

Perspectives from the Netherlands on women in science

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Abstract

The first woman to graduate from a Dutch university achieved that milestone more than 140 years ago in 1879, yet women's participation in science in the Netherlands still needs to improve. This paper presents and puts into perspective the country's latest figures for gender participation in science. It also discusses recent developments in the Netherlands regarding gender and diversity, particularly for women in science. Finally, the paper reflects on measures to increase women's participation in science in terms of both research and policy, and in relation to current Dutch developments in science communication.

Keywords

Women in science, responsible research, science communication

1. Introduction

On 20 April 1871, Aletta Jacobs became the first Dutch woman to be admitted as a *regular* student to a university in the Netherlands. She studied medicine at the University of Groningen, completed her exams in 1878, received her PhD in 1879 and then initiated her own medical practice in Amsterdam. While working as a physician, she also became actively engaged in the feminist movement. From 1903, she focused solely on activism. Interestingly, the papier-mâché models she used to study the female uterus and its various stages during pregnancy were preserved; in 2022, they became part of the main exhibition, 'The Milk of Dreams', at the Biennale in Venice, composed for the first time by a woman, the Italian Cecilia Alemani (Wils, 2008).

In 1626, more than two centuries before Jacobs, Anna Maria van Schurman received special

permission to attend classes at Utrecht University. However, onerous conditions were applied: she had to sit behind a curtain and was not permitted to graduate. At that time, women in Dutch society were generally considered incapable of logical reasoning and too emotional; their sole responsibility was ideally to take care of their children. Therefore, Jacobs's admission to the university in the nineteenth century opened the door for other female students (Wils, 2008).

Nowadays, the situation in the Netherlands has changed, although the arguments that women are less capable of scientific reasoning and should

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instead care for children are sometimes still heard. Women's participation in the workforce is generally quite high, with the Netherlands ranked seventh in the European Union (EU) in 2020 according to statistics from the Netherlands Institute for Social Research (CBS and SCP, 2020). However, about 75% of Dutch women work part-time, which is much higher than the EU average of about 30%. At the same time, the payment gap between men and women in the Netherlands is about 15%, while only about 30% of managers in the country are women. On both metrics, the Netherlands performs worse than most EU member states. Progress has been made in reducing these differences over the past 20 years, but the Netherlands has never been a frontrunner in gender equality, both regarding women working in science positions in particular and women in other types of jobs.¹

Every three years, the European Commission publishes *SheFigures*. It is the main source of pan-European, comparable statistics on the state of gender equality in research and innovation. The report contains data on about 88 indicators. The 2021 edition confirms that the Netherlands performs below the European average for women's representation among the highest levels of academia. This includes ranking for grade A positions in research and innovation. The Netherlands also performs below the EU average for the percentage of self-employed individuals in science and engineering and for those who work as professionals in ICT (information and communications technology). For the latter two groups, the country ranked 21st of the (then) EU28 member states (European Commission, 2021a; Portegijs, 2022; DJA and LNHV, 2021).

On the positive side, the most recent data indicates improvements on many of the indicators for women's representation in the workforce. For example, although still below the European average of 26%, women's representation in grade A positions in research and innovation increased from 18% to 22% between 2015 and 2018. Moreover, the percentage of higher education institutions headed by women rose from 18% in 2017 to 23% in 2019 (European Commission, 2021a, 2021b). However, patent application statistics show that women's representation among inventors has not improved, while the research funding success rate for women

is still lower than for men: the percentage point difference was 3.0 in 2017 and 3.9 in 2019.

Despite the low representation of women in positions in higher education management, the past two decades have seen a sharp increase in the number of women at various other levels in the sector. At the end of 2020, for the first time in the country's history, more than 25% of university professors were female (25.7% precisely), in contrast to 6.5% in 2000. Therefore, the national newspapers extensively covered this achievement. Much of the increase has been achieved in the past five years. Pursuant to a request from the Dutch Platform for Women Professors, the target for 2025 is for one in three professors to be women, which is considered an important milestone to reach a critical mass tipping point (DJA and LNHV, 2021).

Analysis of the general pattern of women's representation in higher education reveals a strong decline in the percentage of women at each step of the academic ladder. Among undergraduate students, the proportion of women (50.6%) is slightly larger than that of men, while women make up 53.5% of graduate students. However, the proportion of women in PhD positions is just 44.4%, representing a significant drop. For each next step, the percentage of women falls, and only 43.5% of assistant professors, 30.4% of associate professors and just 25.7% of professors are female (DJA and LNHV, 2021).

