Evaluating transformative innovation policy instruments with the example of the Austrian program INNOVATORINNEN

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Abstract
This paper deals with the evaluation of transformative innovation policy (TIP) instruments using the case of the Austrian program for the advancement of women in applied research and innovation INNOVATORINNEN. To embed the empirical case, the paper traces the development of innovation policy and notably of Austrian instruments to promote female researchers and gender equality and their evaluations, and argues for the INNOVATORINNEN program as a case of a potentially transformative innovation policy. Using a deductive content analysis, the evaluation concept and practise of the INNOVATORINNEN program are analysed against the requirements of TIP-evaluations proclaimed in recent literature, notably with a view to evaluation strategy, the role of the evaluation, theory of change and methodology. Results suggest that there is high accordance between the program evaluation and TIP-evaluation requirements, in particular with a view to program learning and reflection as well as the evidence-based advancement of the program. The INNOVATORINNEN evaluation goes beyond the requirements for TIP-evaluations with a view to content-oriented co-creative processes with program participants and program owners. Notably, a triangle of knowledge exchange between evaluators, program owners and program participants is found, which benefits the ongoing development of the INNOVATORINNEN program. In contrast, some of the methodological details required in TIP-evaluations are not met in the INNOVATORINNEN evaluation. The paper concludes with an elaboration on the learnings of the evaluation process, which involves a high degree of openness, flexibility, eagerness to learn and respect for boundaries in all parties concerned.

1. Introduction

Innovation policy has seen a shift when it comes to the main targets of investment in research and innovation – an evolution that has been discussed in recent academic literature, amongst others by Weber and Rohracher (2012), Schot and Steinmüller (2018) or Joly and Matt (2022). Transformative innovation policy (TIP) is an emerging generation of innovation policies, reorienting public science funders' and innovation policy professionals' efforts for initiating or contributing to societal change (Ghosh et al., 2021). TIP becomes most evident when it comes to governmental responses to recent global policy agendas, such as the *Sustainable Development Goals* (SDGs), the *Paris Climate Agreement*, the European Union *Green Deal* and the 2020 World Economic Forum agenda on "Fixing inequality" (Ghosh et al., 2021). In the context of TIP, new requirements for the evaluation of policy instruments arise, as outlined e.g. in Molas-Gallart et al. (2020 and 2021) and Boni et al. (2019).

This paper focuses on the Austrian program for the advancement of women in research and innovation (R&I) "INNOVATORINNEN" by the Austrian *Ministry of Labour and Economy* (BMAW) and the *Austrian Research Promotion Agency* (FFG), and therefore on the sector of applied research close to industry. The paper argues that INNOVATORINNEN is a case of a potentially transformative innovation policy. Particular attention is given to the accompanying evaluation of the INNOVATORINNEN program, which is analysed in the face of the requirements of TIP-evaluations as proposed by Molas-Gallart et al. (2020 & 2021), Wise et al. (2022), TIPC (2019), Boni et al. (2019), and Ghosh et al. (2021).

The paper is structured as follows: Section 2 introduces the research question and methodological approach of the paper; section 3 explains the theoretical and empirical background, focusing on the development of innovation policy, its underlying understanding of innovation and its evaluation, as

well as on the development of innovation programs for advancing women in R&I in Austria. Section 4 focuses on the INNOVATORINNEN program as the empirical context of the paper and provides arguments for its characterisation as potential TIP-instrument. Moreover, it sheds light on the accompanying evaluation of the program. Section 5 contains the results of the analysis of the program's accompanying evaluation as TIP-evaluation. Section 6 provides a conclusion.

2. Research question and methodological approach

The research question pursued in this paper focuses on the ongoing and evolving evaluation practice for the INNOVATORINNEN program. It particular, it is of interest whether and how the different elements of this evaluation can be substantiated with theory on TIP-evaluations, and thereby potentially add to further develop existing theory.

For doing so, the development of policy instruments to promote women in research and innovation in Austria will be analysed against the *three frames* of innovation policy (Wise et al., 2022; TIPC, 2019; Schot et al., 2019). In particular, Schot et al. (2019)'s definition of TIP will serve to argue for the INNOVATORINNEN program – in contrast to its predecessor programs – to be an example of a TIP-instrument.

In the same line, the research design of the ongoing accompanying evaluation of the INNOVATORINNEN-program will be presented. Its analysis is based on a deductive content analysis, using the requirements of TIP evaluations by Wise et al. (2022) and others (see Table 1) as coding scheme.

3. Explanation of theoretical and empirical backgrounds

In the following, the theoretical and empirical backgrounds of the paper will be elaborated: The first sub-section focuses on recent developments in innovation policy, embedding the emergence of instruments for the promotion of female researchers in R&I in Austria in this development; the second sub-section deals with the evolvement of evaluation strategy in line with the development of innovation policy. The third sub-section focuses on major innovation policy instruments to promote women in R&I in Austria.

3.1 The way towards transformative innovation policy

In line with a changing understanding of innovation and its effects, innovation policy has changed throughout the past decades. This development has been shown in recent academic literature (e.g. Weber & Rohracher, 2012; Schot & Steinmüller, 2018, Joly & Matt, 2022) and can be summarised in three frames, which are outlined in the following based on Wise et al. (2022). Figure 1 provides an overview of the three frames of innovation policy, also pointing to the underlying notion of innovation and innovation policy for the advancement of women in R&I.

