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# Gender Equality and Its Significance for Scientific Research and Innovation Organisations: A Case Study

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## Abstract

It is partly thanks to the European Commission and the ERA Strategy for Gender Equality that the path to gender equality has been facilitated, and that European research organisations have been encouraged to implement Gender Equality Plans (GEPs). The Italian Institute of Technology (IIT) is an exceptional example of the implementation of gender equality and gender mainstreaming in an Italian organisation dedicated to promoting quality in innovation and knowledge transfer in the STEM fields, where excellence is one of the fundamental elements and researchers from over 70 different nationalities work. This article aims to analyse the first experiences of the IIT in the field of gender equality, diversity, and inclusion. Using concrete examples and the secondary data collection method, we analysed the initial results and outcomes of the implementation of a GEP at the institutional level, taking into account persistent challenges and resistance. According to the findings presented here, gender gaps can still be observed, for example, in patent protection, start-up creation, publication rates, and other areas. Its innovative character lies in the fact that it presents an analysis within a research institute that is not an academic institution and has no previous background or experience in gender policy. We will conclude and present further actions to improve and strengthen the impact of this GEP at a cultural and institutional level.

## Keywords

equality, diversity and inclusion; gender equality; gender mainstreaming; Istituto Italiano di Tecnologia; research organisations

## 1. Introduction

In December 2023, the Italian Institute of Technology (IIT) hosted a nationwide research and support staff gathering at one of the venues for a comprehensive discussion on the initial progress made in implementing the IIT's Gender Equality Plan (GEP). The event, which took place in Milan, Italy, attracted a significant number of participants, both in person and virtually, and was themed "advancing equality in research." This was an important opportunity to present the results of the GEP's first actions in a statistical and qualitative framework. The generous time allotted for discussion provided ample opportunity for participants to comment and contribute to the analysis of the status of the IIT's GEP to date. Other events took place, but the meeting in Milan prompted the GEP team—together with the recently created Diversity, Inclusion and Social Impact Division—to an internal reflection. This was about how to improve a supportive and inclusive culture in the IIT, an institution where scientific excellence, including in research, is indeed the only evaluation criterion (as intended by the European Research Area and the European Research Council; see König & Mohammadi, 2024).

In relation to equality, diversity, and inclusion (EDI) and GEPs, it should be noted that the IIT is not a university and does not share the history of Italian academic institutions, with their tradition of equality committees later to be transformed into Single Guarantee Committees (CUGs)—which are mandatory under Italian law. The IIT is located in a country where gender studies have not yet found institutional anchorage (Vertova & Vincenti, 2025) and dedicated university departments are still absent or rare (Botto et al., 2022; Nocenzi & Crespi, 2025). The lack of gender budgets, positive action plans (Galizzi & Siboni, 2016), and expertise on gender and EDI, render experiences of institutes such as the IIT extremely valuable for their uniqueness (Dahmen-Adkins & Peterson, 2021; Leone et al., 2025). Thus, these experiences could be considered more interesting for a sociological analysis, at least in the Italian panorama (Robbiano, 2022).

As a relatively young and rapidly developing institution—with a strong focus on STEM technologies and subjects—GEPs were a completely new concept when they were first brought to the IIT. As a first observation revealed, GEPs were not fully aligned with the scientific and research interests of the IIT (Addabbo et al., 2023). This seemed quite natural, especially given the usual "distance" from social science and humanities (SSH) topics and the well-established boundaries between scientific disciplines that characterised the IIT (Snow, 1969). Exceptions to this were limited to certain cases of interdisciplinary collaboration where STEM disciplines overlapped with SSH fields for specific research purposes. Such intersections already existed at the IIT in areas such as neurocognitive sciences, rehabilitation, and others (Di Bella et al., 2021).

The IIT was founded more than 20 years ago. In just a few years, it has developed into a well-known research institute capable of maintaining ongoing collaborations throughout Italy and around the world (e.g., with the MIT in Boston, USA). The IIT has quickly achieved a high level of scientific excellence and has been awarded an astonishing number of high-calibre research projects funded by the European Research Council in the recent past.

The introduction of GEPs as required by the European Commission in its granting of funding from the Horizon Europe framework programme has, on the one hand, led to institutions equipping themselves with equality plans that would have otherwise been far from becoming a reality and, on the other, to institutions

thinking about such themes in a driven way, rather than on their own accord (Bencivenga et al., 2021b; Rothwell et al., 2024). For many organisations, the creation of GEPs proved to be a process shared by the institution's scientific community and, to some extent, driven by the institution itself (Campanini & Pizarro, 2021). For many others, GEPs tended to be designed without any real involvement or shared process, and were perceived as an obligation that had to be at least formally fulfilled to access European (and extra-European) funding (Bencivenga et al., 2021a), thus representing yet another formal procedure to be followed (Caprile, 2021). Indeed, in recent cases, the process of developing GEPs was as fast as it was uninvolving (Bencivenga et al., 2021a; Cannito et al., 2023), and the GEPs appeared very quickly on any given organisation's website. As a result, they did not—or could not—have the expected impact (Addabbo et al., 2023), precisely because organisations still lacked the fundamental premise of a shared process aimed at changing their culture and initiating lasting and sustainable institutional change (Tildesley et al., 2022).

