time failed to recognize 'institutionalized gender barriers' (Bird 2010: 1). Thus, they put efforts exclusively in 'fixing the women', disregarding how cultural and structural barriers operate and hinder women's advancement in scientific and decision-making positions.

The cultural and structural perspectives address broader sets of factors at the origin of inequality. According to the cultural perspective, the lack of women at higher organizational levels is related to the history, culture, and policy of the organization, as well as to cultural factors in the broader society affecting it (Fagenson 1990). Research (Broadbridge and Hearn 2008; Heilman 2001; Willemsen 2002) highlights that 'while management in organizations is represented as gender neutral, it often involves practices that are consistent with characteristics traditionally valued in men, stereotyping and a preference for men' (Timmers et al. 2010: 721). Cultural impediments such as gender bias based on stereotypes are well documented in the literature (Metcalfe and Slaughter 2008; Wennerås and Wold 1997). Bleijenbergh et al. (2013) reveal how gender inequality dynamics are strongly interconnected with other organizational problems. Therefore, different measures, such as gender and diversity training of decision-makers, are recommended to address managerial and organizational bias (Willemsen and van Vianen 2008). Other scholars (van den Brink and Brouns 2006) focus on the assumptions of talent recruiters about the 'excellent scientist' and their impact on the behavior of academic staff.

Finally, the structural perspective suggests that organizational hierarchies, procedures, and formal and informal rules informing the ordinary functioning of the institution hinder the recruitment and promotion of women. Timmers et al. (2010: 722) stated that 'the structural perspective concerns the nature of organizational structures and the organization of work, rather than individuals or gender roles'. Explaining the structural constraints, Kanter (1977) identified three key dimensions: the structure of opportunity, the structure of power, and the proportional distribution of men and women. Accordingly, institutional hierarchies determine the likelihood to advance to the top ranks in the organization. Thus, according to empirical research, the most effective way to address structural factors 'may lie in practices that assign organizational responsibility for change' (Kalev et al. 2006: 611).

Several studies have explored how gender inequality is linked to structural issues in organizations (Baxter and MacLeod 2005; Benschop and Verloo 2006; Hearn 2000; van den Brink and Benschop 2011). Structural change approaches in organizations are radical change strategies, which aim not only at 'resetting' structures and creating better opportunities for the underrepresented gender but go beyond that, making equality of outcomes of initiatives a key objective (Benschop and Verloo 2011; Kirton and Greene 2005). There are different streams of structural transformation strategies. A key approach is gender mainstreaming which aims at mitigating gender bias by transforming organizational practices and processes. Gender mainstreaming involves 'regular organizational actors in the transformative process' (Benschop and Verloo 2011: 283) and has potential transformative effects (Stratigaki 2005; Verloo 2005). However, critics point to the deficiency in economic, political' and administrative support to achieve structural transformation through mainstreaming. Critics also point to the lack of a robust methodology (McGauran 2009) and to the divergence of organizational practices in everyday life that prevent gender mainstreaming from attaining set targets (Eveline et al. 2009).

Another structural transformation strategy, developed by Ely and Meyerson (2000), called the post equity approach, sees gender in a power perspective and as a key organizational principle that shapes knowledge, structures, and identities. Based on the work of Acker (1992), this stream assumes that inequalities are produced in everyday interactions and processes in organizations. Central to this strategy is the notion of action research (i.e. cooperation between researchers and organizational members) accompanied by experiments to disturb gendered processes (Benschop and Verloo 2011). In this line of research, Kolb et al. (2003) focus on the cultural and systemic factors in the organizations, which they perceive as inherently masculinized. Such factors can only be addressed through cultural change measures that challenge the existing norms and values of the organizations.

The focus on cultural and structural approaches is built into the funding schemes of different agencies supporting interventions to reduce gender inequality in science. The US Advance program of the National Science Foundation (founded in 2001), the UK Athena SWAN Charter (established in 2005), and the 'structural change' strategy launched by the EC since 2011, all promote action plans that include integrated and wide-ranging approaches.[1] The EC, in particular, which started to fund integrated programs addressing the structural character of inequality later than other actors, nevertheless led the way in including measures addressing scientific priorities, contents, and methods to fully include gender considerations in the overall scientific process (as, for instance, in gender medicine).

As concerns the goal of the structural change process, the EC identifies five sets of problems to address:(1) opaqueness of decision-making; (2) institutional practices inhibiting women's career opportunities; (3) unconscious gender bias in assessing excellence and in the process of peer review; (4) gender bias leading to wasted opportunities and cognitive errors in knowledge, technology and innovation; and (5) employment policy and practice penalizing women. Five corresponding objectives for structural change were singled out: (1) making decision-making transparent; (2) removing unconscious bias from institutional practices; (3) promoting excellence through diversity; (4) improving research by integrating a gender perspective; and (5) modernizing human resources management and the working environment (European Commission 2012).

3. From linear to complex perspectives

Adopting complexity as a frame of reference (Byrne and Callaghan 2014) for design and implementation adds to the structural view of

organizational change for GE in that it emphasizes and helps managing the highly contextual and nonlinear character of policy measures and impact in this field, inviting to adopt flexible and tailored approaches. Most recent literature focuses on the complexity of addressing gender inequality and different ways in which factors of different nature and depth interact in organizations and produce varying impacts, depending on the social, cultural, normative, and organizational settings (Kalpazidou Schmidt and Cacace 2017). Halpern (2014: 73) argues that gender outcomes in science 'depend on a multitude of variables that combine in complex, non-linear ways'. Cullen et al. (2008) concluded that there is a great amount of evidence demonstrating that the complex blend of different structural, cultural, and institutional factors that generate obstacles for women in science, engineering, and technology call for 'a correspondingly integrated and sophisticated strategic and operational response'. In this perspective, Timmers et al. (2010) investigated the efficacy of GE policy measures in the university system in the Netherlands and observe a correlation between the number of policy measures implemented and the ability of an organization to address inequalities.

GE interventions in agreement with the notion of complexity consequently need to take into consideration the contextual factors and acknowledge that there is no single dominant cause producing inequality, but several, intertwined factors. Designing a mono-dimensional or linear model of intervention could thus prove ineffective. GE policies often address a limited number of aspects of the problem, for example, lack of self-esteem and support for women researchers, and choose approaches directly targeting them, for example, coaching or mentoring. This may indeed have a positive influence on the self-perception of researchers. However, as gender inequality is a self-reinforcing process based on complex causation systems, this result may be counterbalanced by, for example, the lack of women in referee committees or lack of role models (Bleijenbergh et al. 2013). Moreover, complex systems continuously adapt (Halpern 2014), so what seems to be a prevailing cause of inequality at one point 'may shift from time to time and in different settings, in continuous interaction with an array of factors' (Kalpazidou Schmidt and Cacace 2017: 103). Recursive causation with reinforcing loops, where processes tend to reinforce each other (Bleijenbergh and Fielden 2015), and unequal relations, where at critical points small modifications can cause great changes (Weick 1984), are the characteristics of complex system interventions (Rogers 2008). The complexity of the issues involved in interventions implementing GE structural actions in organizations should lead to considering multiple strategies, lines of actions, and agents of change (see Glouberman 2001; Glouberman and Zimmerman 2002), designing a tailored and dynamic blend of measures at the individual, cultural, and structural levels.

Even though the need of taking complexity as a frame of reference when designing and implementing policy measures on major social issues (such as GE) is starting to be acknowledged by more informed scholars and practitioners, there are no available models trying to translate this need into practically-oriented plans for action. Indeed, the navigation of complexity is highly contextual, and it is difficult to outline a standard model of practice (Kalpazidou Schmidt and Cacace 2017).

4. From research within a project to the heuristics of change

Data collection and internal surveys are foreseen in most funding schemes for GE interventions in science, functional to project implementation and stakeholders' mobilization. Knowledge creation and use in interventions aiming at GE in research organizations have been highlighted as a key—and potentially controversial—issue. Zippel and Ferree (2018) showed that not only the knowledge needed for implementation, but also the knowledge deriving from it can create internal tensions between academics and administrators and be difficult to manage and communicate. In this respect, different aspects are highlighted, such as the access to and use of internal data, the relative prestige of research approaches (with quantitative approaches considered more 'scientific' than qualitative ones), as well as the difficulty in publishing research deriving from GE interventions, making these interventions less attractive and rewarding for academics (Zippel and Ferree 2018).