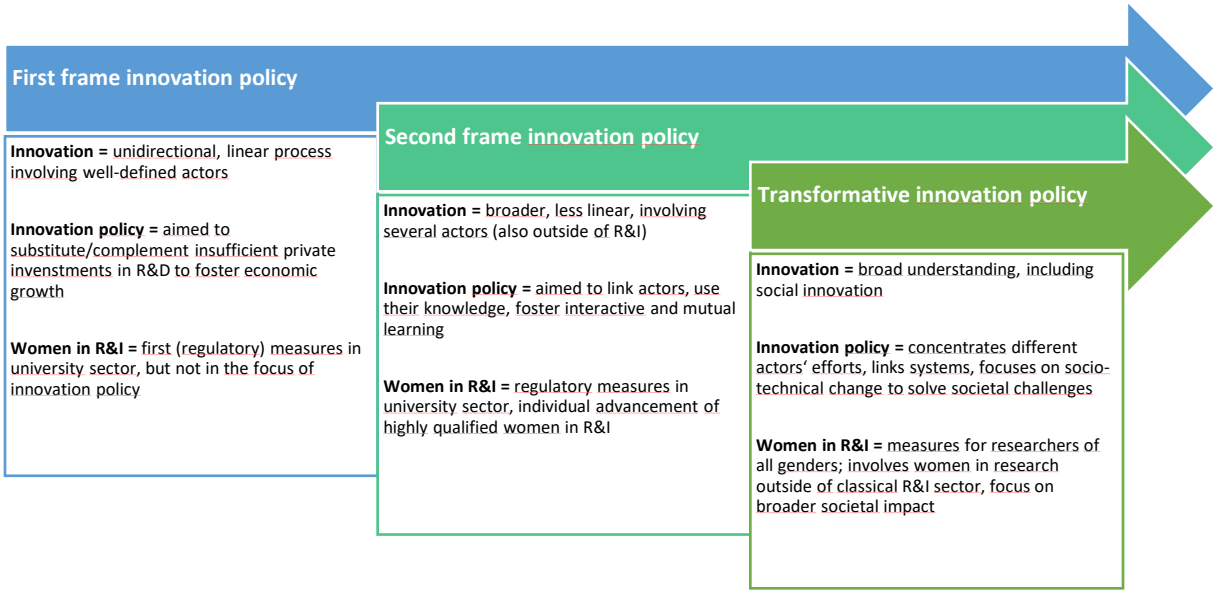

Figure 1 Overview of innovation policy frames. (Source: Own illustration, based on Wise et al. (2022), Carayannis & Campbell (2009, 2012), Schot et al. (2019) and Wroblewski & Schaller-Steidl (2023))

In the *first frame*, prevalent between the 1970s and 1980s, innovation was considered a unidirectional, linear process from development to commercialisation, involving well-defined actors from the R&I-sector (Carayannis & Campbell, 2012), and as means to foster economic growth. Accordingly, innovation policy was primarily aimed at solving the market failure of insufficient private investments into R&I. Policy instruments in use were aiming at stimulating knowledge generation, developing regulatory and educational policy as well as raising awareness of the importance of innovation and technological advancement (Wise et al., 2022). The first measures for advancing women in R&I in Austria appeared in the 1970s, even though promoting women was not in the primary focus of *first frame*-innovation policy; this is not (only) due to the notion of innovation at that time, but primarily to prevalent societal conditions and practices.

In the *second frame*, from the 1980s up until today, the understanding of innovation became broader and less linear – for example, Etzkowitz' & Leydesdorff's (1995) triple helix, the concept of open innovation (e.g. Chesbrough, 2003) and Carayannis & Campbell's (2009) quadruple helix suggested to involve actors outside the R&I sector, such as government, civil society and industry, into the innovation process. Accordingly, innovation policy has been based on the notion to better link and use the knowledge of different actors and to foster mutual learning. Policy instruments under this frame aim at stimulating and facilitating linkages and coordination between actors in order to foster interactive learning, knowledge utilisation, innovation and entrepreneurship, which, in turn, stimulate economic growth (Wise et al., 2022). In the run of this *second frame,* promotion programs for the advancement of women in science, research and innovation started to be established in Austria and Europe. Early programs in the 1990s primarily focused on regulations on equal opportunities in the university sector; in the early 2000s, policy measures in Austria were extended to women in applied and industrial research, mainly comprising the individual advancement of highly qualified women from the R&I sector (Wroblewski & Schaller-Steidl, 2023; details see in chapter 3.3 of this paper).

The *third frame* of innovation policy is currently emerging and summarised under the term of transformative innovation policy (TIP). TIP is based on an extended understanding of innovation, including social innovation. The notion of "transformation" implies a change of socio-technical systems in order to solve complex societal challenges, such as the climate crisis, growing inequality or a socio-economic health crisis in the aftermath of the COVID-19-pandemic (Schot & Steinmüller, 2018; Ghosh et al., 2021). Focusing on this transformation, TIP aims at concentrating different actors' efforts, coordinating with other policy sectors and fostering new connections between systems. Consequently, TIP instruments focus on missions, challenge competition or challenge-driven innovation programmes stimulating experimentation and co-production (Schot et al., 2019). Within this *third frame*, inequalities in different areas of life are addressed as societal challenge, thus equal opportunities in R&I can be considered a major concern in TIP. In recent years, the measures for the advancement of women partly were redesigned to address equal opportunities for "researchers of all genders in their early stages", while concrete objectives within these programs are supposed to assure the sufficient participation of women (Wroblewski & Schaller-Steidl, 2023). At the same time, programs such as INNOVATORINNEN – the empirical context of this paper – were introduced, aiming at promoting women in R&I based on an extended understanding of innovation, and at yielding broader societal impact (see chapter 4 of this paper).

3.2 Evaluating transformative innovation policy

With the broadening understanding of innovation and the development of innovation policy, the evaluation of policy instruments has been confronted with new requirements. While evaluation of innovation policies under the *first frame* was primarily focused on statistical measures of R&I inputs (e.g. funding sources, performers, personnel) and outputs (e.g. published articles, patents), the extended framing of innovation policy to system level (*second frame*) was accompanied by new evaluation approaches. In particular, survey methods and qualitative approaches were used to complement existing statistical approaches. The focus was shifted to new aspects of innovation, such as innovation capabilities or linkages between actors in the innovation process (Wise et al., 2022).