This article provides an initial reflection on how the IIT has taken up the challenge of GEPs, how the first measures were implemented, and what results can still be observed today. The authors have contributed in different ways to the conception and development of the GEP and its implementation. The article addresses gender and uses gender-specific data where available. Currently, the IIT has no way of introducing or defining gender beyond the binary category of male/female. The authors adhere to the concept of gender equality as equal rights, responsibilities and opportunities for women and men, and girls and boys, following the definition of the United Nations and the European Institute for Gender Equality (EIGE), which were also used when introducing an intersectional and gender+ approach (see Crenshaw, 1989; Debusscher & Manners, 2020; Sangiuliano, 2019).

We begin with an introduction to the IIT, tracing its history, albeit in brief strokes, and giving some indications that we consider fundamental for understanding all the constraints that make up the measures envisaged in its GEP.

The IIT GEP, which was introduced in 2021, is reviewed and updated annually in line with company policy. The measures we analyse, therefore, relate to the period from 2021 to mid-2024. We refer to the GEP scheme elaborated by the European Commission, which originally seemed less suitable for research organisations such as the IIT (Brescianini et al., 2024; Diaz et al., 2023). For the concept and application of GEPs, we refer here to the EIGE definition (https://eige.europa.eu), as well as to previous research in the field of GEPs and its application in scientific organisations (Cannito et al., 2023; Galligan, 2025; Pépin et al., 2014). At the same time, we analyse some of the successes and failures of GEP interventions and discuss the resistance encountered at the IIT (Bencivenga et al., 2021a; Linková & Mergaert, 2021). In selected cases, we also present remedial measures that we were able to introduce before moving on to emergency measures (Lombardo & Mergaert, 2013).

The article concludes with a critical examination of the implications of the case study findings and offers reflections on how the pursuit of gender equality can improve the epistemic integrity, institutional effectiveness, and societal relevance of research and innovation organisations.

## 2. Research Questions and Methodology

This study examines the implementation of the IIT GEP and analyses its initial impact, challenges, and outcomes. The research aims to answer the following key questions:

1. How has the implementation of a GEP impacted gender equality at the IIT, and how have key performance indicators (KPIs) been used to monitor progress and measure scientific excellence in this context?
2. What are the main obstacles and resistances encountered in the implementation of the IIT GEP?
3. What measures have been effective in promoting a more inclusive and equitable institutional culture?

To answer these research questions (RQs), a quantitative methodological approach was chosen in which all indicators and calculations are derived from EIGE. Below we briefly outline the first steps the IIT has taken in concretely measuring gender equality and present the following indicators and metrics: (a) gender distribution at different organisational levels; (b) proportion of women in the scientific areas of the IIT; (c) scientific glass ceiling in Italy/the IIT; (d) analysis of the members of the evaluation committees by gender; (e) the Gender Pay Gap Index (GPGI); (f) success rates in recruitment by gender; (g) distribution of publications by gender; (h) external research funding and its economic value by gender; (i) prevalence of gender in start-ups founded by the IIT; (j) distribution of priority patent applications by gender.

The study is based on data and KPIs, including statistical analyses of gender representation in research output and other relevant metrics used to assess merit and ensure career advancement (Abramo et al., 2013; Nielsen, 2016), such as bibliometric measures (Mayer & Rathmann, 2018; Nielsen, 2018) and the measurement of research funding (Cruz-Castro et al., 2023; Ranga et al., 2012), patent applications, and business start-ups (Lai, 2020; Wang et al., 2020). The use of these metrics has been widely questioned and criticised across different fields (Acker et al., 2024; Anzivino & Dordoni, 2021; Kairuz et al., 2016; Pecis, 2016; Wang et al., 2020), particularly concerning the gender dimensions that such metrics tend to neglect due to their reliance on seemingly neutral but structurally biased indicators (Van den Brink & Benschop, 2012). For these reasons, our methodology took into account often overlooked situational and environmental factors (Berry & Frederickson, 2015). These include, for example, an intersectional approach to organisational culture, leadership style, work–life balance policies, and institutional power dynamics, with organisational climate playing a critical role in employee motivation, engagement, and overall performance (Christensen, 1997/2023). We also rely on a secondary data collection method. In fact, the source of the numerical data we present is the data available in the IIT's database: Since its inception, the IIT has had a precise system for measuring results and performance at both institutional and personal levels. This data-driven approach has proven to be fundamental for the IIT to understand what works and where improvements are needed. Indeed, intensive monitoring and continuous feedback loops are central to the IIT's strategy and enable a dynamic process of adaptation and development. In the present GEP experiment at the IIT, ongoing measurement and data-driven decision making also represent critical components of successful gender equality practices. In fact, the quantitative analysis identifies both successful initiatives and persistent challenges, offering recommendations for strengthening gender equality strategies in research and innovation organisations (Chamochumbi Diaz et al., 2024; Mahoney & Thelen, 2009). Our methodology was also inspired by the activities carried out as part of an ongoing Horizon Europe-funded project to improve the outcomes of GEPs' implementation at the company level. This is the project titled

Twinning Research and Innovation Institutions to Design and Implement Inclusive GEPs (NEXUS; grant number no. 101094949), in which the entire Diversity, Inclusion and Social Impact Division of the IIT has been involved from the beginning.