The above-mentioned *SheFigures* data confirms the same figures for positions of women in research and innovation more generally in the Netherlands (European Commission, 2021a). It is, therefore, relevant to discuss the position of gender equality in debates about science and innovation in the Netherlands, and to explore what measures are being undertaken to increase gender equality in science. It is also important to consider what can be expected of universities as major higher education institutions regarding their efforts to improve the situation. In this paper, I discuss the case of the Netherlands within broader policy debates in Europe, such as developments in responsible research and innovation (RRI) and the transition towards open science. Finally, I reflect on gender equality in relation to current Dutch developments in science communication.

2. A European perspective on gender via the notion of RRI

RRI has played a key role in policy developments, significantly influencing European funding programmes such as Horizon2020. The concept emerged from discussions about responsible innovation, such as the nanotechnology debate in the UK in the 2000s (Rip, 2014; Van Oudheusden and Shelley-Egan, 2021). The most cited definitions are from Von Schomberg (2013) and Stilgoe et al. (2013), which emphasise an interactive process, a mutual responsibility for parties on both sides, and taking care of each other in science and innovation.

According to Von Schomberg (2013: 63), ‘Responsible research and innovation is a transparent, interactive process by which societal actors and innovators become mutually responsible to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)’. Additionally, Stilgoe et al. (2013) contended that responsible innovation means taking care of the future through collective stewardship of science and innovation in the present. A specific role for gender or gender equality is not mentioned.

Only the European Commission indirectly refers to gender, which is proposed as one of five key areas to make the concept tangible, by adding the word ‘inclusive’: ‘Responsible research and innovation [RRI] is an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation with the aim to foster the design of inclusive and sustainable research and innovation’. The other four key areas to work on are public engagement, open access, ethics, and science education. Governance of the whole process is seen as an overarching dimension that helps in integrating the five key areas (European Commission, 2018; see also Schuijff and Dijkstra, 2019).

One approach to addressing the gender dimension is the inclusion of concrete indicators, as illustrated by the MORRI (Monitoring the evolution and benefits of responsible research and innovation) project (Myers et al., 2020). Concluding that bringing RRI

into practice remains challenging, Schuijff and Dijkstra (2019) distinguished various themes from relevant studies: *opening up* to stakeholders and the public; *stimulating reflection* on the research and innovation process among researchers and innovators; *ways of anticipating ethical, legal and socio-economic aspects* of research and innovation; and the *institutionalisation of responsibility* through governance or research and innovation processes. Thus, in the studies they reviewed, neither gender nor gender equality was a main topic addressed in these practices. Recent papers discussing 10 years of RRI studies also do not mention gender, other than as a key area in the European Commission’s definition (Owen et al., 2021; Van Oudheusden and Shelley-Egan, 2021). An exception in the literature is Wojniak’s (2017) discussion of RRI projects dealing with gender equality, which concludes that specific strategies for increasing gender equality are often lacking. Wojniak (2017) also observed that EU involvement with the gender dimension contributes to positive changes.

Open science could be seen as building on RRI within European policy developments, and is encouraged from within the European Commission and by UNESCO’s recommendations (European Commission, 2021c). Its main emphasis is on making research and data accessible and openly available. More recently, the transition towards open science has also highlighted the key role of science communication in making scientific knowledge accessible to the public. Notably, however, the specific key areas in the European approach to RRI are not explicitly included anymore. What implications does this have for the position of women in science, and what, in particular, are the influences on Dutch developments?

3. Dutch developments influencing women in science

In the Netherlands, several parallel processes over recent years at least partly explain the current position of women in science.

One relevant development concerns the assessment of academic quality in the Netherlands. Research excellence has, for many years, including

in the Netherlands, been assessed mainly by the impact factor, which has been recognised as disadvantaging women. In May 2013, the San Francisco Declaration on Research Assessment (SFDORA) was published to challenge the idea that research output can be represented by the impact factor only. This worldwide initiative declared a need to improve the ways in which scientific output is measured. In 2018, DORA was taken up more broadly, and various pilots, including in the Netherlands, were conducted to test practical measures, such as using narrative CVs. To share these experiences and possible improvements, the Funding Organisations for Gender Equality Community of Practice started to embed such initiatives.²