In the context of TIP, the requirement of new evaluation strategies is highlighted by several authors (e.g. Molas-Gallart et al., 2020 and 2021, Boni et al., 2019). Next to the traditional purposes of (formative and summative) evaluation – assessing efficiency, effectiveness and the relevance of policy programs (Peersman, 2015) – Boni et al. (2019), Schot et al. (2019), Ghosh et al. (2021) and Molas-Gallart et al. (2021) call for a new evaluation strategy that comprises monitoring transformative outcomes and "signs of change" (in the shape of changes in behaviour, emerging constellation or relationships or activities among people, groups and organisations, evolution of strategic aims), and informing the direction of the pursued systemic change process. In line with Molas-Gallart et al. (2021), the authors stress the integration of evaluation as strategic dimension of the given program with the aim to enhance reflexivity and learning.

According to Wise et al. (2022), TIP-evaluation is strongly rooted in sustainability transitions literature and multi-level perspective on socio-technical transitions. The Transformative Innovation Policy Consortium (TIPC, 2019) developed a "formative approach to TIP evaluation" that differs from traditional (formative, summative) and developmental (see e.g. Patton, 2016) evaluation in several respects. In particular, it stresses mixed methods, participatory approaches, and the integration of evaluation as a formative and strategic dimension of a program to support learning and to inform strategic choices over time. Data gathering and analysis involves participating actors and tries to comprise a variety of perspectives. The results are used as "food for thought" and guide the adjustment of the envisaged transformation path (Wise et al., 2022). Table 1 summarises the integrated characteristics of TIP evaluations.

Table 1 Characteristics of TIP evaluations (Source: Own illustration based on Patton (2006), Molas-Gallart et al. (2020 & 2021), Wise et al. (2022), TIPC (2019), Boni et al. (2019), Ghosh et al. (2021)

Evaluation strategy	• Monitoring transformative outcomes and signs of systemic change in real time (behavioural changes, emerging relationships/activities/constellation/interactions between actors, evolution of strategic aims) • Informing the direction of the change process
Role of evaluation	• Evaluation integrated as strategic dimension of the program to enhance reflexivity and learning • Informing strategic choices concerning the program over the time • Evaluation results used as "food for thought", guide the adjustment of the envisaged transformation path, help to refine the transformation process
Theory of change	• Flexible, revisited and refined throughout the evaluation process • Nested approach to assess multiple levels
Methodology	• Mixed methods • Participatory approaches in data gathering and analysis • Include a variety of perspectives

3.3 Development and evaluation of programmes to promote women in research and innovation in Austria

Austria looks back to a relatively long tradition of measures to promote the equality of women in research, science and innovation. First measures date back to the 1970s, the time that Wise et al. (2022) date the *first frame* of innovation policy (see chapter 3.1). However, it was not until the 1990s and thus far into the *second frame* of innovation policy that an entire set of instruments can be identified that, next to the promotion of women, aims at antidiscrimination and the establishment of women and gender studies as dedicated discipline. The bulk of these early policies was concentrated on the publicly financed university sector and facilitated the institutionalisation and professionalisation of equality approaches. Comparable efforts in the broader higher education sector (comprising universities of applied sciences (UAS), private universities and universities for teacher education) only followed in the past decade (Wroblewski & Schaller-Steidl, 2023).

The sector of applied research close to industry does not know any comparable regulations, but benefitted from programs that addressed female researchers' individual career cycles and the consideration of the gender dimension in research, which were launched as of the turn of the millennium (*second frame* of innovation policies). One prominent example is the program fFORTE, which was recommended by the *Austrian Council for Research and Technology Policy* (*Rat für Forschungs- und Technologiepolitik,* RFTE) in 2001. With this intersectoral program, the *Ministry of Education, Science and Research* (BMBWF) and the former *Ministry of Traffic, Innovation and Technology* (BMVIT) addressed female researchers' entire educational and career cycles; a set of structurally effective measures was realised in subsequent years under the umbrella of fFORTE, such as doctoral colleges at two Technical Universities or the scholarship program DOC-fFORTE of the *Austrian Academy of Sciences* (ÖAW). In 2005, the *Ministry of Labour and Economy* (BMAW) joined the initiative and financed measures under the program w-fFORTE (short for "economic impulses

from women in research and technology" [translation from German]). The program was focusing, amongst others, on the promotion of mixed teams for improving the quality of research and innovation (Dorr et al., 2020, Wroblewski & Schaller-Steidl, 2023) and explicitly addressing the aspect of economic growth which still used to be dominant in the prevalent notion of innovation of that time (see chapter 3.1).

Around at the same time as w-fFORTE, the program FEMtech was established by the former BMVIT (nowadays the *Ministry for climate protection*, BMK) under the umbrella of fFORTE. The aim of the project is to foster the embedment of the gender dimension in research contents as well as women's careers in technical and scientific areas. The program exists up until today in its three main elements: (1) FEMtech research projects (projects with a gender dimension in their research contents, mainly aimed at awareness raising), (2) FEMtech internships (for young female scientists to gain ground in applied research) and (3) FEMtech career (the programme supports organisations in employing more women in the fields of science and technology, e.g. via the FEMtech Career Check for SMEs; Grasenick et al., 2011).

In 2009, the impulse program "Laura Bassi Centres of Expertise" was established as a lighthouse project in the frame of the BMAW's w-fFORTE program. Its aim was to address the problem of female underrepresentation, particularly in those areas of research in which R&D expenditures use to be highest, as well as in top positions. The impulse program was embedded in the w-fFORTE program and served as one-time funding initiative. Its main objective was to "highlight excellent female research performance at the intersection between science and industry" (Heckl & Dörflinger, 2012). Participation was limited to women in classical areas of R&I.