## 3. The IIT as an Exception in the Italian Research Landscape: A Brief Presentation

Founded in 2003, the IIT's research is based on the constant cross-fertilisation of new knowledge and innovative technologies. Its actual activities in this area only began after a few years. From the very beginning, the IIT showed great potential, building a complex structure from scratch and providing services to the scientific community quickly and professionally (Robbiano, 2022). Its motto is: "Where Science Comes True." Due to its success, the Italian government decided to transfer the organisational structure of the IIT to other research foundations, which were to be established under the now expert leadership of the IIT. Currently, the IIT's mission is based on three pillars, which are anchored in the latest Strategic Plan 2024–2029, as shown in Figure 1.

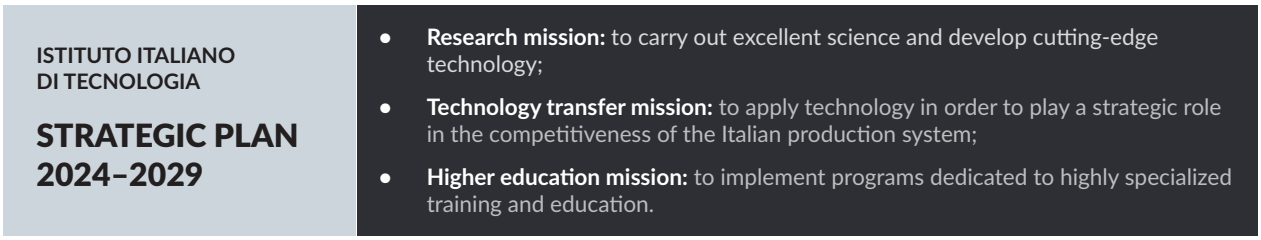


**Figure 1.** The IIT's pillars. Source: Istituto Italiano di Tecnologia (2024, p.11).

Around 80 research units are divided into four major research areas: robotics, nanomaterials, LifeTech, and computational sciences, each led by a principal investigator. With around 2,000 staff members and 80 principal investigators, each heading a research unit, IIT staff come from all over the world, combining over 70 different nationalities and an average age of 36. Being a young institution, the number of patents filed between 2008 and 2023 with at least one author from the institute (1321), the amount of funding received (617 million), the number of projects approved by the European Research Council with a principal investigator at the IIT (71 by 2023, 11 of which in 2023), the number of scientific publications (21316) and the start-ups that the IIT has successfully launched (34) are impressive (Di Bella et al., 2021).

In terms of the cross-section of the workforce by sex at the IIT—and at the national normative level, which provides for two sexes: male/female—the IIT currently employs 57% men (M) and 43% women (F). Table 1 provides gender-disaggregated data on the composition of staff at different organisational levels, including research support staff, researchers, principal investigators, and top management functions.

**Table 1.** Gender distribution across organisational levels, in percentage, 2023.

| | Female | Male |
|---|---|---|
| Research support staff | 62 | 38 |
| Research staff | 39 | 61 |
| Principal investigators | 23 | 77 |
| Top management | 31 | 69 |

Source: The IIT raw data.

It is immediately noticeable that there is a strong preponderance of males among research staff, PIs and top management and, conversely, an equally strong preponderance of females among research support staff. This mirrors the status quo already observed in other organisations (Griffin, 2022), where research in STEM subjects is conducted by men and administrative support is provided by women (Witz & Savage, 1991).

As far as top management is concerned, around 69% (24 out of 35) of the highest management positions were held by men and around 31% (11 out of 31) by women in 2023. These leadership positions are represented by the president, the scientific director, the director general (all of whom are male), the Scientific Committee (17 members, 7 women), and the Directorate for Research Support (15 members, 4 women).

At the research staff level, the gender balance is, as expected (Cervia & Biancheri, 2017; Fissi et al., 2022), greatest in the lower positions, namely postdocs, research fellows, and doctoral students. In general, female research staff are more concentrated in the research fields of nanomaterials and LifeTech, where they also occupy higher positions (Gaiaschi, 2023). In contrast, female researchers are underrepresented in the research fields of robotics and computational science, as shown in the following figure (Checchi et al., 2019).