For example, the Dutch Research Foundation (NWO) piloted narrative CVs in a funding scheme in 2018.² In 2019, DORA inspired the main Dutch public-knowledge institutions and research funders (VSNU, NFU, KNAW, NWO and ZonMW) to publish a position paper. The organisations declared the need for a new way of recognising and rewarding researchers and suggested modernising the assessment system for researchers' positions in academia. As the position paper explains, current societal challenges increasingly demand that scientists work in multidisciplinary teams and cooperate with others. Hence, the skills required of researchers cannot be adequately assessed by focusing mainly (or even solely) on the impact factor. The position paper also observes that researchers routinely deal with both academic and social questions, which they address by providing academic education at the highest level, conducting academic research and using their knowledge to influence society; for those who work in university medical centres, this impact includes providing patient care (VSNU et al., 2019).

According to the position paper, a new system requires cultural changes, coordination at the national and international levels, and collaboration among researchers. First, a diversification and vitalisation of career paths would allow research institutes to make better use of the talents and motivations of academics by promoting excellence in areas besides research. Second, such a new system should acknowledge the independence and individual qualities and ambitions of academics while also recognising team

performance. Third, in such a system, the quality of work should be valued over quantitative outcomes (such as the number of publications). Fourth, all aspects of open science should be encouraged. Finally, the system needs to stimulate high-quality academic leadership (VSNU et al., 2019).

It is expected that such a new approach would allow more diverse and dynamic career paths and lead to lower work pressure (VSNU et al., 2019). Encouraged by the position paper, Dutch universities have started developing plans to implement new ways of recognising and rewarding their researchers.

A second, parallel development is the transition towards (more) open science. In the Netherlands, the National Programme for Open Science (NPOS) brings together national stakeholders to facilitate this transition and disseminate its importance. In their words, 'Open science refers to the global transition towards a new, more open and inclusive way of conducting, publishing and evaluating scientific research' (NPOS, 2022). The aim is that, 'By 2030, scientific knowledge will be freely available, accessible, and reusable for everyone. Open Science in the Netherlands will be embedded as a standard practice across all scientific disciplines from basic to applied sciences, in the natural, medical, social sciences and the humanities' (NPOS, 2022).

A rolling agenda has been formulated with four strategic goals for 2030: first, to work towards societal engagement and participation, for example by including citizen science; second, to work towards inclusive and transparent scientific processes, for example by taking into account the recognition and rewards recommendations; third, to achieve open scholarly communication, for example by removing barriers to scientific knowledge; and, finally, to make research outputs both FAIR (findable, accessible, interoperable and reusable) and open, as far as regulations allow (NPOS, 2022). Gender equality touches upon at least the first two goals.

4. The pandemic academic: A harsh reality for women

Amid rising awareness of women's position in science and several advances towards more diverse and inclusive science and innovation, COVID-19 erupted in

Spring 2020. Two years after the pandemic was declared, several studies have reflected on its impact on academia and the lives of academics. A report by the Royal Netherlands Academy of Arts and Sciences (KNAW, 2022) emphasises that the research community played an important role in generating knowledge to overcome the crisis. While some ongoing research projects were disrupted, new collaborations and COVID-19-related research projects were initiated at the same time. In addition, academics attained a more prominent role in the public domain. However, the report also notes that the pandemic has highlighted cracks in the Dutch academic system, as many academics are facing heavier workloads and have less time available for research. This particularly applies to both men and women with children or care duties. In particular, ‘Female academics with children reported experiencing more work–family conflict than their male counterparts’ (KNAW, 2022: 33). This aligns with findings from the general population, in which women undertake the majority of care work (CBS and SCP, 2020). Female academics were not excepted from this care work. Such developments may set back gender diversity in academia (Waaier et al., 2016). Furthermore, a gender gap was found in the number of published papers and citations across disciplines during the pandemic (KNAW, 2022).

An explanation of why women have been more affected than men is found in survey data about women’s experiences during the pandemic, reported by The Young Academy (De Jonge Academie, DJA) and the Dutch Network of Women Professors (Het Landelijk Netwerk Vrouwelijke Hoogleraren, LNHV). The report revealed that Dutch female academics were more likely to be working in early-career positions and on temporary contracts. Moreover, Dutch female academics also experienced more stress about their research progress and future in academia. The report concludes that, in the Netherlands, those most vulnerable were hit the hardest (DJA and LNVH, 2021). Relatedly, Myers et al. (2020) found that 61% of postdocs among surveyed US and Europe-based scientists believed the pandemic had negatively affected their career prospects, thereby confirming the same trends for women academics in international context during the first period of the pandemic. The increase in work pressure during the pandemic particularly affected Dutch female academics in contrast to men, again reflecting women’s

greater responsibility for care duties, for example, relating to young children and elderly parents (DJA and LNHV, 2021).

