

## Enrollment of women in STEM

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### Abstract

*The aim of this research is to contribute to the development of national policies and strategies for attracting and guiding women in STEM education programs of the Republic of Moldova. The research method is based on national data analyses, statistical trends and econometric forecasting analyses to identify the benefits of increasing the representation of women in STEM areas. The key conclusions are that the enrollment of women in research and education in area of STEM (Science, Technology, Engineering and Mathematics) will contribute to the economic development of a country. The paper presents concrete economic benefits from increasing the number of women in STEM, from creation of new employment to the economic development of the country and in particular in STEM areas.*

*Keywords: STEM, economic development, women implication in development*

*JEL Code: G38 Government Policy and Regulation*

### 1. Introduction

The main problem identified for the study is that women are a minority in science, technology, engineering, and mathematics (STEM) studying and occupations. The problem is not new for Moldova (1.), and it is necessary to identify a solution by studying this issue to propose some policy actions, with consideration of international projects and best practices (2.). Importance of this research is in its contribution to implementation of national policy on gender equality and social equity.

The aim of this research is to analyze the economic potential of achieving a share of 70% of women in STEM by 2050. The study presents

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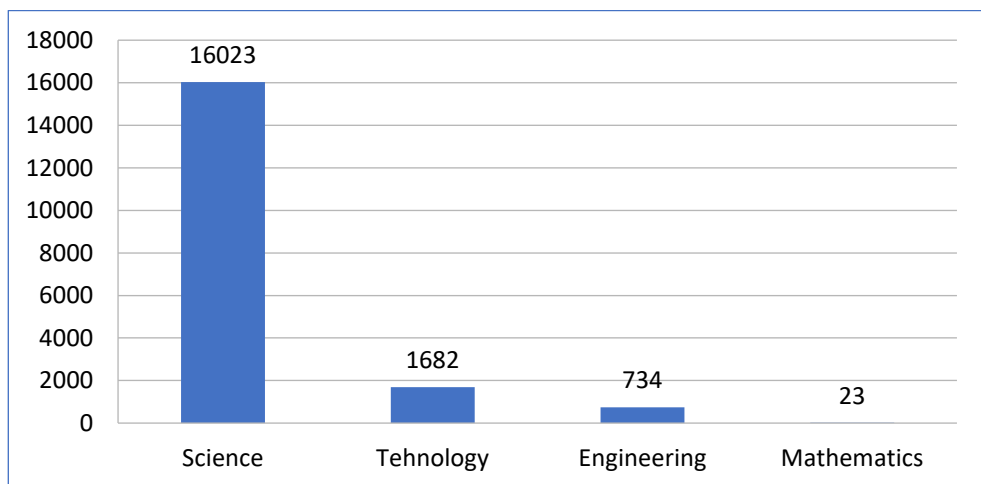
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the potential assessment scenario and should not be considered as a forecasting of future development. The research question is: what if by 2050 the share of women in STEM will be 70%?

The results of research could be useful for national governmental and non-governmental institutions for long term policy decision making on how best to improve the social and economic situation of men and women in Moldova with consideration of gender equity.

In year 2017-2018 only 22.1% of women graduated STEM in the Republic of Moldova, or about 3,5 times less than men - 77.9% (UN Women, 2020, p.1). Women are underrepresented in the area of study STEM (EIGE, 2020, p.1). Only 4.5% of girls do study in the area of Science, Technology, Engineering and Mathematics (STEM) or about 18462 persons in the Republic of Moldova (Robu, 2020, p.5). The Figure below shows the number of girls studying STEM in 2019-2020 in Moldova.

**Figure 1. Women studying STEM in the Republic of Moldova 2019-2020**



*Source: Elaborated by the author, compiled based on data from National Bureau of Statistics*

## 2. Literature review

Although the research subject of gender equity in STEM is new for the Republic of Moldova, there are some successful research results of this subject worldwide.