Knowledge creation in the framework of GE implementation is often framed in terms of action research, emphasizing cooperation between researchers and administrators (Benschop and Verloo 2011) and the need to design and manage project actions based on the results of participatory research processes, representing not only the conditions for change, but also a crucial part of the change process itself.

Among the many strands of action research, the one defined as the 'heuristics of change' can be highlighted here (Badham et al. 2011). It posits—based on the work of Kurt Lewin (1948) —that working to change human systems often involves variables, which cannot be controlled by traditional research methods (Coghlan 2011).

In this perspective, having an observation system in place to monitor and analyze change-as-it-happens (Dawson 2011) during the whole intervention lifespan provides a specific type of information, which helps managing unforeseen complexities and dynamically addresses emerging issues. Sometimes evaluation and monitoring activities, rather than standard research, are instrumental in supporting a reflexive and continuous analysis of the activated change process, as particularly emphasized in the Developmental Evaluation approach (Patton 2010).

The knowledge that needs to be produced in the perspective of the heuristics of change is not directly aimed at diagnosing and addressing structural obstacles and problems to GE. The focus is on the change process itself and its different actors (Declich and d'Andrea 2017), which brings to light the changing orientations and attitudes of the involved stakeholders, the negotiation strategies which are mostly needed in different implementation phases, the alliances which are becoming viable, etc. Moreover, the focus on the process makes it possible to dynamically observe structural barriers to change in the form of stakeholders' reactions, making deeply embedded organizational features and attitudes visible in action and therefore possible to address timely (Cacace et al. 2016).

Focus on process also helps strengthening the alliance and moderating tensions and separation between researchers and practitioners, as researchers need to be practically involved in the process to analyze it, while the practitioners' kind of knowledge—far from being undervalued as merely experiential—becomes a crucial information platform for both research and practice. The whole implementation team also benefits from process analysis, because it makes organized information available for self-reflection practices.

5. Developing a dynamic theoretical framework to activate GE structural change

From the discussion above, it emerges that while the need for structural interventions is widely acknowledged and integrated action

plans are requested by the main agencies funding GE programs in science, the same cannot be said for the other two approaches. This is hardly surprising. Indeed, translating the management of complexity and the focus on implementation dynamics and actors into standard tools supporting practice is far from a trivial issue. A difficult balance is indeed to be found between flexibility and adaptation, on the one hand, and the need to outline a path and provide indications for action, on the other.

The theoretical framework, which we will present in the following sections, represents a first attempt to respond to this challenge. It was developed and tested in the framework of the abovementioned EC-funded structural change project, STAGES, and aims at taking into account the emerging needs highlighted by the three approaches discussed so far, that is, structural perspective, complexity management, and focus on implementation dynamics and actors.

Focus on actors' involvement is certainly not the prerogative of the framework proposed here. Many of the structural change projects funded under EC schemes propose specific methods to either involve different types of actors within the organizations almost simultaneously (e.g. Changing the academy model—GENOVATE or Participatory Gender Audit—GENISLAB), or to start from top management and gradually reach the departments of research and/or teaching (e.g. transformational change—INTEGER). In the GENDERTIME project, the transfer agent is atypical in order to guarantee constant knowledge transfer among partners and inside each institution involved. Whichever start is chosen, most projects adopt participatory methodologies, such as the World Café or action research, so as to involve as many relevant stakeholders as possible (Declich 2015).

The basic idea behind the framework proposed here, which ideally represents its added value, is that the mobilization process of the agency of the involved actors toward the many objectives connected to GE represents the single most important factor to keep complexity under control. This process provides energy to maintain a direction and dynamically manage the implementation of structural-level change. Action design, implementation, analysis and evaluation all revolve around this factor, in the 'heuristics of change' perspective.

In this same perspective, the framework is presented as a flexible and dynamic tool to support organizational change as to GE. We consider the framework to be flexible, as it allows for tailoring to specific contexts, and dynamic, as it provides the possibility to adapt to changing organizational conditions along the implementation process, suggesting concrete steps and tasks to address emerging problems.

The framework was developed to support the design and implementation process of an integrated set of activities, tailored to different European universities and research institutions, and aimed at achieving sustainable results. The first objective of the structural change plans has been to apply a tailored action plan geared at challenging gender arrangements at all levels in the organization, taking into consideration the specific contextual conditions. The second objective has been to produce a deeper understanding of the dynamics surrounding structural change efforts by constantly monitoring, assessing and adjusting actions to activate high levels of learning and change in the organization, achieving action implementation as successfully as possible.

To address the manifold challenges of structural change in complex organizations, the project relied on three theoretical approaches, addressing the challenges raised by the three approaches discussed above, and integrating them in the design process as operationalized, practically-oriented models, as follows:

1. Holistic view of structural change, as necessarily encompassing different areas of intervention and different targets;
2. Multidimensional notion of power, implying the need for structural change plans to challenge gendered power arrangements at multiple, interacting levels;
3. Structural change as social change, and consequent strong focus on activation processes, agency mobilization, structural resistances, and impact-producing dynamics.

In the subsequent sections, we elaborate on these three theoretical approaches.

5.1 A holistic view of structural change: addressing different targets and areas

The point of departure of the design process of the tailored action plan was the outcome of a study of 125 research organizations in Europe, North America, and Australia[2] that aimed at mapping strategic areas, which universities and other research organizations identified as key for addressing gender inequality (Kalpazidou Schmidt and Cacace 2017). Three strategic areas were thus identified in the study: (1) women-inclusive environments, (2) gender-aware science, and (3) women's leadership in science. The first[3] strategic area aimed at making work environments more women-friendly (and thus more inclusive for all) by addressing internal culture, rules, and formal/informal behaviors; promoting work-life balance; and supporting early-stage career development. The second[4] area—gender-aware science—was intended to overcome stereotypes of women and science, which lead to gendering and segregating of scientific fields and tasks, and at including the gender dimension in the process of research and innovation. Finally, the third[5] target area aimed at supporting women's leadership in research practice and innovation processes, research management and science communication. Overall, more than sixty lines of actions were identified in the study for the three areas.

Based on this knowledge, the action plans to be implemented at the different institutions were custom-made to the specific needs of each organization. The action plans therefore involved, already in the formulation of the policy and strategy of the intervention, human resources departments, leaders, and managers and administrators at different levels (see Bleijenbergh and van Engen 2015). Following a similar encompassing approach, the action plans were designed to include—in different proportions—measures addressed at providing support and tools to women researchers, measures addressing the organization, and measures addressing knowledge-production mechanisms (such as, for instance, the formulation of research questions and the selection of study samples), questioning their neutrality. The structural approach therefore did not imply the exclusion of possible measures directly targeting women. Indeed, while the three types of measures are generally presented as opposed to one another, in a sort of evolutionary continuum ('fixing the women', 'fixing the organization', 'fixing the knowledge') (Schiebinger 2008), in reality they tend to overlap. Moreover—provided that the deficit model is avoided (i.e. implying that women inherently need more training than men)—even actions addressing individuals can take on a structural character, affecting the entire institution in cultural as well as in organizational and normative terms (Cacace et al. 2016).

5.2 Multidimensional notion of power: challenging inequality at multiple levels

The action plans were built with the aim to challenge gendered power arrangements at the institutions at different levels. In the design process, and making reference to a multidimensional notion of power,[6] the need to promote change at multiple, interacting, and self-

reinforcing levels was therefore considered, which led to the inclusion of actions addressing four dimensions: interpretative, symbolic, institutional, and operational.