In 2020, the program "w-fFORTE Innovatorinnen" was launched, aiming at supporting women in site-relevant R&I in a targeted way, and to render them visible. Highly qualified women were appealed and empowered to unfold their ideas, to build up their professional networks and to yield more creative freedom and professional development (Alber et al., 2021). The program is the predecessor of the INNOVATORINNEN program, the empirical focus in this paper (see chapter 4).

In line with Schot & Steinmüller (2018) and Wise et al. (2022), all of the above-mentioned policies in the area of applied research close to industry can be counted as *frame two*-innovation policies: They are or were based on the aim to seize different actors' knowledge, to link these actors and foster their mutual learning – also cross-sectionally. The ultimate aim of these policies has been to stimulate, support and highlight excellence, and to foster economic growth. All of these programs underwent evaluations in the past decade (Grasenick et al., 2011, Heckl & Dörflinger, 2014, Alber et al., 2021). It was constated throughout the evaluation studies that all the programs enjoyed an excellent reputation, both in Austria as well as internationally (ibid.). Methodologically, the evaluations comprised mixed-methods designs and participatory approaches. Most of them counted on different types of document analyses, (statistical) data analysis, case studies (e.g. of funded projects), quantitative (online) surveys with beneficiaries, qualitative interviews and/or focus groups/workshops, e.g. with experts and/or the owners of the program. In line with Patton (2016), the evaluations can be classified as developmental evaluations.

4. Empirical context: The INNOVATORINNEN program

The Austrian research promotion program specifically for female researchers, INNOVATORINNEN, initiated by the BMAW in cooperation with the *Austrian Research Promotion Agency* FFG in 2022, has emerged from its predecessor program w-fFORTE (2005-2021), in particular from the pilot program "w-fFORTE Innovatorinnen" (2020-2021) – see chapter 3.3 – and findings of its evaluation. It comprises (1) a so called "leadership program", (2) an alumnae network and (3) the "INNOVATORINNEN Club". The program specifically addresses female researchers, innovators, R&I

entrepreneurs and practitioners, regardless of their discipline, affiliation or career level, to apply by presenting their individual missions related to R&I with an arguably strong pathway towards societal impact. When entering the "leadership program", successful applicants are supported throughout a period of 10 months with a focus on activities for personal empowerment and acquiring new innovation and cooperation competences. The ultimate aim for the participants is to become clear about their individual missions, to make first systematic progress in exchange with the peer group, mentors, future users and experts and to communicate their ideas to others.

For the first round of the leadership program starting out in February 2022, 18 participants could be selected and started into their "learning and leadership journey" as a mixed peer group: Successful candidates came from seven (out of nine) Austrian states (*Bundesländer*); 39 % were affiliated to private companies, start-ups or were in the process of founding their own enterprises. Around one third of the participants came from non-university research institutions, another third from universities. Moreover, the group was characterised by different professional phases and different age groups (in a range between 25 and 55 years), whereby a majority of 56 % ranges between age 25 and 34. With a view to disciplines, classical topics of applied research were represented, such as wood technology, biomedical analytics, micromechanics, material sciences and digitalisation, but also missions in the area of development cooperation, humanitarian aid or theatre & digitalisation.

While the leadership program and the alumnae network (providing network activities for former participants of the leadership program) have been well defined at the onset of the program in 2022, the INNOVATORINNEN Club is still in development and fed by findings from the evaluation underway. In its current state, it is open for all female researchers and innovators and offers networking events and trainings.

Already the pilot program w-fFORTE Innovatorinnen has reached international recognition: It was cited as one out 15 best practice examples in a study by the German *Stifterverband für die Deutsche Wissenschaft* as format that fosters "competences for openness and a culture of enabling" (Leimüller et al., 2021). The study illustrates measures in the program that aim at strategic opening of science and innovation, as well as drivers for economic, scientific and societal impacts.

4.1 INNOVATORINNEN as TIP-instrument

With all its components, the INNOVATORINNEN program can be considered an example of transformative innovation policy: Within the FFG, the program is situated in the strategy department (much rather than in the classical funding administration) which experiments with new formats and target group-specific offerings. The aim of the FFG strategy department is to systematically collect learning experiences for taking up new roles as funding agency with a view to the implementation of transformative innovation policy instruments. In the area of non-monetary support, the program INNOVATORINNEN tries to strengthen the impact of R&I for the grand societal challenges and SDGs in a target group-oriented way and with novel networking formats and systemic innovation processes.

With a view to its target groups, INNOVOATORINNEN aims at supporting women in their role as shapers and designers of applied science close to industry, and enhancing their visibility. In contrast to more traditional programs for the promotion of women in science, INNOVATORINNEN explicitly takes an interdisciplinary and intersectional approach. It acknowledges that scientific careers are increasingly non-linear and often do not follow the "typical" academic path. The creation of new knowledge, developments and products increasingly happens at the intersections of the research and innovation system. Many important impulses for tackling the grand challenges and working towards the SDGs come from areas that are not traditionally rooted within the academic sector. The INNOVATORINNEN program acknowledges this aspect by also addressing highly qualified women

from non-academic sectors, such as education, creative industry or the social sector, and by demanding a sound illustration of the societal relevance and impact of the proposed missions (Régent et al., 2023a).

As outlined above, Schot et al. (2019) define emerging TIP as characterised by instruments that aim at fostering new connections between systems, providing spaces for experimentation, and co-creating solutions for broader socio-technical system change. These characteristics can be found in the INNOVATORINNEN program: The continuing underrepresentation of women in leading roles in science and innovation is an ongoing societal problem that disadvantages a major proportion of the population (e.g. Wroblewski, 2022, Greussing et al., 2016, OECD, 2016, Klapfer & Moser, 2022, Wisenöcker et al., 2021) and holds far reaching consequences for society at large: Recent studies suggest that, when female scientists have freedom of shaping research, contents of and approaches to research topics change, as was illustrated in the frame of the program Laura Bassi Centres of Expertise and the w-fFORTE Innovatorinnen program (see both in chapter 3.3; Wroblewski & Schaller-Steidl, 2023). In particular, if women had more decisive power, they would more strongly pursue research projects to solve social and ecological problems and work towards changing work conditions and collaborative practices (Régent & Ecker, 2022).

