

From Research Training to Labour Market Outcomes: Gender Disparities in Career Advancement and Knowledge Transfer among IIT Alumni

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Abstract: Understanding how gendered expectations influence career trajectories in research and innovation is essential for creating an equitable scientific ecosystem. This paper presents an initial analysis of the career paths of alumni from the Italian Institute of Technology (IIT), focusing on researchers who spent at least three years at IIT in the past fifteen years before moving on to positions in academia, entrepreneurship, or other scientific careers. The broader investigation adopts a mixed-methods approach, combining quantitative tracking of alumni outcomes with qualitative evidence from case studies and semi-structured interviews. This paper specifically draws on insights from the interview data to explore how gender, nationality, geographical distribution, and other social factors intersect in shaping post-IIT career opportunities and constraints. As IIT is a relatively young institution, this paper offers an initial examination of how its institutional practices and networks facilitate or hinder equal access to career opportunities, research funding, leadership positions, and business start-ups. The study also investigates knowledge transfer from IIT to broader ecosystems and examines how knowledge flows may be mediated by gendered patterns of recognition, collaboration, and access to resources. Initial findings indicate that while IIT provides a strong platform for research excellence and innovation, gendered expectations may still influence alumni career trajectories, particularly in relation to access to funding, research outputs, entrepreneurial risk-taking, and mobility choices. By linking alumni experiences and narrative accounts, the study provides a nuanced picture of the how research institutions contribute to gender equality in scientific careers. Additionally, it identifies institutional avenues to foster a more inclusive research and innovation environment.

Keywords: EDI, Gender, Intersectional approach, Career, Alumni community, Istituto Italiano di Tecnologia

1. Introduction: Trajectories of Talent and Institutional Reflexivity

In the globalised landscape of contemporary science, not only do elite research institutions function as sites of technical production but are critical hubs for knowledge transfer and career development (Færgeman et al., 2025). Although recently established, the Italian Institute of Technology (IIT) (2005) exemplifies this model, attracting international talent to a high-intensity, multicultural environment. As a matter of fact, literature on international scientific mobility highlights how global academia serves as a hub for talent circulation and knowledge exchange, with mobility contributing to individual career development and broader scientific networks, particularly in STEM fields such as Engineering and Physics (Han et al., 2024). This is especially true for elite researchers, defined as those with top-level scientific achievements, publications, citations, prestigious awards, and reputation (Ackers, 2005; Kairuz et al., 2016; Azoulay et al., 2017; Yuret, 2017).

Although institutional focus is normally centred around scientific output and standardised scientific performance indicators – alongside well-founded criticism of gender and intersectionality-blind assessment methodologies (Bosak & Sczesny, 2008; Khosravi & Chavan, 2012; Mairesse & Pezzoni, 2015; Leone et al., 2025) – the long-term impact of this on career trajectories remains rather unexplored (Müller, 2014; Zhang et al., 2023).

To understand the link between institutional experience and professional success, this study adopts a retrospective approach (Vettori et al., 2021). It examines how the "IIT experience" shapes the subsequent paths of its researchers, moving beyond scientific or technical training to analyse the influence of leadership styles, gender dynamics, and inclusion policies (Zhan et al., 2023). As these researchers and collaborators transition into roles in global academia, industry, and entrepreneurship, they can become agents of cultural change (Massingham, 2014) carrying the skills, and values developed during their tenure.

The findings in this paper are based on ten semi-structured interviews with former IIT collaborators (Alumni) who held various roles, from PhD students and postdocs to team leaders or collaborators. These interviews were organised around five strategic thematic pillars:

1. Contextual backgrounds and roles within the institution;
2. Perceptions of fairness and career dynamics;
3. The institution's role in facilitating knowledge and network transfer;
4. Reflections on inclusive leadership and gender equality;

5. Practical recommendations for future institutional development.

By analysing these narratives, this research identifies both the strengths of its multicultural launchpad and the systemic gaps that must be addressed to ensure equitable career advancement (Bozzon et al., 2018; Gaiaschi & Musumeci, 2020). This study also aims to contribute to the broader discourse on how research-performing organisations can move beyond formal policy compliance towards a genuinely sustainable, inclusive, and gender-attentive ecosystem.

2. Contents and Methodology

The interviews were conducted in October and November 2025 as part of a broader strategic vision promoted by IIT to strengthen alignment between internal research and collaboration activities, as well as external societal, industrial, and institutional contexts. This initiative aims to enhance the visibility, impact, and transferability of IIT’s research outputs in innovation and technological development. Within this framework, emphasis is placed on individuals who have undertaken periods of work or research at IIT, whose subsequent professional trajectories elsewhere represent a key channel for disseminating knowledge, fostering collaboration, and amplifying the long-term impact of IIT’s research and innovation domain.