The interpretive dimension of change concerned raising awareness of the situation of women at the university, as to horizontal and vertical segregation patterns; starting a reflection on the assumed gender neutrality of science; demonstrating gendered assumptions and consequences of organizational practices and procedures, and hence generating the preconditions for tailored actions. The symbolic dimension of change addressed the image of science as based on masculine values and symbolism, creating stereotyped images of scientists and science itself. Actions here targeted the visibility of women scientists and their achievements, particularly in male-dominated fields, as well as the visibility of leadership commitment and support to the implemented actions. The institutional dimension addressed the norms, practices, and procedures in the organization. Changes here concerned the modification of existing rules and structures or creation of new ones, such as GE policy plans, diversity committees, up to the introduction of gender mainstreaming mechanisms. Finally, the operational dimension targeted managerial aspects and entailed negotiations to get to the actual and effective implementation of the agreed actions and new arrangements, respecting a specific timeframe, constantly monitoring and assessing the process of change.

Based on these first two approaches, a wide-ranging perspective was employed to design the action plans, resulting in the template illustrated in Table 1. The first two columns in the table refer to the strategic areas and their connected objectives, according to the perspectives highlighted above. The third column contains explanations and examples of actions for the different areas and objectives, which can be traced to the four negotiation areas, substantiating the effort to simultaneously challenge gendered organizational arrangements at different levels.

5.3 Structural change as social change: focusing on actors and processes

The last important step in action plan design addressed the question of the change process: how can policy be turned into social action, that is, into concrete, active, and sustainable support to achieve change at all levels in the organization? In this perspective, it was assumed that–given its width and depth—the notion of structural change could be equated with that of social change, entailing both a transformation of the structures and identification and mobilization of change-oriented agencies among key stakeholders.

To the aim of action plan implementation, the broad sociological concept of 'structure' was operationalized to indicate the general framework and circumstances where the action plan took place and, from an even more practical point of view, the specific set of opportunities and obstacles which were expected to come to the surface when the action plan was implemented, influencing and constraining it. Male dominance is, in this case, embodied in organizational features and formal/informal norms (which express themselves, for instance, in language, stereotypical assumptions, widespread behaviors), while often resisting change due to mere institutional stickiness. 'Agency' was identified as the different players' capacity and willingness to take action, highlighting above all explicit support (but also conflict) aroused by the implementation of the action plan. The dynamics of male dominance are directly observable here as fresh actions. The emphasis on the classical sociological concepts of structure and agency and their close interaction in the production of social change is in line with theoretical perspectives broadly connected with social constructionism,[7] focusing on the potential structural effects of social action (Archer 1995, 2003; Berger and Luckmann 1966; Giddens 1976, 1984).

As for the management and observation of the different aspects of the change process, the tool of negotiation[8] was used in action plan design. Internal and external negotiation processes have been planned and observed, including micro-, meso- and macro-level strategies allowing consensus-building, conflict management, new allies identification, and anticipation of effects and reactions before and during implementation, to address potential resistance and other upcoming problems.[9]

Negotiating the interpretive and symbolic levels (see Section 5.2) was mainly linked to working on the agency of the mobilized stakeholders, that is, trying to engage them by acting on the motivational and cognitive sides of the structural change. Institutional and operational negotiations, on the other hand, were more directly connected to pursuing change in the structures of the organization (Cacace et al. 2016).

Following this model, the change process was broken down into different strongly interconnected components, whose occurrence was not expected to be linear. These components, briefly discussed below, are:

- the creation of an internal transformational agent;
- the activation of agency dynamics, with the arousal of supportive or conflicting/resisting attitudes and behaviors toward the intervention;
- the interaction of agency dynamics and structural circumstances; and
- the resulting outcomes in terms of structural change.

The focus on both the structural and agency sides of change implied that, for the policy (the action plan) to be turned into shared social action, it was necessary that a transformational agent was present, being able to function as a catalyst for change. Key features of an efficient transformational agent were identified in the capacity of the group, for example, to develop a shared and strategic view of the activities, to keep internal cohesion, to gain authoritativeness and legitimization to negotiate with internal stakeholders, to build links with other change-oriented groups within the organization, and to communicate the project to different audiences.

The transformational group was then expected to be able to start activating the agency of other internal actors (groups, organizational units, beneficiaries, etc.) directly or indirectly concerned, to gain their active support and contribution to the actions of the structural change process. Ideally, the diffusion of transformational attitudes among different groups of stakeholders would have made it easier to pursue change objectives through ever diminishing efforts on behalf of the promoting team. The degree of agency mobilization was to be assessed using indicators such as participation in internal and external initiatives, involvement in action design, implementation or monitoring, and creation of new informal groups. It was also anticipated that agency could have manifested itself in terms of resistance or opposition to the actions, which could vary from simple lack of awareness to denial, from indifference to strong opposition.

The structural features of the organization (including cultural aspects) could, depending on the specific action concerned, facilitate or hinder the work of the transformational group. Friction dynamics of agency and structure were expected in regard to multiple aspects, such as the availability of information and data, availability of technical, financial and human resources, time constraints, existing

Table 1. Design template for the action plans: strategic areas, objectives, and examples.

		Objectives	Description and some examples of actions
STRATEGIC AREA	1. Women-friendly environment	1.1. Actions promoting change in organizational culture and formal/informal behaviors	Measures pertaining to the modification of the cultural and behavioral patterns within the research environment, by promoting awareness-raising initiatives addressing specific internal and external targets, promoting gender studies across university faculties and departments, and supporting women in coping with environmental stress factors.
		1.2. Actions promoting work-life balance	Provision of services facilitating work-life balance, by means of supporting access to internal and external services of various kind and the promotion of customized and flexible organizational practices.
		1.3. Actions supporting early-stage career development	Measures specifically aimed at sustaining early-stage career development for young scientists, particularly addressing the barriers that women frequently meet in that early phase. These measures include contractual arrangements supporting temporary staff, career advice, mentoring and training for early-career researchers, provision of funds for professional development and training officers in charge of hiring and promotions.
	2. Gender-aware Science	2.1. Actions challenging gender stereotypes and consequent horizontal segregation	This is pursued, on the one hand, by addressing images and representations of women and science, especially through the collection of data documenting the groundlessness of stereotypes, the use of gender-sensitive language and textbooks, as well as awareness-raising initiatives. On the other hand, particular attention is devoted to fighting those mechanisms translating gender stereotypes into horizontal segregation, by attaching a gender to disciplines, topics or tasks. This is done especially by addressing training initiatives of various kinds to those responsible for career development support and task attribution.
		2.2. Actions aimed at gendering S&T contents and methods	Actions are aimed at questioning epistemological and theoretical assumptions, methodologies and priorities. Research and dissemination activities are usually undertaken in this regard, but also curricular reform of scientific disciplines to include relevant gender studies, institutional or organizational arrangements to increase the number of women research directors, and the dissemination of tools to support the process of gendering the design of research and innovation or funding devoted to gender-sensitive research.
	3. Women's leadership of science	3.1. Actions promoting women's leadership in the practice of research*	Measures supporting women in attaining leadership positions in the traditional academic career, encompassing, among the others, review of criteria to assess scientific quality, support for mobility, delivery of specific training, mentoring, provision of dedicated funds for research, creation of reserved chairs, introduction of new institutional bodies or regulations to redress gender imbalances.
		3.2. Actions promoting women's leadership in the management of research*	Measures supporting women in attaining leadership positions in research management, including tools such as direct support to access boards and committees, introduction of quota systems, creation of candidate databases, lobbying.
		3.3. Actions promoting women's leadership in scientific communication	The third leadership field addressed concerns scientific communication, grouping the tools aimed at strengthening women's visibility and role in the communication flow among scientists and to the general public.
		3.4. Actions promoting women's leadership in innovation processes and science-society relationships	The fourth objective deals with leadership roles in managing the relationships between science and technology, on the one hand, and social, political, and economic actors, on the other, with a specific focus on the management of the issues involved with technological innovation.

Source: Own presentation based on PRAGES

rules, laws and regulations, dominant cognitive and cultural patterns, existing GE policies, etc.