The KNAW study makes six main recommendations for levelling the playing field and preventing a lost generation. First, it recommends monitoring the long-term impacts of the pandemic for at least the next two years, including monitoring changes in their academic careers, research practices and the research community as a whole. Second, certain processes could be made faster and more efficient. A third recommendation is to rethink established practices, while a fourth is to develop science communication from merely explaining facts towards dialogue and let it become an integral part of academic education. A fifth recommendation is to increase team collaborations within the academic community. Finally, the study pleads for critical reflection on the role of big tech (KNAW, 2022).

5. More insights on the obstacles experienced by Dutch women in science

In 2021, the Rathenau Institute collected Dutch survey data about researchers’ and lecturers’ motivations to work in academia (Koens et al., 2022). Previous studies in 2014 and 2018 collected data from researchers only (Koens et al., 2018). The backdrop to the 2021 study was increasing support for the Recognition and Rewards programme (VSNU et al., 2019) and the Open Science developments (NPOS, 2022), alongside rising awareness of and attention to diversity and inclusion. The influence of the pandemic was also taken into account. The survey results portray findings from the outcomes in practice. Moreover, the survey questionnaire was adapted to capture the situation in 2021. Female respondents indicated that their personal situations, especially their family status and care duties, hinder their career ambitions. Among those based in universities or medical research centres, women mentioned these barriers more than men (43% versus 33%). Also, one in six women mentioned their sex as a reason for experiencing barriers, while only one in 19 men did so.

The Dutch Ministry of Education, Culture and Science (Ministerie van Onderwijs, Cultuur en Wetenschappen, MECS) commissioned the Technopolis Group to study why women leave academia. The study was published in September 2022, and its data, which was collected from a survey and follow-up interviews, confirmed findings from previous studies (Van Belle et al., 2022; MECS, 2020). It showed that both women and men leave academia because of limited career perspectives, a negative work ethos and temporary contracts. Also influential are cultural aspects such as relationships with supervisors and the difficulties of finding a good work–life balance (Van Belle et al., 2022).

The study report overviews a broad range of work-related factors contributing to the decision to leave the academic field: the perception of working in science, the high work pressure, poor work–life balance, uncertainty about contracts and thus finances, and the need to work unpaid office hours. Furthermore, personal factors such as children or having a partner influence the decision to leave academia. There are also important national factors, such as the short duration of pregnancy leave, the limited parental leave of both women and men in the Netherlands, difficulties in access to childcare and pressure caused by the high costs of childcare. Other factors include negative work habits, the high level of competition in the sector, temporary contracts, and secondary working conditions. More local aspects of organisational culture also play a role, such as the relation with one’s supervisor, one’s acceptance of work–life balance and the availability of role models. Finally, the decision to leave may be influenced by organisational policy, transparency about conditions and possibilities, and a clear application to policies (Van Belle et al., 2022; see also Waaijer et al., 2016).

Particularly during the interviews, the respondents also mentioned reasons to stay in academia. The three main positive factors were, first of all, work content; second, personal aspects related to organisational culture and work habits in the science field, such as independent working; and, third, the high level of autonomy and freedom over topic choices (Van Belle et al., 2022).

Finally, the study gives multifaceted recommendations for improving women’s position in science (Van Belle et al., 2022). At the national or research-field level, entitlements to longer periods of

pregnancy leave and longer parental leave for both partners should be extended; revised funding schemes can reduce competition; and adaptation of assessment and evaluation procedures is recommended. At the EU level, reflection on assessments and evaluation procedures would encourage reformulation of what makes research good. A final recommendation is to enable other or more diverse career options within the scientific system. In particular, fewer temporary contracts can stimulate women’s career prospects and potentially reduce competition. At the organisational level, the report recommends improving supervision and rewarding mentorship; recruiting and promoting more role models; increasing transparency in assessment and rewards for scientists; and developing policies that enable better work–life balance (Van Belle et al., 2022).