The interviews were structured around five thematic sections to gather both retrospective assessments and forward-looking recommendations, as shown in the table below.

Table 1: Content of the semi-structured interviews

Theme	Objective	Key Areas of Inquiry
1. Introduction and context	To outline the interviewee’s internal career path and interpersonal experience at IIT.	Role and duration at IIT; composition (roles, gender) of the research group; maintenance of contact with former colleagues.
2. Experience and career dynamics within IIT	To assess how fairness, equality, inclusion, and opportunity were perceived within research groups and the institute.	Perceived fairness in access to professional development opportunities; perception of formal or informal intersectional disparities (based on gender, nationality, age, etc.) impacting careers.
3. Knowledge, networks, and transfer	To evaluate the role of IIT in knowledge transfer and career networking after leaving the institution.	Whether IIT promoted knowledge transfer (to academia, business, start-ups) and how; suggestions for making the Alumni Community an effective network for career opportunities.
4. Alumni as agents of cultural change	To investigate the role of Alumni in driving cultural change related to inclusion in their post-IIT professional lives.	Whether the IIT culture helped them address inclusion/diversity in their subsequent career; usefulness of specific training on inclusive leadership, gender bias, or diversity management.
5. Reflections and recommendations	To gather practical suggestions and ideas for institutional improvement.	Actions a research institution could take to maximise the career potential of early-career researchers; final recommendations for the working group conducting the study.

Participants were drawn from former IIT collaborators, and from this selected based on criteria designed to ensure diversity of perspectives, including gender, scientific or administrative domains covered during their time at IIT, length of time since leaving the organisation, level of responsibility, and expressed willingness to participate in the study. This approach enabled the inclusion of a range of professional trajectories and institutional experiences relevant to the research objectives. It is also important to note that not all individuals

contacted agreed to participate in the interviews; a small number of former collaborators declined or did not respond to the invitation. These refusals were considered as part of the recruitment process and reflect the voluntary nature of participation in the study. Future phases of the investigation will explicitly seek to engage former collaborators who reported negative or less positive experiences at IIT, to broaden the range of perspectives represented and address potential self-selection bias in the current sample (Hiratsuka, 2025).

As a result of this activity, we have a set of respondents broken down as follows: 5 women and 5 men; 2 from administrative support roles and 8 in research; 9 Italians and 1 non-Italian; 7 working in Italy and 3 abroad. Among the researchers, there are 2 university professors (working outside Italy) and 6 in the private sector. Of the 6 in the private sector, 3 are entrepreneurs who have been involved in founding start-ups, and one is the founder of a start-up that is now a company listed on the US stock exchange.

All of them have worked at IIT at some point in the past ten years, each for a period of at least three years and up to a maximum of seven years.

Furthermore, participants were informed in advance about the aims of the initiative and agreed to take part in the interviews by signing an informed consent form, compliant with GDPR, prepared by the legal and ethics department at IIT. They were also assured that the results would be anonymised and pseudonymised to prevent the identification of participants.

The following is an analysis of the main points that emerged during conversations with staff from various backgrounds as previously outlined. The interviewees were assigned a number and will be referred to by their numerical code.

3. The Work Done: Initial Findings

The interviews addressed themes that can be grouped as follows: career development; organisational climate; gender, diversity and inclusion; and the role of the IIT Alumni community. In this paper, we will focus primarily on the gendered aspects of career development and subsequent entry into the job market after the experience at IIT.

Overall, the absence of formal discrimination emerged: both researchers and professionals stated they had never perceived discrimination based on gender or age and confirmed they had not been discriminated against in terms of professional development. One interviewee stated, "I have never perceived discrimination based on gender, or based on age, or based on any other factor." Nevertheless, some female interviewees reported negative experiences, particularly when they were the only woman in the group highlighting gender disparities as a critical issue. In one case, the interviewee recalled being strongly advised by her supervisor to "have thicker skin" due to what she perceived as a discriminatory work environment towards women. When she asked, "If I had been a man, would you, Principal Investigator, have asked the same question?" the answer she received was a flat "no."

Regarding the debate on talent versus opportunity debate and gender imbalance, some argued that the scarcity of women in engineering is not due to a lack of talent but rather a limited capacity to identify and recruit female talent. Other interviewees took for granted that in some scientific domains, such gender segregation is natural. One interviewee remarked, "We have been educated to be engineers and not to pay attention to inclusion!" Another commented, "In a field such as robotics engineering, for years only men were seen in laboratories, and no one was surprised by this".