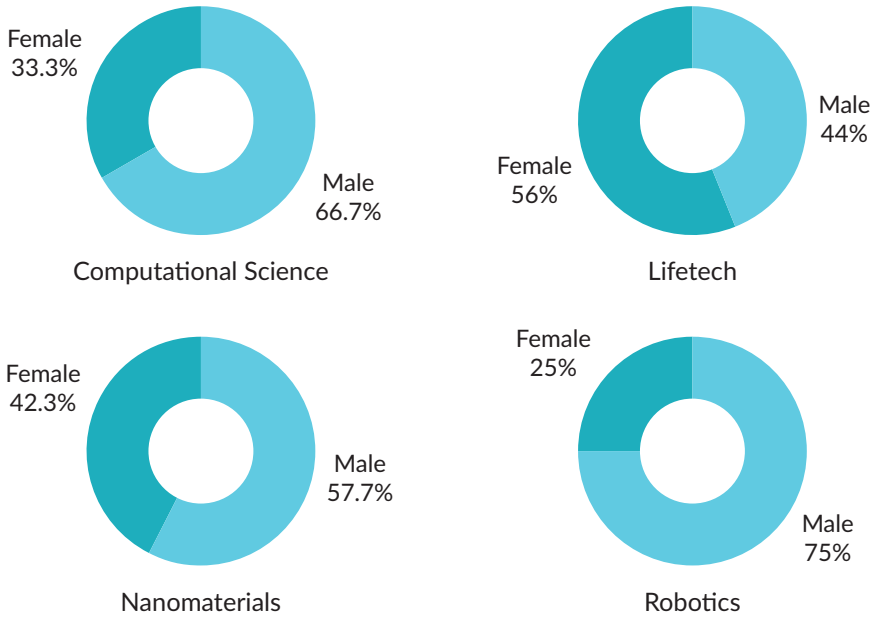


**Figure 2.** Composition of workforce by gender and scientific field, 2022. Source: IIT internal database and unpublished raw data from 2023.

Even though it is an institution dedicated to innovation and frontier research, and, therefore, subject to constant change (Christensen, 1997/2023), and despite the young average age of its members, the IIT reproduces the paradigm of gender segregation both in scientific fields and in labour and management positions (Avolio et al., 2020; Biasin & Chianese, 2020). Nevertheless, gender representation and distribution at the IIT can be considered relatively progressive by Italian standards, where inequality and underrepresentation in other research and academic institutions are often even more severe (Fissi et al., 2022).

Figure 3 shows the positioning of the IIT in the Italian panorama in relation to the Scientific Glass Ceiling Index—the index that measures the relative likelihood of women reaching leadership positions in scientific

careers compared to men, normalised on the basis of the relative presence of women compared to men in all research positions.

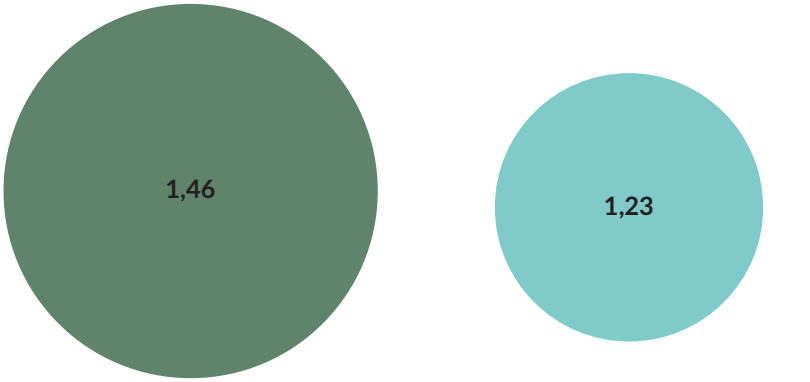


**Figure 3.** Scientific Glass Ceiling Italy/IIT in comparison. Source: European Commission (2025) and IIT unpublished data (latest available calculation year in each case).

The calculation of the Scientific Glass Ceiling of the IIT was carried out as follows: Required data were the number of women in grades A, B, and C for a given year Y (FGY; head count) and the number of men in grades A, B, and C for a given year Y (MGY; head count).

The formula was the following:

$$\frac{((Fay + Fby + Fcy)/(Fay + Fby + Fcy + May + Mby + Mcy))/Fay}{Fay + May}$$

The population was grouped by role using the taxonomy recommended by the EIGE for European comparability. The closer the index was to 1, the lower the glass ceiling, i.e., the lower the underrepresentation of women among professors/senior scientists.

The index calculated above shows that the IIT performs better than the reference nation. Nevertheless, despite the progress made, significant challenges remain and further efforts are needed to advance gender equality in a sustainable and structural way (Di Bella et al., 2021; Robbiano, 2022).