Next to its inclusive approach calling for female researchers across sectors and disciplines, there are further particularities of the INNOVATORINNEN program that distinguish it from previous instruments for advancing women in R&I. One aspect is the strong focus on the impact of the participants' research missions, this in a twofold manner:
Firstly, candidates are asked to pursue missions with a demonstrated societal or ecological impact, and to elaborate on the pathway to reach it. The aspect of the impact is a key criterion for candidates to be selected into the program, and remains a core focus throughout the duration of the leadership program. Thus, much rather than focusing on aspects such as the gender dimension or the excellence of the research, as it was the case in the previous programs (see section 3.3), the broader societal impact is in the front. Through the program's thematic and disciplinary openness, solutions for broader societal problems of any kind are envisaged. As it was found in a survey in the frame of the evaluation, most respondents were aiming at impacts in the area of health and wellbeing (SDG 3), measures for climate protection (SDG 13) and sustainable consumption and communities (SDG 12).
Secondly, INNOVATORINNEN focuses on the impact on the researcher on the personal level. The question "what does the participation in the program evoke in the researcher" is fundamental to the program and taken up at several instances throughout the leadership program in the frame of the accompanying evaluation. Results are fed back into the further development of the program, which is an ongoing endeavour. With the focus on the impact on personal level, the INNOVATORINNEN program joins a set of new strands of impact measurement as pursued in particular under the umbrella of "open innovation in science" (Beck et al., 2022) and in newly established practices by research funding institutions such as the Danish *Novo Nordisk Foundation* (Régent et al., 2023b).

The aspect of open innovation is also inherent in other elements of the program, in particular by involving actors from different sectors relevant to the innovation system and/or to the participants' individual missions. Throughout the leadership program, participants are given the opportunity to exchange on their ideas with different actors (e.g. from science, civil society, state actors, industry) in the frame of specifically designed co-creation and experimentation workshops, and they are given tasks to reach out to relevant actors individually and discuss their ideas with them.

Finally, INNOVATORINNEN considers itself a learning program (Régent et al., 2023a). It is constantly informed by its accompanying evaluation, particularly with a view to the personal development of the leadership program participants (on an aggregated level) as well as the design of the INNOVATORINNEN Club. More details on the evaluation of the program can be found in the section below.

4.2 Evaluation of the INNOVATORINNEN program

The author of this paper is part of the research team that has been commissioned with the accompanying evaluation of the program INNOVATORINNEN. The evaluation was started in May 2022 und continues through December 2023. This way, two entire cycles of the leadership program can be accompanied. The evaluation study is built on two modules focusing on the leadership program with their alumnae networks, and on the INNOVATORINNEN Club. Details on the respective research questions and methodological steps can be seen in Table 2.

Table 2 Evaluation of the INNOVATORINNEN program (Source: Own illustration)

Module	**1: Accompanying research on the leadership program cycles 2022 and 2023**	**2: Research for the INNOVATORINNEN Club**
Research questions	- What are the participants' characteristics (in terms of age, discipline, affiliation, missions, intended impacts, role in projects, care responsibilities, etc.)? - How suitable and effective do participants consider the program? (e.g. with a view to changes in their own self-perception, confidence and working style, personal progress towards empowerment and their individual mission, experience with peer group, etc.) - Which effects are reported by program alumnae and how does the network among them evolve?	- What are the characteristics of the INNOVATORINNEN Club-target group? - What do female researchers' life and work realities look like? - How strongly are women involved in the development of new projects and cooperation? - Which support can the INNOVATORINNEN Club provide women? - What would women change in R&I (structures and processes, research topics, target groups, etc.) if they had full decisive power?
Methodological steps	- Quantitative surveys among all participants of the first and second cycle of the leadership program (2022 and 2023) - Qualitative interviews with selected participants of the first and second cycle of the leadership program with the aim to gain profound knowledge on participants personal stories linked to their participation in the program - Open participative observation of selected program elements - Participation of evaluators in co-creation workshops, co-productive sessions together with program participants, the owners of the program, and other external stakeholders with a focus on participants' missions - Focus groups with program owners, selected participants and alumnae with a focus on program characteristics and learning points for the program	- Quantitative survey among former female beneficiaries of FFG-funding (n = 277) - Quantitative survey among female researchers interested in the INNOVATORINNEN Club - Profound reflection on the underrepresentation of women in R&I and the role of the INNOVATORINNEN program between the program owners and the evaluators, resulting in a published book chapter - Reflexion workshop with program owners and external stakeholders - Qualitative interviews and focus groups with selected users of INNOVATORINNEN Club-offerings

At the time of submission of this paper, one Module 1- and one Module 2-survey, one participant observation, one co-creation workshop, one reflection workshop with the owners of the program and an external expert, as well as the interview series with candidates of the first cycle of the leadership program have been accomplished, and the reflection between program owners and evaluators resulting in a co-authored book chapter that is going to be published in June 2023.

5. Does the INNOVATORINNEN evaluation qualify as TIP-evaluation?

The paper at hand pursues the research question in how far the evaluation of the INNOVATORINNEN program is in line with requirements/elements of TIP-evaluations as presented in Table 1. Table 3 summarises the results of the deductive content analysis of the conceptualised and documented evaluation process.

