

MANAGEMENT

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TRENDS IN SCIENTIFIC ACTIVITIES DEVELOPMENT IN POLAND

In recent years, Poland's development in research and experimental development (R&D) has garnered significant attention. The "Poland 2020 Development Trend Report" indicates that R&D expenditure in Poland reached 1.2% of its GDP in 2020, underscoring the country's commitment to scientific research [1]. This article provides a comprehensive analysis of the trends in scientific activities in Poland, particularly highlighting the country's investment in Research and Development (R&D) within natural sciences and engineering. By examining the ratio of Poland's R&D expenditure to its GDP and analyzing the growth trend of gender diversity in the scientific field, the article reveals the significant role of the business sector in driving technological innovation. Moreover, it emphasizes the positive impact of EU policies on Poland's scientific activities, especially in enhancing research capabilities and international collaboration. Overall, the article demonstrates Poland's active development phase in the global scientific arena through increased R&D investment, promotion of gender equality, and strengthened partnerships with international allies.

Overview of R&D Expenditure in Poland. R&D is a key component of economic development and productivity in many countries. Poland's R&D expenditure, reported at 1.2%, stands in contrast with the 2.1% average for other countries. In recent years, Poland has shown steady growth in R&D expenditure, with the business sector playing a dominant

role. This reflects the active role of the private sector in driving technological innovation [1].

Gender Ratio. Women constitute about half of the overall workforce. However, since 2005, the proportion of women in R&D firms has been decreasing (Polish Research Council, 2011). Despite a higher percentage of men in the Polish R&D sector, female participation is on the rise, indicating a positive shift towards gender diversity (Poland 2020 Development Trend Report, 2021). In 2020, the feminization rate of internal R&D personnel in Poland was 35.1%, with a higher rate of 38.2% in the service sector (Figure 1).

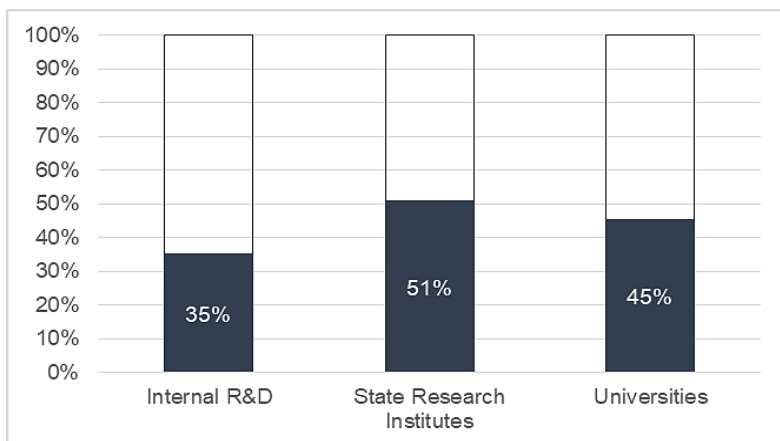


Figure 1. Feminization Rate in Different Sectors in Poland

Source: Poland 2020 Development Trend Report, 2021

Notably, 88.8% of female researchers in this sector were actively engaged in research functions. Nearly three-quarters of these women (72.8%) worked in specialized research entities. The highest feminization rates were observed in State Research Institutes (50.8%) and universities (45.4%) (Figure 2). Additionally, 47.4% of internal R&D personnel held at least a doctoral degree, with the highest rates in the service sector (56.8%), particularly in education (87.5%) and scientific research and development (50.6%). This trend could significantly influence the future development of Poland's scientific community.

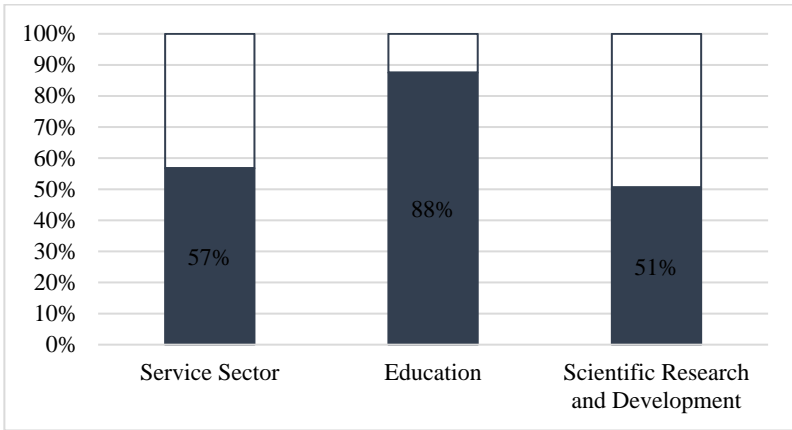


Figure 2. Female Doctoral Degree in Different Sectors in Poland

Source: Poland 2020 Development Trend Report, 2021

To compare feminization rate in different sectors with female doctoral degree in different sectors in Poland, We could find that the doctoral rate of female and feminization rate in different sectors exhibit a positive correlation. The trend of gender diversity in Poland's R&D sector is evident in several areas: 1) Increasing Female Scientists (the number of female scientists is growing, and they are increasingly occupying leadership and management positions in higher education institutions and research organizations); 2) Women in Leadership Positions (female scientists are not only increasing in number but are also becoming more prevalent in leadership and management positions in higher education institutions and research organizations); 3) Policy Push for Gender Equality (the Polish government and scientific institutions are encouraging female participation in scientific research and promoting gender diversity through various programs and policies, such as gender equality projects).

Main Research Areas: Poland's R&D expenditure primarily focuses on natural sciences and engineering, indicating the country's efforts to build international competitiveness in these areas [2]. This expenditure can be further divided into several key areas:

1. Biological Sciences and Medical Research: Polish research institutions are devoted to developing new medical technologies and medications in the field of biological sciences [3].

2. Environmental Science and Sustainable Energy: Emphasis on environmental protection and the development of sustainable energy

technologies, reflecting Poland's concern for global climate change issues [4–5].

3. Information Technology and Artificial Intelligence: IT, especially artificial intelligence and data science, represents a rapidly developing area in Polish scientific research.

Impact of EU Policies on Polish R&D: EU policies, particularly the "European Research Area" program, have positively influenced the development of R&D in Poland. EU funding and policy support have enhanced the research capabilities and international collaboration of Polish research institutions [6].

The future development direction of Poland's research infrastructure will be based on its ability to develop a strong scientific community and contribute to European innovation. Looking ahead, Poland has made notable progress in enhancing women's participation in scientific research, especially in higher education and professional scientific services. These trends indicate that gender balance in the Polish scientific research field is set to improve further, creating more opportunities for gender equality and fostering diversity. Poland's investment in R&D is expected to continue growing, especially in increasing the proportion of female scientists and strengthening cooperation with EU member states. This is anticipated to further elevate Poland's status in the global scientific community.

To improve research efficiency in Poland, author suggests these three actions: 1) support female researchers and promote gender equality in education; 2) increase funding for humanities and social sciences, while maintaining investment in other fields like biology, medicine, environment, energy, IT and AI; 3) participate and integrate more in EU academic activities and use EU resources and experience effectively [7–8].

The report provides an overview of Poland's scientific capabilities and potential for growth as well as highlights some key policy initiatives that can support this progress. Overall, Poland's scientific activities are in an active phase of development. With increased R&D investment, promotion of gender equality, and closer ties with international partners, Poland is poised to have a greater impact in the global research arena.

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