## 4. IIT and Its GEP: First Results and Outcomes

### *4.1. IIT's Values and Commitment to Inclusion*

At the core of the IIT lies a set of foundational values—integrity, courage, societal responsibility, and inclusion—that serve as operational guidelines that guide both institutional policy and daily practice. The IIT was founded as an international research centre and attaches great importance to diversity. This is also reflected in the very international composition of its staff: Around a third of the staff come from abroad, a significant proportion of them from non-European countries. This global orientation has contributed to the development of an organisational culture that actively fosters non-discrimination and inclusivity across all levels of the institution.

However, when it came to developing a GEP, the IIT did not simply choose to fulfil mandated requirements, but instead developed an approach that reflected its unique institutional identity. Unlike many other research institutions in Italy, IIT has included an 'Area Zero' in its GEP—its intention being to go beyond gender equality and pursue a holistic, intersectional vision (Eigenmann et al., 2024; Verloo, 2006) of inclusion (Dixon-Fyle et al., 2020). This commitment—initially robust, at least on a formal level, especially on the part of the scientific leadership—diminished more and more over time. The initial input and first design reflect the complex dual identity of the IIT: an institution embedded in the regional context of Liguria, yet with a distinctly international and supranational orientation.

Since the first formal establishment and implementation of the GEP in 2021, the IIT has been monitoring the measures set out in it, measuring its impact (Brescianini et al., 2024), and comparing the results with the KPIs shared by the scientific and academic community (Abramo et al., 2013; Kairuz et al., 2016; Wang et al., 2020). Thereafter, if necessary, corrective actions were implemented to improve the impact on the institution, as in 2022 and 2023, when some of the planned actions were postponed due to major organisational changes or union consultations. In particular, the IIT GEP includes concrete strategies and actions aimed at removing potential barriers that could limit women's careers within the institute. These include initiatives that benefit the whole community to promote fair and transparent recruitment, access to training and development programmes as well as the creation of a working environment that upholds diversity and inclusion, and enables a good work–life balance.

The first major action after the first IIT GEP was the permanent establishment of the Diversity, Inclusion and Social Impact Division with the appointment of a diversity and inclusion manager and the approval and funding of the GEP itself (actions implemented in 2021). In addition, a policy statement on "equal opportunity, diversity and inclusion" and "combating harassment, sexual misconduct and bullying" was adopted, and a clear reporting procedure for such incidents was introduced, as defined in the IIT Code of Conduct for Scientific Behaviour adopted in December 2022.

The GEP provided the IIT with the opportunity to continue its first training on the gender dimension in research and the analysis of the gender pay gap in top scientific positions, which was carried out in 2022. The initial outcomes of the GEP also included the implementation of the first D&I survey conducted within the IIT in 2022, the results of which played a key role in the development of the first Diversity and Inclusion Action Plan. This plan aimed to expand and integrate the GEP's inclusive goals to promote a more equitable and inclusive work environment.

Although the GEP seemed to be going well, it suffered its first setback in 2023. In fact, a number of actions that were planned for this year had to be postponed, even if they had already been planned. Nevertheless, it is important to emphasise that many of these delays and changes were due to new regulations, such as the new European Charter for Researchers or new trade union negotiations.

### *4.2. GEP Key Actions: Challenges and Setbacks*

The following presents a selection of additional and exemplary measures that the IIT has implemented as part of its GEP.

A distinctive aspect of the Institute is the selection of scientific staff, which results from the fact that the IIT is a private organisation that receives public funding. It therefore takes a private approach to negotiations and contracts and has introduced features of Anglo-Saxon and particularly American private selection procedures, with the tenure-track system for researchers moving from one phase to the next of the tenure process, which, if successful, leads to a fixed-term contract as an IIT researcher. The procedure can take up to 10 years if the evaluation committee reacts favourably at the various stages. At the end, the successful researcher is offered a permanent contract and position. Independent of this, the IIT sets up evaluation and selection committees when it recruits new staff. The GEP has planned an intervention in this important area by organising awareness-raising activities to promote gender equality in the evaluation committees for the selection and promotion of staff, including tenure track. The first gender measurement of the members of the evaluation committees revealed a strong gender imbalance. In 2022, the committees were composed of an overwhelming majority of male reviewers (68%), with women representing less than a third (32%). In this case, the GEP measures did not achieve the expected results and were confronted with the status quo of the reference scientific environment, with the composition of the evaluation committees not changing significantly in the following year (67%–33%). This, however, was largely due to chance factors rather than a change in institutional orientation. Indeed, social, cultural, and environmental factors influence people's abilities and their ability to pursue careers, reach top positions, or occupy the highest posts in research and innovation (Bradley et al., 2009). No matter how hard we try to achieve gender balance, for example, in evaluation committees, it is always difficult to find females with the necessary background and preparation. Where this is the case, women are inundated with requests to participate in evaluation committees at both national and international levels, representing a very small number of people and thus facing a greater burden than their male counterparts (Bagues et al., 2017; Parkouda & Liao, 2024).