The research in USA (Ramsey et.al., 2013) demonstrates the importance of a welcoming academic environment for women in STEM, and it also provides a model for how key elements of intensive university programs targeting women can be translated into a more general approach that reaches a wider audience.

Although are search focused to one institution (Perna et.al., 2008) of African American women in STEM fields, the findings shed light on the ways that institutional characteristics, policies, and practices may mitigate the barriers that limit attainment of African American women in STEM fields.

Another important study in USA (Yonghong Xu, 2015) demonstrated significant departure between the earning profiles of men and women within the first ten years of employment. Further, findings indicate that women in STEM occupations experienced multiple earning penalties concurrent with their growing family obligations. To increase the representation of women in STEM fields, interventions are called for to encourage a family-friendly workplace that is open to and supportive of women managing a home and career. Also, incentives are needed to support women's continuation to graduate education as a means to increase their human capital and to level their earning power.

The role of women in STEM in Latin-American and the Caribbean region shows essential differences among countries (García-Peñalvo, 2018). Some countries seem to have good numbers of women in Science such as Argentina – 52%; Venezuela – 56%; Bolivia – 62%; countries like Honduras, Mexico, Columbia, Ecuador and Chile achieve low rates of about 30%. The young women studying STEM programs is much lower than men.

A self-assessment tool was developed (García-Peñalvo, 2019) for assessment the gender equality in higher education institutions of Latin America, an interview protocol for female role models, and a mobile application to show those role models.

In recommending (Diekman, 2015) that STEM organizations develop programs that recognize communal goal pursuits as important to persistence in STEM, we also encourage such organizations to be aware of the subtle and overt devaluing of communal activities.

Leadership in STEM organizations thus should be proactive in clarifying the value accorded to these activities.

In the Republic of Moldova, the gender equality research (EIGE, 2020) is conducted with support from UNWOMEN, and more and more national institutions are involved in the process.

First steps are done (Robu, 2020) on assessment of economic benefits of promotion social and gender equity. The Republic of Moldova committed to promote the social and gender equality and the work is in progress in this area.

## **2. The methodology**

The analyses are based on assessment of the scenarios of future development of the area of STEM in Moldova. The calculations are made in MS Excel, and more advanced tools for long term planning are under consideration for future use. The objective of the research is to model a scenario of achieving 70% of women working in STEM by year 2050 in the Republic of Moldova. In order to model such a scenario an assessment of existing data on women in STEM in Moldova was done, and observation is that in 2019-2020 the share of women in STEM in Moldova was only 4,5%. This value was exponentially extrapolated to year 2050 to see how it change to achieve 70% of women in STEM, and how it impacts other economic indicators.

## **3. Results**

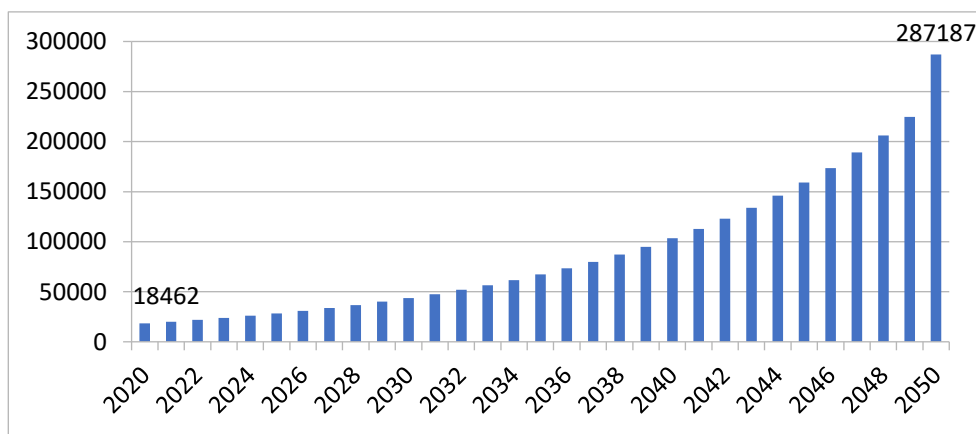
The results are based on the mathematical modelling of a scenario with assumption of having 70% of women in STEM by 2050, based on data for base year 2020. The analyses have shown that about 287 thou. Additional jobs in 2050 due to improvements in gender equality by addressing gender segregation in educational choices and increasing the participation of women

in STEM, or about 70 % of the jobs taken by women. Every year an increase of 9% of number of new girls is foreseen to join the STEM area of study in order to achieve 70% of women by 2050.