In terms of outcomes, the team set out to pursue change—as anticipated—in different dimensions:

- as growing awareness of the gendered dimension of the scientific organization (negotiating interpretations);
- as a rebalancing of the symbolically masculine imagery of science, and identification and neutralization of stereotypes of women and science (negotiating symbols);
- as a redefinition of rules and procedures, and creation of new ones aiming at GE (negotiating the institutional rules of the game); and
- as the capacity of translating declarations and commitments into action (negotiating the concrete functioning of the new arrangements).

The following scheme (Fig. 1) has been used as an attempt to dynamically summarize the elements described above. Having as a point of departure the theoretical framework described earlier, an itinerary was outlined, starting from a team endowed with the task of concretely applying a policy instrument such as the gender action plan at a university, through the progressive mobilization of various supporting agencies, the friction with structural obstacles of different kinds, and the activation of the change process in different relevant change dimensions and strategic areas. Social innovation in gender arrangements was expected as a result of the diffusion of transformational attitudes, within and outside the promoting organization, even if various rounds of the spiral (and adaptation processes of the action plan) were considered to be necessary.

Hence, the intervention model was developed trying to take into account the complexity of the context and multiple aspects and variables, which could come into play, with a specific focus on the involvement process of internal actors and negotiation strategies on different dimensions of change. However, the tools which have been used to set the change process in motion were designed having in mind that a clear, linear implementation pattern was difficult to establish, nor did the design underestimate the variability and relative unpredictability of the process itself.

Having embraced the perspective of complexity, the team implementing the action plan becomes aware that interventions focusing on deep and extensive social phenomena like gender inequality should strive to foster the right conditions to increase the probability that change can occur. To do so, the team needs to address multiple aspects and dimensions of change and involve multiple actors with their diversified agencies to steer the process. However, as mentioned earlier, a linear relationship between actions and outcomes cannot be expected (Kalpazidou Schmidt and Cacace 2017; Reale et al. 2014).

Based on these preconditions, in the following sections we discuss the framework and the ways it addresses structural change through an analysis of a concrete case: the design and implementation process of a GE action plan at a Danish university participating in the project.

6. The Danish intervention: contextual elements

The low share of female researchers in senior positions in Danish academia has been a pertinent problem. In addition, Denmark has for long been characterized by low levels of public and political attentiveness to the structural and cultural aspects of gender inequality in academia. University leadership and policy-making bodies have thus largely relied on GE measures aimed at fixing the individual female researchers rather than targeting cultural and structural barriers (Kalpazidou Schmidt et al. 2015). Only recently, a particular focus on these factors can be observed in policy documents with recommendations for concrete actions to address them (see Ministry of Higher Education and Science 2015). However, as studies emphasize, policy declarations may be tokens without any connection to concrete actions (Hoque and Noon 2004). In addition, studies reveal

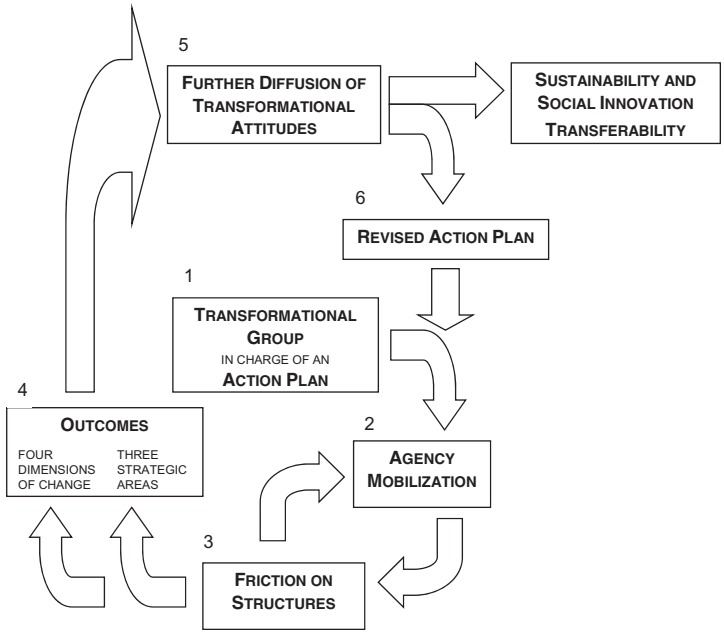

Figure 1. Intervention logic for structural change (developed from Cacace et al. 2016).

the inconsistency between policy declarations and implementation at universities since GE measures often lack coordination and support at the department and faculty levels (Timmers et al. 2010). Such findings demonstrate the importance of organizational commitment and of development of clear strategies in the implementation of GE projects (Nielsen 2017). Therefore, a GE strategy with a concrete tailor-made action plan was developed and implemented at a large Danish university.

The targeted university conducts research within a broad range of disciplinary domains and fields, enrolls more than 44,500 students and has approximately 11,500 employees (4,000 researchers). Gender inequality has been a persistent problem in the organization both among the leadership and the academic staff, with a share of women at only 16 per cent of full professors, 33 per cent of associate professors, and 43 per cent of postdocs, while the share of female PhD students was 51per cent at the time of the intervention (Nielsen et al. 2013). However, there was—and still is—significant variation across scientific fields, that is men dominate full professor positions in science, technology, engineering, and mathematics (STEM), while the highest share of female professors is found within humanities and social sciences (Nielsen 2015).

Earlier attempts to address the gender inequality problem at the university were unsuccessful. The main reasons for the lack of success are to be found in (1) the hierarchy of organizational objectives where GE was not among key priorities, (2) the lack of consensus concerning the cause of gender inequality among leaders at different levels in the organization (in regard to whether the problem even exists and, if so, how to address it) (Nielsen 2015; cf. Benschop and Verloo 2006; Connell 2006), and (3) the fact that initiatives had not been fully implemented or had remained at the intention or policy formulation stage (cf. Walby 2005). Moreover, in line with the existing literature on diversity management, one may assume that the lacking commitment and support from the leadership to previous GE action plans, may have led to a situation, where the issue of GE has been perceived as less central and worthwhile at the lower organizational levels than what would have been the case otherwise (see Kellough and Naff 2004; Nielsen 2015).

At the university in question, structural change actions as to GE were carried out simultaneously with other significant organizational changes. In 2009–10, as a follow-up to the sweeping reforms in the Danish higher education sector, the university started a transformation process of its entire organizational structure, merging nine faculties into four main scientific areas and fifty-five departments into twenty-six. This came on top of a comprehensive restructuring of the universities and the public research system at the national level in 2007–8, which resulted in a merging of the institutions, reducing their total number from twelve to eight universities and from thirteen to four government research institutes. For this particular university, the merging process meant the incorporation of new units and research institutes into its structure (Kalpazidou Schmidt et al. 2015).

The reorganization of the university has been seen by the action implementation actors as an opportunity to put GE on the agenda and make it one of the key elements of the ongoing structural change process, taking advantage of the existing openness of the organization to change. At the same time, the reorganization of the university also involved a risk to lose focus on gender in the complex process of changing the entire university with respect to both scientific and organizational aspects (cf. Coleman and Rippin 2000). As a consequence, the need for a tailored action plan (using the transitory organizational openness) that could effectively achieve change by raising awareness, mobilizing and committing the relevant agents from the very beginning, was crucial.

7. The Danish intervention: the process of action plan implementation

Based on the encompassing theoretical framework described in previous sections, and considering the broad definition of structural change elaborated by the EC (2012), the action plan at the university was designed by integrating different components so that it represents a tailored blend of measures (see Table 2). The GE goals pursued by the university were thus centered around the areas of developing a women-inclusive environment (changing the culture of the organization as well as formal and informal behaviors, supporting early career researchers, and promoting work-life balance); stimulating women's leadership in the management and practice of research, and in scientific communication; and promoting gender-aware science by challenging gender stereotypes.

The implementation process was likewise characterized by the interplay of different strongly interconnected components, each playing a greater or smaller role based on the specific characteristics of the concerned university and their dynamic evolution.

It is important to stress that—following the perspective of the heuristics of change—the process was constantly monitored and assessed, and all gathered data together with the monitoring and assessment outcomes, were documented in reports during the entire process (see Grønfeldt et al. 2014; Kalpazidou Schmidt et al. 2015; Nielsen et al. 2012, 2013, 2014, 2015a,b,c,d).