A very similar approach can be applied to the gender pay gap, another fundamental measure included in the IIT's GEP. A gender pay gap does not necessarily mean discrimination. It can also result from various factors, including occupational segregation, differences in career progression, and others (Goldin, 2008, 2014). For a more nuanced understanding of the phenomenon, the IIT conducted a detailed analysis, taking into account factors such as job roles, years of experience, and scientific indicators.

As for measures for the reduction of the gender pay gap and the creation of a decision aid tool to make fair pay policy choices for principal investigators, the IIT's GPGI reflected similar behaviour to that analysed above, which the authors of this article believe is due to casual factors primarily, rather than a tangible result of GEP implementation and cultural change. It is a fact that the KPI for 2023 was worse than that for 2022, where the measure in question was not recognised as fundamental to lasting and sustainable change. This says a lot about gender equality in organisations, as demonstrated by several scholars over the last decades (European Commission et al., 2016; Pillinger, 2023) and confirmed in various European Commission reports (Plantenga & Remery, 2006).

The GPGI at IIT was calculated using the formula:

$$\frac{(\text{average male salary}/\text{average male hours}) - (\text{average female salary}/\text{average female hours})}{\text{average male salary}/\text{average male hours}}$$

The number of female staff has increased from 2021 to 2023, and the pay gap has remained fairly stable. In 2021, the gap was 10%, meaning that women earned on average 10% less than men; in 2022, the gap

increased to 13%, indicating a worsening of the pay gap; in 2023, the gap decreased slightly to 11%, which is a small improvement but still higher than in 2021.

The indicator considered the average gross hourly wage for men and women, function, research area, and age group in order to measure gender-specific wage discrimination. All staff units were taken into account for the calculation, both permanent and external staff, assuming a contribution of 40 hours per week for the latter and including staff on part-time contracts. This study emphasises the significant salary differences between male and female employees (Verashchagina & Capparucci, 2013). Despite the consistent improvement in the representation of female staff at the IIT, the GPGI remains significant and persistent. According to the European Commission and EUROSTAT, the GPGI in the European Union was 12.7% in 2022—i.e., women earn 0.87 euros for every 1 euro earned by a man (European Commission, 2023, 2024)—and still represents an unresolved challenge (Leythienne & Pérez-Julián, 2021). At the same time, the IIT represents one of the best results in Italy, a country where only 55% of working-age women are employed (in the EU, around 70% as per 2022 data; see European Commission, 2024).

Concerning gender over- or under-representation in certain areas, the GEP team immediately identified the weak points and took action to attract the under-represented genders in the organisational units (research units and central administrative offices) that have a higher gender gap in the distribution of staff, and then calculated the recruitment success rate by gender (Checchi et al., 2019). This rate calculates the frequency of successful female and male applicants in relation to the total number of applications received for advertised positions. The indicator refers to all selection procedures, including those for the tenure-track programme. In this case, there has not only been a growing interest in the subject, but also a significant improvement. The success rate of female applicants (1.10% in 2023, 1.72% in 2022) for a position has come closer to that of male applicants (1.29% in 2023, 2.13% in 2022), although the difference is still notable.

## 5. The Case of Area Zero

As it is not possible in this short article to analyse all of the IIT's activities about the individual measures of the GEP, we will now focus on the specific area that the IIT has added—"Area Zero: An inclusive culture"—which is particularly dedicated to inclusion and gender-specific participation in research results, production, and funding. This area was developed to better align the GEP with the specific characteristics of the IIT described above and to develop training on gender equality and equity specifically for managers, leaders, and senior researchers, and make it an integral part of induction and familiarisation activities for all individuals starting at the IIT. In addition, Area Zero was created with the aim of offering e-learning modules on the various dimensions of equal opportunities and inclusion to promote a broad awareness of equality at all organisational levels with an intersectional approach (Bonu Rosenkranz & della Porta, 2024; Sangiuliano, 2019).

In this area, a high level of staff participation in training activities, including webinars and training on specific topics, was noted. Activities focused on recognising and raising awareness of prejudice, inclusive language, mental health, and wellbeing. A total of eight activities were delivered with a total of 265 participants. The qualitative evaluation showed overwhelmingly positive results and will be the subject of further publications in the future.

Regarding the scientific indicators and technology transfer, it is generally recognised that they can effectively demonstrate an individual's actual involvement in knowledge production or exploitation (Truss et al., 2012) and their importance for different aspects of career progression (Otero-Hermida & García-Melón, 2018). To this end, the scientific indicators used at the IIT for an initial assessment were calculated using a database defined with the full counting metric. This metric assigns full credit to each author if a research product, such as publications, citations, or other products, was produced in collaboration with others. The data for scientific staff refers to the years 2021, 2022, and 2023 and comes from the IIT databases.

In particular, the indicators for scientific publications were realigned to publications with authors categorised according to their stated gender in the selected three years studied. Both indicators show a remarkable stability of values between 2022 and 2023 (72% male authors, 28% female authors). It is noteworthy that the proportion of publications authored by female authors increased slightly in 2022 compared to the data from 2021 (73%-27%), as shown in Table 2.