It is expected that the increasing of performance indicators will conclude in reduction of the labor costs and to higher volumes of production. The higher involvement of women in STEM will contribute to 5% increasing the production for every 1% of increased number of women in STEM. Or, the 70% of women in STEM by 2050 will result in 15 times higher level of production. As result, it is possible to propose a decreasing from 8 to 6 hours per day of working time by 2050. This will improve the balance of work-vs-family time. The Figure bellow shows forecast of women in STEM in Moldova.

An international comparison of results of this study with EU study (EIGE 2020) have shown that between 6.3 to 10.5 million of new jobs created by 2050 if it will be achieved a target of 70% women in STEM, for Moldova this number is 287 thou. jobs. Every year an increase of 8% of new women in STEM is foreseen in EU, for comparison in Moldova it is 9% to achieve 70% by 2050.

**Figure 2. The women in STEM in the Republic of Moldova 2020-2050, pers.**

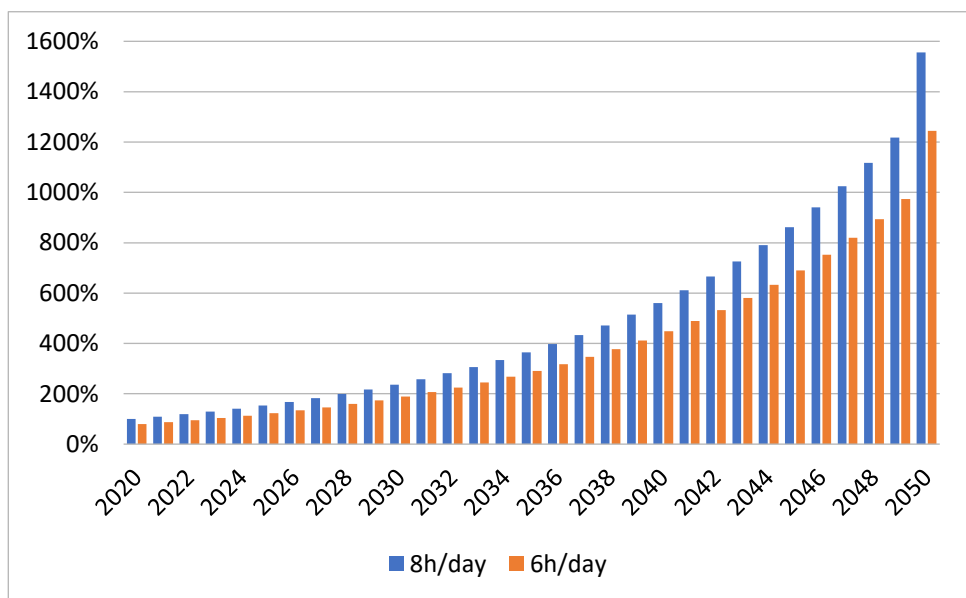


*Source: Elaborated by the author, expert estimation based on assumption to have 70% women in STEM by 2050.*

The results of analyses show that an improvement of the gender equality in area of studying STEM in Moldova will contribute to reduction of shortage of qualified employers, to increased level of employment of women, and to a better productivity.

All the mentioned factors will contribute to the economic development of the country due to improved productivity and increased number of qualified personnel in STEM. The Figure below shows the comparisons of production level by 2050 comparing to year 2020 in %.