Table 3 TIP-evaluation elements in the evaluation of the INNOVATORINNEN program

Aspect	Elements of TIP-evaluations	INNOVATORINNEN evaluation
Evaluation strategy	Monitoring transformative outcomes and signs of systemic change in real time (behavioural changes, emerging relationships/activities/constellation/interactions between actors, evolution of strategic aims) Informing the direction of the change process	Evaluation as strategic dimension of the program. Monitoring "signs of change" through surveys and interviews with participants, participative observation at several instances. Informing change process through co-creation workshops with focus on participants' missions; workshops and co-authored publications with program owners.
Role of evaluation	Evaluation integrated as strategic dimension of the program to enhance reflexivity and learning Informing strategic choices concerning the program over the time Evaluation results used as "food for thought", guide the adjustment of the envisaged transformation path, help to refine the transformation process	(Interim) results are regularly reported and considered 1) throughout the leadership program, 2) from one cycle of the leadership program to another, 3) for developing the INNOVATORINNEN Club. Evaluation is considered a strategic dimension of the program with a view to 1) program development, and 2) contribution to the participants' missions (co-creation).
Theory of change	Flexible, revisited and refined throughout the evaluation process Nested approach to assess multiple levels	Evaluation concept is adjusted to the program needs in real time: 1) Data gathering instruments are created in close collaboration with program owners, 2) in module 2, methodological steps are used flexibly, depending on the developing state of the INNOVATORINNEN Club.
Methodology	Mixed methods Participatory approaches in data gathering and analysis Include a variety of perspectives	Mixed methods and participatory approaches in data gathering and dissemination. No participatory approaches in data analysis. External stakeholders' view is not considered.

5.1 Evaluation strategy

The program owners explicitly consider INNOVATORINNEN a "learning program" based on controlled trial and testing (Alber et al., 2021). Already the creation of the INNOVATORINNEN program as such was inspired and co-determined by evaluation results of its predecessor program (ibid.). Thus, the program is conceptualised in a way to assure regular feedback of (interim) results to the program owners with the aim to inform the program's further development. For doing so, workshops between the evaluators and the program owners are held on a regular basis in order to inform the latter about the latest results and discuss their implementation into the further run of the ongoing program, which is developing in real time based on evaluation results. These refer, on the one hand, to participants' views on the leadership program – their behavioural and interactional changes are monitored in the evaluation (Module 1) through regular surveys, interviews and open participative observation; on the other hand, the wider perspective of women in R&I, their life and work realities and potential obstacles to leadership in R&I are considered (Module 2). The results of both modules are used to further develop the leadership program and to develop the INNOVATORINNEN Club.

The INNOVATORINNEN evaluation also appears in line with TIP-evaluations with a view to informing the direction of the change process. Here, particularly two elements stand out:
Firstly, the evaluators are involved co-creation workshops for the leadership program participants. On the one hand, these workshops serve as data gathering opportunity in shape of an open participative observation. On the other hand, the evaluators appear to the participants in the role of external stakeholders/experts – next to other external experts – for discussing and developing further ideas on the continuation of their individual missions. This way, the evaluators' expertise as social and economic scientists and, more importantly in this context, their gathered knowledge in the run of the ongoing evaluation, are used in a co-creative setting to further develop the participants' missions.
Secondly, the evaluators entertain reflexive processes together with the program owners on the general problem of female underrepresentation in R&I close to industry (particularly in top positions). One result of these processes was a co-authored book chapter published in June 2023. This way, the gathered knowledge throughout this evaluation contributes to shaping the public (academic) discourse on the topic.
Both of these aspects – co-creating ideas with program participants and co-authoring publications with program owners – can be considered rare elements in evaluations. They underline the collaboration at eye level between program owners, program participants and evaluators, and can therefore be highlighted as evaluation approaches of a new, disruptive style.

5.2 Role of the evaluation

As outlined in sub-section 5.1, the evaluation plays a significant and strategic role in the program. Module 1 regularly gathers data from the participants in shape of surveys, interviews and observations. The results are reported to the program owners who primarily use them as information source to develop the subsequent cycle of the leadership program. Partly, adjustments within the same cycle of the leadership program are possible.

An even more decisive role of the evaluation can be seen in the development of the INNOVATORINNEN Club (Module 2) – apart from an initial anchor concept, the program owners flexibly design and adapt the major components of the Club in line with the evaluation results. So far, particular importance was given to the survey with close to 300 female researchers all over Austria (the sample was drawn from women who had received FFG-funding in a shaping or leading role in the past 10 years) which aimed at eliciting their needs with a view to a supportive network under the umbrella of the INNOVATORINNEN Club. In autumn 2022, the Club started with its first events and

offerings. The evaluation foresees another survey to track participants' satisfaction and elicit further ideas for the Club. Further methodological steps will be taken as the Club evolves, see section 5.3.

In total, the strategic role of the evaluation in the program can be seen a twofold manner: On the one hand, the evaluation is an essential element for evidence-based program development; on the other hand, the evaluation also gives "food for thought" for the participants' missions in the frame of the co-creative workshop settings (see 5.1).

5.3 Theory of change

As it was already mentioned in the previous sub-sections, the evaluation concept is handled in a flexible way. There is an anchor concept that was developed by the evaluators at the onset of the evaluation, identifying the data that needs to be gathered, and how it should be analysed (see Table 2). The data gathering instruments were developed in close collaboration with the program owners. Some methodological steps, such as the evaluators' participation in co-creation workshops, were introduced while the evaluation was ongoing, the reason being that it was considered useful to benefit program beneficiaries from knowledge gathered through the ongoing evaluation process.

Particular flexibility is given with a view to Module 2 of this evaluation: Since the INNOVATORINNEN Club is emerging as the evaluation is evolving, the methodological steps of the concluding work package will be defined based on the results of the second survey, and thus will depend on the further development of the Club. Hence, it can be stated that there is a mutual dependence between the Club and the evaluation, in the sense that the former is based upon evaluation results, and the latter adapts its methodology to the needed knowledge gains for the Club.

5.4 Evaluation methodology

The evaluation is based on a mixed methods research design (see Table 2) and on participatory approaches in data gathering and, as outlined in section 5.1, in the dissemination of results. However, in contrast to the methodological elements of TIP-evaluations (see Table 1), data analysis is done in an utterly non-participatory manner by the evaluators.