**Table 2.** Distribution of publications by gender, in percentage.

| Year | Female authors | Male authors |
|---|---|---|
| 2021 | 27 | 73 |
| 2022 | 28 | 72 |
| 2023 | 28 | 72 |

Source: The IIT raw data.

These percentages do not accurately reflect the—albeit still disproportionate—breakdown of research staff by gender and thus support the justified criticism of an impossible gender-blind assessment of publications and research performance in general (Khosravi & Chavan, 2012), which also raises some criticisms of the blind use of KPIs.

It is recognised that monitoring the gender dynamics of applicants, recipients, and gatekeepers of research funding, funding processes, instruments, and criteria, as well as the role of key funding organisations, plays a central role in promoting gender equality in research. Therefore, it is of paramount importance to ensure that all genders can influence the research agenda and scientific progress (Acker et al., 2024; Biasin & Chianese, 2020). The discussion on this important topic at the European level goes back a long way (European Commission, 2009; Tildesley et al., 2022). At the IIT, similar percentages as for publications are also observed in the acquisition of external research funds, with a distribution of 73% of funds with a male scientific supervisor and 27% female supervisors in 2022 and 2023. This was a slight increase in the percentage compared to 2021, when the ratio of men and women was 77%–23%. In addition, the percentage of participation in fundraising is disproportionately high if we consider the economic value of the contributions received (Abramo et al., 2013; Montorsi, 2021). In this case, the gap widens as a female researcher receives a lower economic return, as shown in the following Table 3.

In this context, "economic value" refers to the total amount of external research funding received and not just the number of contracts concluded. While the percentage of contracts awarded to male and female collaborators suggests a certain level of participation in fundraising, the gender disparity is more evident in the actual monetary value generated by these contracts (Cruz-Castro et al., 2023). The authors agree that one of the most common reasons for this is that women, even when successful, apply for less funding than

**Table 3.** External research funding and economic value comparison, in percentage.

| Year | Number of contracts | | Economic value | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 2021 | 77 | 23 | 72 | 28 |
| 2022 | 73 | 27 | 78 | 22 |
| 2023 | 73 | 27 | 86 | 14 |

Source: The IIT raw data.

their male counterparts. Alternatively, they do the same work for less money, in a kind of analogy to the GPGI described above (Abramo et al., 2013; Acker et al., 2024). Although the gender gap in research funding and fundraising has remained relatively constant, economic inequality at the IIT has widened significantly, especially in the last year observed, 2023. This confirms that the gender gap is still active (Cruz-Castro et al., 2023), including in terms of how differential participation and success in fundraising might affect women's performance in science and research implementation (Hermansson et al., 2021; Schmaling & Gallo, 2023), with women suffering from performance bias and often underestimating their own value, while conversely men demanding more for the same work from an economic perspective (Babcock & Laschever, 2021).

In response to the implementation of the GEP, the IIT was given the opportunity to conduct a comprehensive analysis of gender representation in IIT entrepreneurship. The indicator adopted considers the prevalence of gender in start-ups, taking into account their corporate structures, and is calculated annually for each individual start-up. In 2023, based on the start-ups monitored by the Directorate of Technology Transfer, women associated with IIT (or employed by IIT staff at the time the start-up was founded) account for 12% of IIT staff in the overall corporate structure of start-ups. This figure represents a significant improvement compared to 2021 (9%) and remains unchanged compared to 2022 (12%).

Despite a modest improvement in the data, this study once again emphasises the pervasive gender inequality in entrepreneurship as highlighted by Gupta et al. (2009). Even in areas where the production of knowledge and novel products is more evenly distributed between the genders (Marlow & Patton, 2005; Reyes, 2022), male entrepreneurship remains largely dominant.

As for the observation of intellectual property rights, patenting trends were observed using data from a database defined by the complete count method described above. In this case, the method fully assigns each research product, in particular the priority patent applications, to each inventor if it was created in collaboration with others. The data on scientific personnel are considered as of 31 December 2021, 2022, and 2023. The most important indicator analysed was the gender distribution of inventors in priority patent applications filed between 2021 and 2023, as shown in Table 4.

**Table 4.** Distribution of priority patent applications by gender, in percentage.

| Year | Male | Female |
|---|---|---|
| 2021 | 84 | 16 |
| 2022 | 76 | 24 |
| 2023 | 75 | 25 |

Source: The IIT raw data.

In this context, the term "priorities" refers to priority patent applications, which are the first official applications for an invention. A priority patent application establishes an early filing date for the invention and gives the applicant a legal advantage when seeking patent protection in multiple countries.

The data shows that while female inventors are gaining presence in patenting, they are still a minority, demonstrating a persistent gender gap in technological innovation and patent ownership (Caviggioli et al., 2022; Pecis, 2016).