7.1. Dynamically managing challenges and opportunities

The first challenge was the establishment of a transformational agent as a new organizational player within the university. Central to this process was the creation of an effective core team (involving social scientists with expertise on gender and action research) and the legitimization of the team in relation to internal stakeholders. Research reveals that the involvement of experts, in particular gender experts, in the implementation supports the identification of processes in the organization that seem neutral but reinforce structural differences, while in policy-making, it is an important precondition for gender policy change (Bleijenbergh and Roggeband 2007).

Activating the transformational agent entailed developing a common view of the implementation process, gaining internal credibility and legitimacy, and building closer links with existing groups engaged in GE and closer relations with key players. The achievement of visibility and recognition of the team within the organization, a process that usually takes time, in particular within larger organizations with hierarchical structures and long-lasting traditions such as the targeted university, was the first objective of the team. Crucial to the legitimization and visibility process was the strong endorsement of the action plan and the transformational team from the human resources (HR) department, already from the beginning of the process (cf. Bleijenbergh et al. 2013). The HR department, part of the leadership of the university, was involved in the design of the action plan and provided active support to the implementation. Evidently, the fact that there was no leadership turnover (usually a recurring problem in larger organizations) after the reorganization of the university was a facilitating factor during the implementation. Yet the legitimization process was time-consuming due to the

reorganization of the entire university (in which the leadership of the university and the HR department were the main actors), on the one hand, and the fact that GE was not among the prioritized areas in the course of restructuration, on the other.

The composition of the core team remained unchanged during the entire implementation, which facilitated the process, as team members and other actors had time to develop good working relations during the course of the actions. The internal cohesion of the team arose from the fact that the team was robust from working together (carrying out research in cooperation even before this project) and had the required complementary expertise to handle the task. Moreover, the cohesion of the team prevented internal tensions, supported managing work overload, ensured continuity of actions, and was decisive for the process as a whole.

A second challenge for the transformational team was the process of activating agency dynamics, directly or indirectly concerned, that is, the activation of groups, organizational units, leaders, managers, researchers, etc., in order to gain their commitment and active support to the activities. An enduring negotiation at the interpretive and symbolic levels was thus initiated, aimed at overcoming widespread skepticism around the existence and breadth of gender inequality at the university. The presentation and dissemination of information about gender gaps also had the objective of detecting supportive attitudes and mobilizing contributions to the action plan, extending the core team, supporting the establishment of networks or informal groups around specific activities (such as lunch meetings), and involving interested stakeholders in redesigning, monitoring, and implementing the activities. In addition, communicating the action plan to different audiences, internally and externally, and establishing alliances (for instance, with other Universities, Research Councils, and the Ministry of Science), has been a valuable tool in the activation of different types of agency.

Structural impediments were nevertheless in the way. As mentioned earlier, in the first implementation period, the entire organization and, in particular, the leadership, were fully immersed in the restructuration of the university. This directed the team toward employing actions which did not require high involvement levels from the top leadership. Such actions involved mapping the situation and collecting data on gender inequality, conducting a wide-ranging survey targeting the GE inequalities in different faculties and departments, launching a wide awareness-raising and communication campaign on GE and the action plan, using internal, regional and national media. The first step in the structural change process was hence to attain disaggregated knowledge about GE issues by gathering data to feed into the intervention logic of the tailor-made actions. In this respect, the core team, being part of the university faculty and having insights into its organizational structure and culture, was in an advantageous position to handle the task.

It is evident that the team composition affected the structural change process and its outcomes. The composition of the team with internal actors has been crucial to activating transformational dynamics. A strategy of successively widening the circles of actors, enlarging the team, has been pursued in order to achieve structural change. Thus, besides the core team, that is, the group of people directly in charge of designing and implementing the action plan, the process involved the so-called extended team, that is, institutional bodies, key institutional players, networks, individuals, or groups of people who, in cooperation with the core team, promoted the activities, working toward sustainability. The composition of the extended team was targeted to match different types of existing and emerging needs. Such needs require enriching the core team with people bearing new competences and social capital, involving key leaders at different levels in the organization (vice deans, department heads, etc.) to intensify action plan implementation, mobilizing the

Table 2. The designed action plan: strategic areas, objectives, and actions.

Strategic area	Objectives	Actions
Women-inclusive environment	1. Actions promoting change in organizational culture and formal/ informal behaviors	1.1. Documenting developments in GE
		1.2. Communicating strategies to promote the visibility of female role models
		1.3. Organizing four university-wide workshops
		1.4. Periodical training modules on gender diversity management
		1.5. Supporting a young researchers' network
	2. Actions promoting work-life balance	2.1. Establishing and managing home offices for staff
		2.2. Introducing flexible working hours
		2.3. Rules for time reimbursement for PhD coordinators/assistant professors/postdoc supervisors
		2.4. Organizing and managing dinner services to bring home
	3. Actions supporting early-stage career development	3.1. Mentoring program for young female researchers
		3.2. Career advice and training for early-career women researchers
		3.3. Setting up mechanisms to support temporary staff
Gender-aware science	4. Actions challenging gender stereotypes and horizontal segregation	4.1. Organizing four faculty-level initiatives on stereotypes
		4.2. Collecting data on horizontal segregation at faculty level
Women's leadership of science	5. Actions promoting women's leadership in the practice of research	5.1. Establishing praxis for women's presence in evaluation committees
		5.2. Establishing new rules for the evaluation of productivity
		5.3. Disseminating information about available opportunities
	6. Actions promoting women's leadership in the management of research	6.1. Supervision of young female researchers on research management skills
		6.2. Direct support to access decision-making boards
	7. Actions promoting women's leadership in scientific communication	7.1. Communication of women's scientific excellence

Source: Own compilation

necessary resources to achieve structural change (e.g. by initiating a new training course for research leaders). The extended team hence integrated the competences, the networks and the bodies with the required disciplinary backgrounds (involving, e.g. the vice deans for talent development and research), allowing to reach out more widely in the different scientific areas.

The incorporation of key stakeholders (HR, communication department, vice deans from different faculties, Taskforce for GE and Diversity Committee members, networks, female researchers with strong voices, etc.) into the extended team contributed to increasing the visibility and legitimacy of the transformational agent. The legitimacy of the transformational agent internally was reinforced by the growing embeddedness of the activities in the national environment and, after some time, the recognition of its expertise and position as national experts in structural change by the Ministry of Science. The Ministry used the expertise of the core team on several occasions, such as in relation to providing national input as to GE in Horizon 2020, in organizing GE conferences, offering the core team a membership in the genderSTE COST working group, etc. In addition, the team provided inputs to the recommendations of the national taskforce 'More Women in Research', established by the Minister of Science. This 'external' recognition, in connection with a general requirement from the Ministry to work toward structural changes, facilitated the implementation of the activities internally.

Evidently, the fact that the transformational team has been an internal actor might have had some adverse effects in regard to, for instance, the credibility of data analysis carried out by the core team. However, the fact that the data analysis was part of a PhD thesis (with the participation of international experts in the assessment committee), in combination with an external to the university international monitoring and evaluation actor embedded in the process, ensured high standards in data gathering and analysis.

When the restructuration process was settled, a new demand for support for gender-related interventions emerged in the organization, initiated from the top leadership, which was centered on the need to draft new organizational strategic documents, such as a new GE plan, based on evidence and data. Thus, due to the activities undertaken up to that moment, the team was positioned in the organization as a structural change knowledge tank for the leadership, in terms of data, evidence, concrete actions and targeted solutions.