The narratives of the alumnae highlight a critical managerial gap within STEM-intensive research environments, where technical meritocracy is often conflated with leadership capability, to the detriment of an inclusive organisational culture. As Interviewee 9 observed, "highly accomplished scientists are not necessarily proficient managers who are attentive to gender instances and gender disparities", suggesting that the transition from senior researcher to group leader frequently occurs without the necessary training in soft skills or gender, equality, diversity and inclusion (GEDI) management. This structural deficit demands a move towards the professionalisation of leadership; Interviewee 4 emphasised that institutional evolution depends on the mandate to "train managers in an inclusive manner, which in my opinion is the most important thing", identifying managerial accountability as the primary lever for systemic change and counter-bias actions. Furthermore, the desire for a shift in institutional climate is explicitly linked to gender representation at the highest levels of governance. Interviewee 9 expressed a specific hope for the appointment of "a female director who is more sensitive towards diversity and inclusion", reflecting a widespread expectation among women researchers that gender diversity in top management acts as a catalyst for a more inclusive institutional framework.

The persistent disparity in labour market participation within specialised high-tech sectors, such as robotics, must be traced back to the socio-historical origins of these disciplines. For decades, the foundational frameworks of robotics and engineering were established almost exclusively by men, institutionalising a mono-gendered environment that shaped the standards of merit, leadership, and professional belonging. This historical legacy has created a structural "path dependency", where the long-standing absence of female voices at the discipline's inception fostered organisational cultures and career trajectories tailored to a male-centric model. Consequently, the contemporary underrepresentation of women in these fields is not merely a modern recruitment failure, but the cumulative result of historical exclusion that has entrenched occupational segregation over time. Addressing today's gender gap thus requires acknowledgement of these historical residues that, for generations, lacked the diversity of perspective necessary for inclusive systemic development (Leone et al., 2025). Collectively, these insights suggest that addressing gender disparities in the STEM labour market requires moving beyond "performative" GEDI policies towards a fundamental professionalisation of inclusive leadership and the strategic leveraging of women-led professional networks.

The need for inclusive, sensitive and attentive leadership is contrasted with the experiences of those who transitioned into the private sector, where GEDI standards appear to be more rigorously institutionalised. In corporate environments, as noted by Interviewee 4, there is "significant attention to diversity and inclusion... positively stressed", suggesting that private firms may offer more robust structural protections for employee well-being than traditional academic settings.

The role of social capital and professional development through a GEDI lens remains a cornerstone for navigating these disparities; Interviewee 7 highlighted the necessity of institutionalised alumni communities to "give value to people's experience and diversity and create that network that [...] always helps".

Regarding non-scientific training, several interviewees reported that they did not receive any specific training on subjects outside their primary roles, such as gender mainstreaming, GEDI, or additional professional or transferable skills. In fact, a key suggestion from all interviewees is the greater need for managerial training on topics related to GEDI. Multiple interviewees stressed the crucial need for compulsory management training for Team Leaders/PIs (supervisors), especially on topics like diversity, inclusion, and avoiding cognitive biases in hiring and evaluation, which are still very often perceived as neutral but in reality are based on gender disparities.

The main contents are summarised in the table below.

Table 2: Main points from the semi-structured interviews

Key Point	Summary
Reported gender discrimination	At least two female interviewees reported experiencing discriminatory behaviour due to their gender in a male-dominated environment.
Personal discrimination	Other interviewees stated they did not personally perceive, or experience discrimination based on identity, gender, age, background or other factors.
Intersectional and diverse environment	The international nature of IIT was uniformly praised as a key formative experience.
IIT as a Launchpad	IIT provided the crucial foundation for major international career advancement.
Systemic career reflection	Leaving the institution is seen as a necessary part of growth for both the individual and the institution itself.
Gaps in training on GEDI themes and GEDI mainstreaming	Training was highly technical but lacked focus on crucial non-scientific, managerial, or soft skills.

4. Conclusions

IIT is a young institution which people have often viewed as a springboard for their career since its inception in 2004, so perspectives vary greatly depending on both original and current roles. It is also noteworthy that interview participants had generally favourable perceptions of the institution, as others would most likely have declined to take part.

Participants emphasised that technical brilliance does not automatically lead to inclusive leadership; instead, the study suggests that for a research-performing organisation to achieve true maturity, it must evolve from a site of high-intensity technical production into a reflexive ecosystem where equitable career advancement is valued as highly as scientific output (Murgia & Poggio, 2019; Picardi, 2019).