**Figure 3. The level of production in STEM in the Republic of Moldova to 2050**



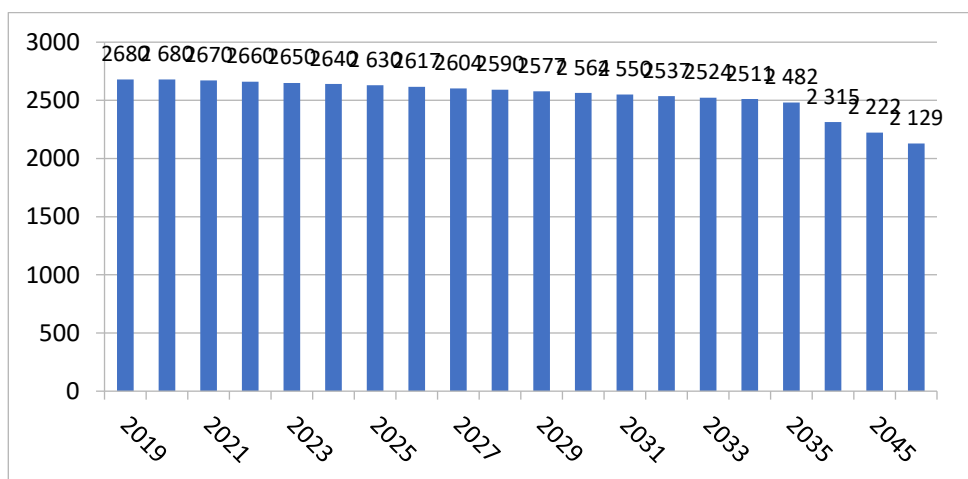
*Source: elaborated by the author, expert estimation based on assumption of 8 or 6 hour of working day.*

It is observed an increase by 1500% of total production in area of STEM by year 2050, comparing to year 2020. The increase is based on assumption that it will be 8 hours per day – the duration of working time. If the duration of working time is considered 6 hours per day then it is observed an increase by 1200% by 2050 of production in area of STEM in Moldova comparing to 2020.

The consideration of 6h/day duration of working time is based on the probability that the high level of productivity will result in increased level of unemployment. It is worth to consider the mentioned factor as an option for future policy making in order to balance the productivity and unemployment rate. An important factor to be considered is the growth rate of population.

The population growth of the Republic of Moldova is forecasted to be negative (World Population Prospects: 2017). In year 2019 the population of Moldova was 2680 inhabitants, for comparison in year 2000 it was 4,3 mill inhabitants. It is foreseen a decrease<sup>1</sup> by -0.38% per year by 2025; by -0.51% per year by 2030; -minus -0.85% by 2050. The trend of decreasing number of populations is mainly due to migration, and decreasing number of children in families. Observed trend in negative growth of population is an important warning for the need in new policy on population for the Republic of Moldova.

**Figure 4. Population forecast of the Republic of Moldova, th. inhab.**



*Source: Elaborated by the author, compiled based on Medium Projection for the Right Bank from UN Department of Economic and Social Affairs/Population Division -World Population Prospects: The 2017 Revision, Key Findings and Advance Tables.*

<sup>1</sup> Medium Projection for the Right Bank from United Nations Department of Economic and Social Affairs/Population Division -World Population Prospects: The 2017 Revision, Key Findings and Advance Tables.

#### 4. Conclusions

Implication of women in research and education in area of STEM (Science, Technology, Engineering and Mathematics) will contribute to the economic development of a country. The main conclusions are as follows:

- about 287 thousand additional jobs are created in 2050 due to addressing gender segregation in educational choices and increasing the participation of women in STEM
- an increase of 9% per year of number of new girls is foreseen to join the STEM areas
- The higher involvement of women in STEM will contribute to 5% increasing the production for every 1% of increased number of women in STEM
- The 70% of women in STEM by 2050 will result in 15 times higher level of production.
- It is possible to propose a decreasing from 8 to 6 hours per day of working time by 2050. This will improve the balance of work-vs-family time.
- The results of analyses show that an improvement of the gender equality in area of studying STEM in Moldova will contribute to reduction of shortage of qualified employers, to increased level of employment of women, and to a better productivity.

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