6. Final reflections

This final section reflects on how science communication can contribute to improving women’s position in science. A recent pilot project with the title ‘Science communication by researchers: Valued!’ evaluated Dutch researchers’ views on the increasing demand to communicate about science and explored their needs and barriers in fulfilling these tasks (Van der Putten, 2022). Currently, science communication efforts are perceived as a task without a formal position in the academic profiles of researchers, despite the growing importance of the science–society relationship. Outcomes of the project show that researchers see science communication as a part of their work that they value and to which they attach importance (Van der Putten, 2022).

According to the project report, four recommendations can be made for formalising the role of science communication in academic research. The first is to align science communication with the open science policy; it can play a role in the transition process. A second recommendation is to recognise science communication as a core task in researchers’ career profiles, alongside conducting research, delivering education and providing academic leadership. This would fit with the Recognition and Rewards programme and the broadening of tasks recognised in researchers’ academic careers. The third suggestion is to integrate elements of science communication in every stage of the

research process, from the start to the end, as a planned activity. Finally, it recommends valuing science communication as a profession with expertise and collaboration with communication professionals and their networks. This includes making science communication training and education available to all researchers who want to communicate, raising awareness of and increasing skills in various ways of engagement, and bringing together scientists who are interested in science communication, thereby building networks and communities (Van der Putten, 2022). Although women's position in science is not expressly mentioned, the report suggests experimenting with new forms of science communication that explicitly focus on diversity and inclusion and calls for sharing experiences of both successes and failures.

Overall, the report's recommendations seem to fit well with the call for recognition and rewards and a broader assessment and evaluation of researchers' tasks. Furthermore, science communication can play a role in the transition towards open science. While access to scientific knowledge can be explained as a democratic right, as well as a moderator for diversity and inclusion, that knowledge is not accessible when not communicated well. Knowledge and experiences from science communication and the communication dynamics are then important. People need translations and guidance in engagement processes to be better equipped to take well-considered decisions. Public engagement, as one aspect of science communication, can be considered an enabler of open science (Boon et al., 2022; Van der Putten, 2022).

In summary, attention to women in science, gender equality, and diversity and inclusion is rapidly increasing. This is a promising development that may accelerate the rise in women's representation in science, especially in higher positions. However, to resolve the ongoing imbalances, continuous attention to training and awareness-raising is needed at the policy level, at the institutional level of universities, and at the individual level. Training and increasing the awareness of researchers can be a stimulating factor in reducing imbalances as soon as possible.

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Notes

1. In the English language, the word 'science' is preserved for the natural or physical and applied sciences (see definitions below); however, the Dutch translation of '*wetenschap*' has a broader meaning that also includes research from other fields (see comparative definition below). As this paper presents a Dutch perspective, therefore, 'science' refers to research from the natural, medical, and social sciences and humanities.

Two definitions of 'science' in English: 1) **Cambridge Dictionary** (<https://dictionary.cambridge.org/dictionary/english/science>, last accessed 26 September 2022): (knowledge from) the careful study of the structure and behaviour of the physical world, especially by watching, measuring, and doing experiments, and the development of theories to describe the results of these activities: pure/applied science; recent developments in science and technology; space travel is one of the marvels/wonders of modern science. 2) **Oxford Advanced Learner's Compass** (<https://www.oxfordlearnersdictionaries.com/definition/english/science?q=science>, last accessed 26 September 2022): knowledge about the structure and behaviour of the natural and physical world, based on facts that you can prove, for example by experiments: new developments in science and technology: the advance of modern science/the laws of science.

A Dutch definition of '*wetenschap*' (Van Dale online, <https://www.vandale.nl/gratis-woordenboek/nederlands/betekenis/WETENSCHAP#>. YzFps0zP2Uk; last accessed 26 September 2022): *we-ten-schap* (de; v). 1: **het weten**; = **kennis**; 2: (*meervoud: wetenschappen*) *het geheel van kennis en de manieren om die te verwerven: natuurwetenschappen natuurkunde, scheikunde, geologie enz.; sociale wetenschappen sociale geografie, culturele antropologie, economie, pedagogiek, politieke wetenschappen, sociologie enz.* [(knowledge, plural sciences) the whole of knowledge and ways to collect knowledge: natural sciences, physics, chemistry, geology, etc.; social sciences, social geography, cultural anthropology, pedagogy, political sciences, sociology, etc.]

2. See details about DORA at <https://sfdora.org/>.

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