Institutional and operational negotiation strategies and tools were used to address established structures that hindered the transformational work. To this end, some internal structures (such as the GE task force and the committees dealing with gender diversity) were actively engaged in the efforts of the team from the beginning. Institutional and operational negotiations were utilized to activate such structures toward pursuing structural change. In particular, the team worked to critically analyze the existing institutional and normative arrangements, to then negotiate their reshuffling with administrative officers and leaders. Important factors in this respect were the collection of data to support evidence-based policy, the awareness-raising actions (i.e. through workshops and seminars, and training of research leaders) of how existing rules and regulations produced pertinent inequalities and ways to improve them by pointing out where to concentrate efforts. Moreover, the team addressed the prevailing cognitive and cultural patterns producing biased outcomes, while, as mentioned above, using the available financial and human resources that could engage in the transformation process (such as the HR, GE Taskforce, etc.) to extend the transformational team and thus mobilize more agents. The use of active and participatory approach to involve leaders and close cooperation in the framework of the extended team resulted in synergies with the work of other bodies and actors, facilitating institutionalization of numerous actions, and generating sustainable results.

There were internal structures where friction dynamics were at work producing potential conflicts. These potential conflict situations were addressed through negotiations by connecting GE initiatives to institutional strategies and missions and by framing actions as targeting emergent priorities and widely recognized challenges in the organization. Thus, the activities supported, for example the university's quest for competitiveness, talent recruitment, scientific impact and research funding by linking them to the GE issue and diversity approaches (Cacace et al. 2015). In some cases, the redesigning and adapting of the actions was necessary in order to provide support to internal policies and initiatives, for instance in the case of talent recruitment and the decreasing rates among early-career female researchers. Actions targeting younger female researchers were redesigned to support the existing efforts by the university.

It is of significance to focus here on the variations across the scientific fields mentioned above, where male full professors dominated in science and technology and life sciences. These environments were also the most vividly engaged in the implementation of the actions toward GE structural changes. The evidence-based policy paper produced by the transformational team, pointing out the structural obstacles hindering the advancement of women, in particular within specific departments and scientific areas such as science and technology and life sciences (thus highlighting that some fields experience the 'leaky pipeline' phenomenon more than others), amplified the impact of the activities. In a staff survey, 80 per cent of female full professors within the abovementioned scientific areas stated that their workload was too high compared to 55 per cent of the male professors. Moreover, the survey revealed that life sciences—despite gender parity at the student level for more than two decades—were still facing crucial challenges in retaining women at the upper ranks of the profession (Nielsen et al. 2015a). The policy paper was an important outcome of both interpretive/cognitive and institutional/operational strategies, explicitly specifying the persistent GE challenges and ways to address them. The paper was handed over to the university leadership to negotiate the integration of its conclusion into the university policy framework for equality. The policy paper comprised comprehensive materials combining gender balance and recruitment statistics on vertical and horizontal segregation, gender statistics distributed by scientific area and department, gender-specific data analyses of a psychological workplace assessment, interviews with department heads, a web-survey on work-life issues, as well as bibliometric analyses of the researchers' scientific performance distributed by gender. The paper contributed with interpretations, central points and perspectives that served to qualify and clarify the following steps of the leadership's work to promote GE. These negotiations did eventually lay the groundwork and support the formulation of the subsequent GE strategy of the university, summarized in the last part of the following section.

7.2 Integrating top-down, bottom-up, and cross-cutting approaches

Already during the first steps of the implementation process, it became clear that the country- and organization-specific interrelation between different processes produced a characteristic pattern of persistent vertical and horizontal segregation at the university (Nielsen

et al. 2015b,d). Based on the approach outlined above, oriented at managing this complexity leveraging on the diversified agency of internal and external actors operating in different strategic areas and at different levels, a threefold implementation model was developed.

The model, which will be briefly described below, synthesizes the most important drivers of the change process and represents the final outcome of the actual implementation experience at the Danish university, as well as a contribution for other agents willing to take on the same challenge. It integrates and models, in a tailored way, the different theoretical components considered in action plan design (see Section 5), and represents their dynamic actualization in a specific context.

The implementation model included a top-down and a bottom-up approach, while cross-cutting activities were employed simultaneously to maximize impact. The effect was the generation of a dynamic process feeding the three approaches into each other in an integrative strategy and thus reinforcing their impact to produce sustainable structural change (Kalpazidou Schmidt et al. 2015). The first part of the top-down approach included an awareness-raising campaign aiming at placing GE high on the public and policy agenda, and among external stakeholders at the national level, thus mobilizing agency and activating a dynamic process, in a context where the universalistic idea of gender-neutral meritocracy is well-rooted in the society. Targeted external stakeholders included the political system, key policy-makers and experts, as well as the public. This entailed intensive presence of the core team in national and local media, organization of workshops and seminars, and extensive participation in GE arrangements, and involved 'snowball effects' influencing the state of affairs at the national level. This aimed at increasing the external pressure on the organization to adopt a more proactive structural transformation approach. The second part of the top-down approach involved the efforts of the team internally, that is mobilizing agency dynamics in the organization and targeting university leadership at different levels (university rectorate, faculty and department) and its engagement (also by GE training) in sustainable structural change. This segment aimed also at committing the decentralized levels (departments) to take action by emphasizing clear structures of responsibility, thus securing continuous commitment. It required, among other things, efforts to support and advise the HR department, the GE Taskforce, the Diversity Committee and the Committee for Research and External Cooperation, as well as training of research leaders on GE to ensure sustainable change. As mentioned earlier, the HR department was involved in the action plan design from the beginning, while the other committees, in close cooperation with the HR, invited the core team to discuss effective ways to proceed, working toward structural changes. A central element in this segment was the cooperation with the communication department to maintain the issue on the agenda by constantly publishing articles and reports, and commenting on GE developments—or the lack thereof—through webzines, the university newspaper, etc., thus making vertical and horizontal segregation visible. The cooperation with the administrative personnel was smooth after the finalization of the restructuration of the university.

The aim of the bottom-up approach, targeting both internal and external stakeholders, was to reach out to, mobilize and support female researchers, in particular through organizing workshops tailored to the needs of the researchers and empowerment initiatives for younger female researchers. Efforts included establishing a GE resource center, raising awareness, supporting and advising formal/informal female and young researchers' networks and mentoring programs, training young researchers, promoting empirical research, etc. The involvement of the researchers in the activities was a challenge in the first implementation year. One explanation lies in the contextual factors and the common perception in Denmark that gender discrimination does not occur, thus structural biases are often overlooked or neglected. The other explanation is grounded in the blind trust in meritocracy and an aversion toward all types of affirmative actions in order to avoid stigmatization. Specific efforts to make vertical and horizontal segregation visible among researchers (such as university-wide workshops and seminars) were organized to address the lack of awareness about or denial of gender biases.

Simultaneously, a cross-cutting strategy was endorsed to bring together the top-down and bottom- up approaches, mutually reinforcing them to achieve greater implementation effectiveness. Central to this process has been the production of evidence-based policy inputs, communication and dissemination of information and data, raising of awareness about the issue, and adoption of a 'small steps' approach. The latter was done in order to successively achieve increased legitimacy and visibility, also by linking GE to more 'acknowledged' issues in the organization and the Danish society, for example, through framing GE interventions in relation to advances in innovation, internationalization and competitiveness. Another avenue to pursue has been to challenge the concept of excellence and the idea of the 'gender-blind' university, pointing out the limits to meritocracy and ways to address them. Moreover, as mentioned earlier, as a consequence of the dynamic restructuring of the entire organization, actions were redesigned, when needed, to incorporate emerging aspects and address them instantly to promote structural change. One such example was the active support provided by the core team to establish two new networks by female researchers, thus fulfilling a need for new structures to take over, replacing an old network dissolved in the first implementation year.

The overall aim of the strategy was to increase the internal and external pressure on the organization from the top, from above and from the outside, thus prompting a more systematized and structurally oriented line. The strategic objective of increasing the external pressure by rendering the university publicly accountable for the internal promotion of GE, represented an innovative attempt to influence and form developments in an otherwise closed hierarchical system. Table 3 is an illustration of the dynamic model for activating GE structural transformation in a complex organization which was effective at the Danish university.