Diversity and gender issues are not always recognised, partly because, in some cases, those who deny their existence are white males in positions of authority, such as Principal Investigators or team leaders (Weisshaar, 2017), some of whom even acknowledge this themselves. A few women have highlighted gender differences. In one case, a woman reported being pressured because of her role as a young assistant. She emphasised that her vulnerability was heightened by being both the only woman in the group and the most junior team member, a position that increased expectations, visibility, and dependence on senior approval. The lack of leadership capacity to recognise or address gender and broader EDI concerns further worsened the situation. As she reflected, "I was an assistant at that time and my experience was awful." This account illustrates how hierarchical precarity, combined with gendered isolation, can create environments in which unequal burdens and limited avenues for recourse become normalised. Another woman explained that, since the scientific field in question is still largely male-dominated, even now, in her senior position, she tries to maintain a certain balance: "Mindful of my experience at IIT, I now try not to apply any bias when recruiting my colleagues and I try to promote a certain gender balance in my team, without compromising on the criteria of merit and competence." She does not base her choices solely on gender but strives to ensure equal gender representation in her research group. Another woman interviewed admitted she had never attended a training course and, after participating in a specific GEDI training at her current company, said that if she could go back, she would consider such training and awareness essential for anyone working in an institution: "After receiving ad hoc training, I discovered how much training can help in addressing potential gender inequality right from the advertising and recruitment process." Some men acknowledged that, as members of the dominant majority in both the scientific field and their research group during their time at IIT, they never noticed any differences but admitted their complete lack of awareness of the issue: "We were all men, I was neither surprised nor attentive."

Therefore, we can conclude that the lack of training in GEDI issues is a point raised by the majority. However, in two cases, interviewees stated that, since the discussion concerns science and highly educated individuals, there were certainly no prejudices and consequently no need for training or greater awareness: "Science is science and is neutral." This reveals the same bias as those who believe that inequalities occur only among people who are not highly educated and supports the false thesis that the more education one has, the less bias one holds (Gundara, 2000; Knowles & Lowery, 2012).

None of the interviews addressed GEDI and gender approaches from a scientific perspective, specifically in terms of conducting research and producing knowledge. Nevertheless, in several cases, those conducting research were also involved in interactions with end users, designing aids for people and their related activities. The approach to scientific integrity, understood as adapting scientific activity to the needs of the people for whom the research is carried out, therefore appears to be almost absent.

The melting pot experience was positive, with all interviewees considering it highly beneficial to have worked in an environment rich in cultures, nationalities, and languages, which required the daily use of English. It is also noteworthy that as this is an institution based in Italy, all interviewees regarded internal career opportunities as significant and not determined by factors that are decisive in the Italian context, such as age, geographical origin, or cultural background. However, much remains to be done regarding gender equality, as currently, out of approximately 74 Principal Investigators and 16 Facility Coordinators – who are responsible for a research unit or facility, lead scientific activities, and coordinate team members – the majority are men (www.iit.it/en-US/about-us/principal-investigators, last accessed 1/12/2026): 20 women and 54 men PIs, and 6 women and 10 men Facility Coordinators.

Furthermore, the IIT has not always significantly contributed to people's careers, and career paths and growth opportunities have been unclear for most. Even in areas supporting research activities, such as administrative

or technical roles, staff turnover remains fairly high, partly due to a lack of incentives for growth, professional stimulation, and clarity about possible career paths.

These findings should be considered preliminary insights within an ongoing investigation that will continue over the coming years. Thus the institutional specificity and participants' positive perceptions of the institute does not undermine the structural dynamics identified, which merit deeper reflection. These accounts indicate that while the research environment offers a prestigious 'scientific launchpad', the transition to the labour market often reveals a stark contrast with the private sector, where, as observed in two cases, there is a more explicit and "positively stressed" focus on "diversity inclusion and employee well-being".

This work is expected to stimulate further internal discussion at IIT and, more broadly, to contribute to comparative reflection among similar research institutions facing shared challenges related to career development, GEDI awareness, and the alignment between scientific excellence, organisational practices, and societal impact.

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Ethics Declaration: Participants were informed in advance about the aims of the initiative and agreed to take part in the interviews by signing an informed consent form, compliant with GDPR, prepared by the legal and ethics department at IIT. They were also assured that the results would be anonymised and pseudonymised to prevent the identification of individuals who participated.

AI Declaration: AI-based tools were used to support the transcription of interviews and to assist in the preliminary synthesis of their main contents, which were subsequently reviewed, interpreted, and further elaborated by the authors.

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