Moreover, limitations can be constated with a view to the inclusion of a variety of perspectives. While program owners', participants' and female researchers' views on a broader scale are included, further external stakeholders, such as representatives of the innovation system, are not considered in this evaluation.

6. Conclusions and learnings

This paper deals with the Austrian program for the advancement of female researchers INNOVATORINNEN. The paper argues that INNOVATORINNEN is an example of a potentially transformative innovation policy. It differs from previous related programs in several respects which are elaborated on throughout the paper. In particular, it is not limited to yielding female innovation for fostering economic growth or scientific excellence; much rather, it aims at female researchers of all career stages, disciplines and sectors and is meant to empower them to take leading and shaping roles in research and foster their visibility. Its ultimate aim is to achieve impact for female researchers on the personal level, as well as societal impact emerging from the participants' missions.

The main purpose of this paper was to fathom whether the accompanying evaluation of the INNOVATORINNEN program qualifies as TIP-evaluation. A deductive content analysis has shown that

several requirements of TIP-evaluations (see Table 2) can be found in the accompanying evaluation of the INNOVATORINNEN program: Evaluators and commissioners act as equal partners in a collaboration that is clearly focused on the content-related development of the program, which is strongly responsive to evaluation results underway. Notably, INNOVATORINNEN can be considered an example of a "learning program" based on controlled trial and testing (Alber et al., 2021). The evaluation process is characterised by mutual learning and knowledge transfer in both directions, which does not only provide a basis for informing and refining the development of the program, but also for shaping the discourse of empowerment and visibility of female researchers and innovators from an intersectional perspective.
Comparing the INNOVATORINNEN-evaluation with TIP-evaluations, two essential elements go beyond the requirements: (1) the evaluators' participation in co-creation workshops with program participants, aiming at benefitting participants' missions from knowledge generated in the run of the accompanying evaluation; and (2) reflection processes between evaluators and program owners with the aim, amongst others, to shape the public discourse on the topic of advancing female researchers. Both elements underline the collaboration at eye level and mutual learning between evaluators, program owners and participants, building up a knowledge-triangle which ultimately enriches the further development of the program and contributes to its objectives. In contrast, two methodological elements of TIP-requirements are not met in the accompanying INNOVATORINNEN-evaluation, which are a participatory approach to data analysis and the involvement of a wider range of external stakeholders' perspectives, such as representatives of the Austrian innovation system. Nevertheless, high accordance between the ongoing evaluation practice of the INNOVATORINNEN program and the required elements of TIP-evaluations as proposed by Wise et al. (2022) and others can be constated.

With a view to challenges and learnings, it must be stated that, in contrast to "regular" evaluations, the accompanying INNOVATORINNEN-evaluation demands high flexibility in both evaluators and program owners, but also in program participants: Being the methodological experts and in the role of independent external knowledge gatherers, the evaluators must be ready for constant shifts from the original methodological concept and must flexibly assess and implement evaluation requirements raised by the program owners. These, in turn, have to show the same amount of flexibility with a view to their program design, as well as acceptance for an open-ended evaluation process. In addition, they need, at least to some extent, to engage with the methodological steps of the evaluation – an area that is not necessarily subject to their work –, while respecting the independent nature of the evaluation. Finally, the quality of the evaluation is in large parts dependent on program participants' openness and flexibility with regards to their engagement with the evaluation and the evaluators. In total, both the evaluators and the program owners are required to create and maintain an atmosphere of trust and mutual respect throughout the entire duration of the evaluation that goes far beyond what is required in "regular" or more traditional evaluations.

This paper reports about work in progress and comes with a set of limitations. Firstly, in the current state of the research, the development of programs for advancing female researchers in R&I is limited to an Austrian perspective only; the international dimension is not considered at the moment of submission of this paper. Secondly, particularly due to the qualitative nature of the analysis, it must be stressed that the author of this paper is part of the evaluation team, thus the conducted analysis must be seen as an analysis of the author's own work. This implies, on the one hand, that much tacit knowledge concerning the evaluation was flowing into the analysis, but, on the hand, an external and more distant perspective could not be provided for. Finally, this case study-based research is not embedded into a broader empirical analysis of TIP-evaluations. Further empirical research is needed to collect different examples and practices, and thereby extending and substantiating the theoretical and empirical backbone of TIP-evaluations.

References

Alber, C., Dusl, L., Ecker, B., Pohoryles-Drexl, S. (2021). Erfahrungen und Ergebnisse aus der begleitenden Erhebung zum Pilot w-fFORTE Innovatorinnen. URL: https://repository.fteval.at/570/1/w-fFORTE%20Innovatorinnen_Erfahrungen_Pilot_BMDW_FFG_WPZResearch.pdf

Boni, A., Giachi, S., and Molas-Gallart, J. (2019). Towards a Framework for Transformative Innovation Policy Evaluation. Transformative Innovation Policy Consortium (TIPC) Research Report (April 2019)

Carayannis, E. G., Campbell, D. F. J. (2009) ''Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem', Int. J. Technology Management, Vol. 46, Nos. 3/4, pp.201–234.

Carayannis, E. G., Campbell, D. F. J. (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. J. Innov. Entrep. 2012, 1, 2.

Chataway, J., Daniels, C., Kanger, L., Schot, J., and Steinmueller, E. (2017). 'Developing and Enacting Transformative Innovation Policy'. Paper presented at the 8th International Sustainability Transitions Conference, Gothenburg, Sweden, 18–21 June.

Chesbrough, H. (2003). Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business Press)

Dorr, A., Heckl, E., Kaufmann, J. (2020). Evaluierung des Förderschwerpunkts Talente. Endbericht. URL: https://repository.fteval.at/id/eprint/549/1/KMU_Evaluierung_Talente_2020_Endbericht_BF.pdf

Etzkowitz, H., & Leydesdorff, L. (1995). The Triple Helix—University-Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development.