The strategy pursued resulted in concrete sustainable structural changes in the organization, manifested in the subsequent strategic plan for GE at the university (see Kalpazidou Schmidt et al. 2015). The new strategic plan addressed the following:

- committing the four faculties to develop decentralized GE action plans and initiate systematic annual reports following up on the initiatives at centralized and decentralized levels;
- formulating research vacancies appealing to both male and female applicants;
- assessing the actual time for research (i.e. focusing on actual productivity relative to available time, rather than aggregate measures of past performance, accounting for maternity/paternity leave periods);
- developing broader assessment criteria and emphasizing the importance of focusing on future potential rather than past performance in recruitment guidelines;
- creating more transparent and clearly defined qualification criteria to avoid pre-selection of candidates for research positions;

- establishing career planning/counseling for younger researchers and allocating a supervisor for all postdocs/assistant professors to ensure integration in the local research environments;
- increased focus on the gender balance among recipients of university research grants;
- creating more attractive and gender-inclusive work environments via continuing professional development of all leaders in the organization, and including gender diversity management as an integrated part of the university's training of managers, research leaders and PhD coordinators;
- obtaining a more equal gender balance in decision-making bodies;
- achieving equal representation in assessment and appointment committees;
- establishing de-centralized diversity committees (at faculty and departmental levels);
- establishing a financial support program to cover additional expenses (i.e. family expenses) related to research stays abroad;
- ensuring ongoing monitoring and communication of key targets and statistics;
- evaluating developments at faculty and departmental levels; and
- evaluating the implementation and impact of the new GE action plan.

8. Strategic intervention areas of structural change actions

The outcomes of the tailor-made action plan[10] which were briefly reviewed above contributed[11] to setting out the most compelling intervention areas to address in order to achieve structural change in a complex organization. These intervention areas are described below in the framework of the implementation process at the Danish university (see Cacace et al. 2015).

Collecting data and monitoring developments has been crucial to describe and interpret gender balance, and arrangements and procedures in the organization, identify problems and formulate tailored interventions, but also to redefine them during the implementation process. Data have been key in disputing the inclination to underplay or deny the existence of gender inequality. Data have also been crucial in making the issue visible and setting it on the agenda, thus raising collective awareness. Moreover, data have been decisive for negotiating with the leadership to find solutions, pointing out the areas where the need for interventions was greatest. Data provided the reference point for measuring progress and setbacks, assessing policies and interventions as these developed. Finally, making data collection and policy assessment permanent by establishing monitoring and evaluation bodies and procedures, thus institutionalizing them, kept the issue on the agenda, underpinning structural and cultural change.

Engaging leadership at different hierarchical levels has been central to the implementation process. In this respect, strategic interventions to achieve structural change have comprised actions aligned to the emergent strategies and key policies of the organization, supporting internal initiatives but also adapting to create an inclusive environment. The tailored action plan provided a unique opportunity to incorporate gender issues into the very mission of the university. This was achieved by pointing out the relevance of GE for the multiple tasks the university is expected to manage (i.e. competition for funds and talent, societal engagement, economic development, etc.). Another efficient strategy has been the engagement of leaders at different levels directly in the actions as active players and the use of their unique positions, in particular in GE bodies and advisory boards. This implied negotiations about the potential role they could play in the transformation process. For example, the 'small steps' approach that was adopted to establish cooperation, starting by offering support and gaining credibility among the lower level leaders and gradually scaling up to the more central leadership, as central leadership was difficult to reach in the beginning due to the restructuration process. Finally, building partnerships with external bodies and institutions has increased the visibility and raised the profile of the team and the GE actions within the organization, thus opening new avenues and facilitating further engagement of the leadership in GE actions.

Change can become structural through the impact of an intervention on the strategic orientation of an organization. Thus, formulating new policy and strategy to pursue sustainability by promoting change in internal strategic documents and regulations, and in specific gender-relevant procedures, has been central to the intervention presented here. Due to the complexity of the issue and the limited implementation time, full institutionalization of the actions was not feasible. More complex arrangements involving further actors were required. For example, supporting the establishment of new internal bodies, such as new networks, and getting them institutionalized to ensure continuity for parts of the action plan, has been an effective strategy at the Danish university. Such bodies can capitalize on their own experience from the organization, launch new and revise existing actions, and mobilize additional key internal and external stakeholders.

Promoting and facilitating new networks or using existing ones have thus been powerful tools in the structural transformation process. Such bodies proved flexible as regards activities and membership, and could rapidly accommodate new demands and tasks. Two disciplinary networks were formed as a follow-up of the action plan, with varied aims and understandings of the women-in-science issue. They were more inclined to support the implementation of the action plan, promote new sustainable actions, or perform specific functions, such as mobilizing further agents and supporting career development of young female researchers. Involvement of these networks in the action plan has led to empowerment of women to take action in the planning of additional actions and negotiation activities. An important impact of networking has been the bridging of top-down and bottom-up approaches, supporting internal and external actors, thus creating new spaces for dialogue and negotiation within the organization and with external stakeholders to put pressure on the university.

Communication activities require a strategic approach, based on considerations of what messages to communicate, to which audiences, and by which means. Thus, the communication strategy adopted in this case has been tailor-made to the organization but also reflected the overall national context. Very early in the implementation process, the team realized that formulating attractive messages, important to the organization and the wider Danish audience, in a language appealing to the targeted actors, was of significance for the success of the action plan. An integrated and diversified communication plan, addressing different media and developing partnerships (e.g. with the communication department in the organization and other local and national media channels) has proved effective in supporting and maintaining GE as a pertinent issue on the organizational and political agenda. The communication plan required targeting of external stakeholders, since external communication and nation-wide visibility facilitated internal acknowledgement and secured smooth implementation of the activities.

Table 3. A dynamic implementation model for activating GE structural change in scientific organizations.

Top-down approach— targeting internal stakeholders	Top-down approach— targeting external stakeholders	Cross-cutting approach
• Mobilizing and committing the leadership • Mobilizing and committing internal stakeholders • Supporting and advising GE and Diversity Committees • Supporting and advising the HR department • Cooperating with the communication department • Making visible vertical and horizontal segregation • Training research leaders	• Mobilizing public opinion at national level (media, conferences, workshops, etc.) • Mobilizing external stakeholders, national agencies (communication and dissemination activities) • Mobilizing the political system (policy-makers at different levels)	• Integrating top-down and bottom-up approaches • Achieving legitimacy and visibility (locally, nationally) • Re-designing action plans to include new aspects of GE policy • Small steps approach linking GE to recognized issues • Linking GE to innovation, internationalization, competitiveness issues • Pan-national/pan-university awareness raising • Producing evidence-based policy input • Communicating and disseminating information (locally, nationally) • Challenging the idea of the 'gender-blind' science, pointing out the limits of meritocracy • Challenging the concept of excellence
Bottom-up approach— targeting internal stakeholders • Outreaching, mobilizing and supporting female researchers • Establishing, supporting and advising informal female networks • Organizing empowerment initiatives for young female researchers	Bottom-up approach— targeting external stakeholders • Promoting empirical research—evidence-based reports and theses on GE • Establishing a GE resource center open to all	

Developed from Kalpazidou Schmidt (2015).

9. Revisiting theory

The analysis presented here can be only understood as a work in progress, as it concerns an aspect of the promotion of GE in organizations which has so far received little attention in the scientific literature. In fact, while there are currently many documents and scientific papers dealing with how to promote GE in research organizations (prevalently in the form of recommendations, toolkits and guidelines),[12] research work focusing on the dynamics of change activated by gender-oriented initiatives are scarce.[13]

The effort made in this article has been that of documenting the presence of these dynamics in a very specific case, that is, the implementation of an action plan at a Danish university carried out under a European project.[14] Revisiting our theoretical framework based on this experience allows us to make three key observations.

The first observation concerns the cycle of the change process. We assumed and described this cycle as organized in four different phases, even though partially overlapping. In this view, the creation of the transformational agent precedes the activation of agency dynamics which, in turn, interacts with the structural conditions and leads to some structural outcomes. The experience of actual implementation confirms our initial understanding, positing that representing these phases as a linear process is misleading.

In the case of the action plan at the Danish university, the four phases kept on expanding throughout the project, becoming permanent components of the process. The development process of the transformational agent did not stop when agency dynamics started being activated, and neither did the activation process—on the contrary, this process was boosted when, interacting with structural circumstances, the first structural outcomes had emerged.