## 6. Conclusions: GEP as a Driving Force at the Cultural and Institutional Level

In summary, this article has highlighted the existing gap in the study of how the principles of EDI, particularly gender equality, intersect with the pursuit of scientific excellence in research and innovation organisations. While a growing body of literature critically examines these dynamics in academic institutions—often from a sociological perspective (e.g., Acker et al., 2024; Griffin, 2022)—there remains a notable lack of focused analyses on non-academic research institutions, particularly those operating in STEM fields. In contrast to universities, where such frameworks have been more extensively studied and implemented (Agodi et al., 2021), research institutions have received comparatively little attention. This study made an initial contribution to this under-researched area by examining how GEPs are implemented in a research-intensive context and suggesting directions for further investigation and development.

In the first instance, the GEP had enabled the IIT to systematically collect and analyse data disaggregated by gender and position, which was unique among research institutions. As far as we know, prior to the implementation of the mandatory GEP requirements by the European Commission, there were only a few public research institutions that kept comprehensive data disaggregated by gender and specific fields according to the GEP (RQ1; Nielsen, 2016; Verloo, 2006). This example could, thus, be perceived as disruptive, whereas scientific measurement and metrics have so far only served to measure and evaluate scientific excellence using a supposedly gender-blind method (Mayer & Rathmann, 2018).

Secondly, despite the fact that it is a transformative institution, institutional changes cannot be introduced and have an impact within a few years. In general, in response to RQ2, there is still a lack of commitment in leadership positions and a genuine interest in ensuring that GEP measures do not remain GEP measures forever, but are embedded in the organisational culture of the institution (Bencivenga et al., 2021a). A stronger commitment from higher levels within the institute could pave the way to prove that the GEP was not the classic ticking-off exercise (Tzanakou et al., 2021; Wroblewski & Palmén, 2022) in order to gain access to European funding. The group that implemented the GEP's measures immediately encountered perhaps the most widespread resistance, namely a lack of interest or motivation to adhere to it and raise awareness, which in turn could have a multiplier effect and lead to cultural change, which corresponds to RQ1 and RQ3 (Agodi et al., 2021). Intensive monitoring and constant feedback were key to the GEP's success, ensuring its actions were well publicised within the IIT and that everyone was aware of its activities. Participation of individuals was encouraged by all means available, including offering multiple time slots and customised content for different participants. Over the years, strategies were then developed to mitigate resistance and potential barriers (Wroblewski & Palmén, 2022), with a crescendo of activities and a constant effort to respond to the needs arising in the early years of the GEP—until today. However, the question of top management commitment remains open.

Thirdly, the IIT's GEP has triggered actions and reflections that have gone beyond the minimum requirements, with measures that have successfully promoted a more inclusive and equitable institutional culture—providing a first response to RQ3. Indeed, it has provided the IIT with an invaluable opportunity to critically engage with transversal issues of crucial relevance, such as inclusion and the promotion of an equitable work environment. Nevertheless, the need for further incorporation of the GEP in institutional culture is evident (Cannito et al., 2023; Caprile, 2021), as seen in the fact that the indicators for the institution's performance were not integrated with those for disaggregated data, with gender participation or with the gender composition of the KPIs in the last strategic plan (RQ1, RQ2). Even today, activities are still only seen as GEP-related measures, often owned by those who implement them without becoming part of the cultural substrate of the individual, starting with the top positions. Of course, there are also major exceptions, and in the years that IIT has been implementing the GEP, we have seen lively participation in GEP-related events, including from PIs who are genuinely interested in cultural change. This is one of the main positive outcomes of GEP activities, not only highlighting the importance of the individual in the organisation, but also providing opportunities to represent key flagships, which are both important examples of how organisations can be transformed starting from their people (Christensen, 1997/2023). Another important example is the fact that the IIT participates in several projects funded by the Horizon Europe framework programme that address issues such as equality, diversity, inclusion, and gender.

The last reference concerns the right to representation on governing bodies (Bagues et al., 2017). Italy is a country that has had to equip itself with gender quotas (Checchi et al., 2019), i.e., laws at national level that require a minimum participation of women in certain bodies allowing female participation in key or leadership positions, such as director's boards in listed companies, or public selection bodies to name a few (Arzu & Mantovani, 2020; Fissi et al., 2022; Perna et al., 2019). Given the historical composition of IIT boards, the question arises as to whether the introduction of mandatory quotas for gender representation would promote the transition to better representation in IIT's top positions as well (Bagues et al., 2017). In an institution where the only benchmark is excellence, where merit trumps all, one should still pause and ask the question of all time when it comes to gender and representation. If it is true that representation is a fruit of co-optation among peers, that a career that exceeds one's abilities is often a postulate of one's possibilities, then the issue we speak of in this conclusion might also be grounded in an institution based on excellence and merit. This idea, however, does not attempt to undermine the reach of gender mainstreaming by reducing it to a non-issue or a nameless problem (Goldin, 2021; Kelan, 2018). With Campanini and Pizarro (2021), Celis and Lovenduski (2018), and Galligan (2007), the authors agree, then, that representation is power.

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