Ghosh B., Kivimaa P., Ramirez M., Schot J., Torrens J. (2021) 'Transformative Outcomes: Assessing and Reorienting Experimentation with Transformative Innovation Policy', Science and Public Policy, 48: 739–18.

Grasenick, K., Kupsa, S., Warthun, N. (2011). Evaluierung des Programms FEMtech. Endbericht. URL: https://repository.fteval.at/id/eprint/166/1/2011_Evaluierung%20des%20Programmes%20FEMtech.pdf

Greussing, E., Schott, M. (2016). Austrian University Female Founders Report 2016. WU Wien, URL: https://www.wu.ac.at/fileadmin/wu/d/cc/gruenden/Report_Female_Founders_16.pdf

Heckl, E., Dörflinger, A. (2014). Begleitende Evaluierung der Impulsaktion „Laura Bassi Centres of Expertise". Endbericht. URL: https://repository.fteval.at/id/eprint/87/1/Begleitende%20Evaluierung%20der%20Impulsaktion%20Laura%20Bassi%20Centres%20of%20Expertise_Endbericht.pdfJoly, P.B., Matt, M. (2022). Towards a new generation of Research Impact Assessment approaches. Journal of Technology Transfer, 2022, 47 (3), pp.621-631. ⟨10.1007/s10961-017-9601-0⟩. ⟨hal-01784894⟩

Klapfer, K., Moser, C. (2022). Arbeitsmarktstatistiken. Ergebnisse der Mikrozensus-Arbeitskräfte-Erhebung und der Offene-Stellen-Erhebung. URL: https://www.statistik.at/fileadmin/publications/Mikrozensus-Arbeitsmarkt-2021.pdf

Molas-Gallart, J., Boni, A., Schot, J., and Giachi, S. (2020). A Formative Approach to the Evaluation of Transformative Innovation Policy. Transformative Innovation Policy Consortium (TIPC) Research Report (July 2020).

Molas-Gallart, J., Boni, A., Giachi, S., and Schot, J. (2021) A Formative Approach to the Evaluation of Transformative Innovation Policies, Research Evaluation, 2021: 1–12.

OECD. (2016). Kurzdossier zum weiblichen Unternehmertum. URL: https://www.oecd.org/cfe/leed/Policy%20Brief%20on%20Women%27s%20Entrepreneurship%2DE.pdf

Patton, M. Q. (2006) 'Evaluation for the Way We Work', Nonprofit Quarterly, 13: 28–33.

Peersman, G. (2015). Impact evaluation, in: https://www.betterevaluation.org/themes/impact_evaluation

Régent, V., Ecker, B. (2022). Survey for the preparation of the INNOVATORINNEN Club. (Unpublished)

Régent, V., Alber, C., Ecker, B., Pohoryles-Drexel, S. (2023a). Erfahrungen und Ergebnisse aus der begleitenden Erhebung des Programms INNOVATORINNEN, in: Wroblewski et al. (Hg.). Von der Geschlechterpolitik zur diversitätsorientierten Gleichstellungspolitik. Wien (forthcoming)

Régent, V., Ecker, B., Sardadvar, S., Wagner, V., Grund, M., van Scherpenberg, C. (2023b). Evaluierung des LBG OIS Centers und des LBG Career Centers. Studie im Auftrag der Ludwig Boltzmann Gesellschaft und des Bundesministeriums für Bildung, Wissenschaft und Forschung.

Schot, J., Boni, A., Ramirez, M., and Alvial-Palavicino, C. (2019). 'Transformative innovation policy and social innovation'. In: Howaldt, J., Kaletka, C., Schröder, A., and Zirngiebl, M. (eds.) Atlas of Social Innovation, ii: A World of New Practices. Munich: oekom Verlag.

Schot, J., Steinmueller, W. E. (2018) 'Three Frames for Innovation Policy: R&D, Systems of Innovation and Transformative Change', Research Policy, 47: 1554–67.

TIPC (Transformative Innovation Policy Consortium) (2019). Guide to: Three Frames of Innovation. http://www.tipconsortium.net/resource/guide-tothree-frames-of-innovation

Weber, K. M. and Rohracher, H. (2012) 'Legitimizing Research, Technology and Innovation Policies for Transformative Change: Combining Insights from Innovation Systems and Multi-Level Perspective in a Comprehensive 'Failures' Framework', Research Policy, 41: 1037–47

Wise, E., Eklund, M., Smith, M., Wilson, J. (2022). A participatory approach to tracking system transformation in clusters and innovation ecosystems – Evolving practice in Sweden's Vinnväxt programme, in: Research Evaluation, 31(2), 2022, 271-287. https://doi.org/10.1093/reseval/rvac006

Wisenöcker, A., Resl, B., Szentgyorgyi, R., Borchardt, K., Seidl, A., Fitzgerald, A. (2021). Frauen in der Medizin 2021. Frauen in Führungs- und Entscheidungspositionen in der Medizin. Was fördert und was hindert die Karriereentwicklung? Karl Landsteiner Institut für Human Factors & Human Resources im Gesundheitswesen. URL: https://www.kli-hr.at/wp-content/uploads/2022/03/Frauen-in-der-Medizin-2021_%C2%A9-KLI-1.pdf

Wroblewski, A. (2022). Leitfaden zur Entwicklung von Gleichstellungsplänen in österreichischen Hochschul- und Forschungseinrichtungen. Studie im Auftrag des Bundesministeriums für Bildung, Wissenschaft und Forschung und des Bundesministeriums für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie.

Wroblewski, A., Schaller-Steidl, R. (2023). Kulturwandel. in: Wroblewski et al. (Hg.). Von der Geschlechterpolitik zur diversitätsorientierten Gleichstellungspolitik. Wien (forthcoming)