This explains why the process of change was everything except linear. For example, the interaction between agency dynamics and structural circumstances has, in many cases, radically modified the transformational capacity of the team. Similarly, some structural outcomes have contributed to opening new interactions between agency dynamics and structural circumstances. The interactions among these components contributed to making the process of change a process characterized by ups and downs or rapid advancements and sudden setbacks, which continuously challenged the team.

The second issue concerns the substance of the change process. Certainly, a vast array of elements came into play in the process of change, including ideas and views, passions and feelings, personal expectations, institutional procedures, organizational and other constraints, resources and funds. However, what kept all these elements together, providing a viable social space for managing them, were negotiation processes. The four components of the process of change were developed through negotiations. The construction of the transformational agent, for example can be understood as a never-ending negotiation process among team members, or among the team and other internal actors about, for instance, the situation of gender inequality in the organization, the actions to launch, the stakeholders to contact, the objectives to pursue, and so forth. Similarly, agency dynamics have been activated through negotiations between the team and other actors, and all structural outcomes have been the result of intense negotiation processes, involving both internal and—as we noted— external actors.

The practice of negotiation emerged from implementation as a continuous and multi-layered social process, which encompasses many dimensions (symbolic, interpretive, institutional, and operational) and assumes many shapes (including conflicts, informal conversations, formal statements, media communication, behavioral patterns, etc.). In this perspective, identifying the underlying negotiation basis appears to be a good entry point, both for managing the complexities involved in action plan design and implementation, and for better analyzing the process of change.

The third and final issue derives from observations carried out in the framework of the broader European project the Danish university participated in, which involved the implementation of action plans at different research institutions (Cacace et al. 2016). Even though a comparison of the different experiences is beyond the scope of the present article, it is important to note the differential relevance—in the different settings of implementation—of the theoretical components employed to appropriately address structural change for GE. It is easily understood, for instance, that the relevance of the three strategic areas (inclusive environment, gender-aware science and women's leadership) can be largely divergent in different countries, disciplinary areas, and types of research institutions. Likewise, change generally needs to be negotiated at different levels in different settings. In the case of the Danish university, many institutional structures, policies and services supporting GE were already in place, but what was missing was the awareness of the persistent existence of inequality and its strong effects on women's careers. Symbolic and interpretive negotiations were therefore mostly needed in this situation, as a prerequisite for the mobilization of internal and external stakeholders.

Finally, the possibility of setting up an efficient and authoritative transformational team greatly varies in different institutions, due to institutional, normative or resource-related issues, as well as due to prior existence of other internal or external groups endowed with agency for gender-related change. Each implementation process therefore presents a specific profile along the lines of different analytical perspectives that have been used. It is precisely this great variability in contextual conditions and dynamics that prevents—in accordance with the tenets of complexity theory—the direct and uniform application of action templates on the concrete reality of the research institutions, and requires the development of specific models, dynamically tailored to the processes and resistances activated during implementation. Implementation models thus represent a form of adaptation of general theoretical frames underpinning the design process, and are functional to action, as in the case of the dynamic model developed at the Danish university.

As experiences in the implementation of GE action plans in research institutions proliferate, in Europe, North America and globally, more and more empirical material becomes available, representing a wide variety of contextual situations. These experiences provide a fertile application ground for a comparative analysis of their basic components, dynamics and outcomes, thus making it possible to test the theoretical framework outlined in this article on a larger scale.

Conflict of interest statement. None declared.

Notes

1. For descriptions of the programs, see the following: Advance: see the Advance Program website, https://www.nsf.gov/ehr/Materials/ADVANCEBrochure.pdf Athena SWAN: see the Athena SWAN website, https://www.ecu.ac.uk/equality-charters/athena-swan/ EC: see p. 17 in the Horizon 2020 Work Programme 2018–2020, http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-swfs_en.pdf
2. See the PRAGES project.
3. In relation to the 'leaky pipeline' phenomenon, see Blickenstaff (2005), Jensen (2005), Etzkowitz and Gupta (2006), and Sonnert et al. (2007); in relation to access to resources for research and early-stage career development, see Ellemers et al. (2004); European Commission (2009); in relation to women's isolation from informal networks, see Gupta et al. (2005); in relation to work-life issues, see Zimmer (2003), DG for Research and Innovation (2003), Matysiak and Vignoli (2008), and Martin-Garcia (2009).
4. This includes stereotypes on women in science (see Thielen 2002, Faulkner 2007, Wajcman 2007, Rees 2012), the notion of science as a male endeavor (see Haraway 1991) and the inclusion of sex and gender variables in research and innovation (see European Commission 2013; Klinge and Wiesemann 2010; Ovseiko et al. 2016; Schiebinger 2008).
5. This comprises notions such as academic career paths (see Valian 1998; Schiebinger 1999; Naldi and Vannini Parenti 2002; Bordons et al. 2003; and Palomba 2006); access to management positions (see Callon et al. 1997; European Research Advisory Board 2007); access to positions related to scientific communication (see Bucchi 1998; Greco 2002; Bijker and d'Andrea 2009); access to positions related to the management of relationships with the society (see Bijker and d'Andrea 2009; Etzkowitz and Leydesdorff 2000; Ziman 2000).
6. The multidimensional model of power is developed with reference to Foucault (1991, 1998), Bourdieu (22, 1991), and Quaranta (1984).
7. Social constructionism's key tenet is that facts are created through social interactions and people's interpretations (Berger and Luckmann 1966). In this perspective, on the one hand, reality appears to people as an objective and external entity (i.e. a structure); on the other hand, people contribute to modifying it by their interpretations and actions (i.e. through their agency). How these two aspects—structure and agency—actually interact in the process of change has been and still is one of the key theoretical issues in sociology. Different solutions have been proposed, more or less connected to or compatible with social constructionism, such as Giddens' structuration theory (1976, 1984) or Archer's morphogenetic approach in the framework of critical realism (1995, 2003).
8. For a more detailed description of the concept of negotiation, see Mead (1934), Blumer (1969), Habermas (1987), Honneth (2002), Luhmann (2000), Berger and Luckmann (1966), Grobler (2007), and Swann (1987).
9. The negotiation theory adopted here has a mostly sociological character (see note above). Nonetheless, it encompasses many dimensions usually included in negotiation theories developed in the context of industrial relations, as well as in negotiation models elaborated in the business environment (for a synthesis, see De Moor and Weigand 2004). Among the most important elements, the following are pointed out in the literature: the significance of correct identification of the involved actors, their interests, expectations, and relative power (Bacharach and Lawler 1981); the weight of psychological dimensions of the negotiation process (e.g. Lax and Sebenius 1986); the importance to be attributed to the

different interpretations of the situation developed by each actor through a 'framing process' (Neale and Bazerman 1985); or the possibility to achieve win-win solutions for all the involved parties (Fisher and Ury 1981).

10. For a detailed description of the outcome of the action plan, see Kalpazidou Schmidt et al. (2015) and Nielsen et al. (2014).
11. The experience from all the action plans implemented under the STAGES project has been the basis to identify, verify and exemplify the most compelling intervention areas for structural change (see Cacace et al. 2015a)
12. See Genova et al. (2014), INTEGER Project (2015), Cacace et al. (2015), Bozzon et al. (2016), EGERA Project (2016), Fältholm et al. (2016), Salminen-Karlsson (2016), Declich and d'Andrea (2017), GenderTime Project (2017), and EIGE (2017).
13. An exception can be found in the approach of Benschop and Verloo (2011: 287), many aspects of which resonate with the framework presented here. The authors, acknowledging the urgency in developing strategies for GE in organizations, frame change as a 'socially accomplished, dynamic, and contextual process with many actors and interests at play' and propose a strategy with a political stand in relation to change. The scholars advocate for a participatory approach, involving all affected parties to mitigate resistance using short- and long-term agendas. Dialogue, negotiation to reach a common position, commitment, and alliances with other groups and experts, are key for an actual change to take place, as are visibility and voice of women in agenda-setting and decision-making.
14. See the STAGES project.

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