

# Towards a strategic approach to attracting female students and researchers in the ICT field

Lili Nemeč Zlatolas, Maja Pušnik, Tina Beranič, Marjan Heričko

Faculty of Electrical Engineering and Computer Science, University of Maribor

Institute of Informatics

Koroška c. 46, 2000 Maribor, Slovenia

{lili.nemeczlatolas, maja.pusnik, tina.beranic, marjan.hericko}@um.si

## Abstract.

*Attracting female professionals, researchers and students in the STEM fields has been a growing topic in recent years. By comprehending the importance of diverse teams in all areas, the emerging challenges are also addressed by the Institute of Informatics at the University of Maribor. Therefore, strategic monitoring of actions was introduced in order to attract females in the field of Informatics. In this paper, we address the importance that the academic organisations and Institutions create action plans and follow the guidelines for attracting potential female staff, who can ameliorate the teams at Universities. We present an example of how the action plans are being monitored and extended actively, based on trending guidelines.*

**Keywords.** Gender equality, ICT, Informatics, actions, STEM, strategic monitoring.

## 1 Introduction

In 2018, 17% of ICT students and 16.5% of employed ICT specialists were women (Eurostat, 2018, 2020). In response to repetitively small numbers, the European parliament has started to support empowering women in the digital world strategically ("More women in ICT: empowering women in the digital world," 2018). Many benefits are anticipated from this effort, as Phillips et al. (2014) have found that diverse groups are better at solving problems than the homogeneous groups. Diversity on the other hand also generates more revenue and inspires future generations ("Top Three Reasons We Need More Women In Tech," 2020; "Why We Need More Women In Tech In 2020," 2020). There is a similar mentality at the Institute of Informatics at the Faculty of Electrical Engineering and Computer Science.

Since its establishment in 1993, the Institute of Informatics, which operates at the Faculty of Electrical Engineering and Computer Science at the University of Maribor, has employed and supported female

members. The number of female employees has increased by 129% in the last ten years, due to careful career planning support and a healthy and supportive work environment at the Institute, as well as the creation of strong collaborations and following actions to attract female researchers. To formalise the existing orientations aimed at providing an equal environment, the *Ladies in Informatics initiative* was founded in 2018 ("Ladies in Informatics," 2020). The initiative pursues to unite female scientists with related research interests in the ICT domain. It is growing by welcoming new female researchers and student members, as this is an important focus of the initiative. The initiative's website is presented in Figure 1, and the work and activities within the initiative, which include several key goals (advocate, collaborate, promote, motivate, support and encourage), are presented in Figure 2.

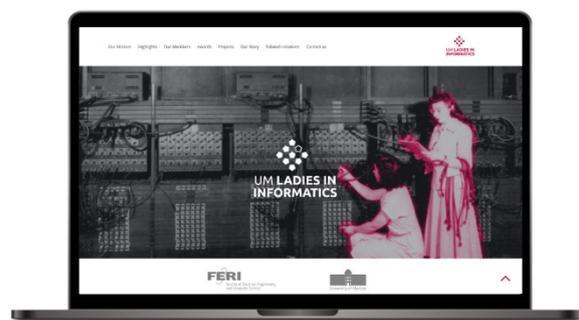


Figure 1. Website of the *Ladies in Informatics initiative*.

Many similar initiatives can be detected, formed to connect women in STEM, and promote actions to improve gender balance because of the underrepresentation of women in these fields. For example, the publication by Informatics Europe presents an excellent groundwork for following actions of bringing more women into the STEM fields (*More Women in Informatics Research and Education*, 2016). We will continue this paper with a review of related initiatives, as well as listed actions to attract more

female scientists. We will continue with the presentation of the indicators, identifying the level of female inclusion possibilities, as well as support in STEM fields. The discussion on how to improve the current status and best practices will also be reported.



**Figure 2.** Goals of the *Ladies in Informatics initiative*.

## 2 Related initiatives

Some initiatives have created actions that could be followed to attract female scientists to higher positions or attract more female students into ICT studies. Initiatives like *IEEE WIE*, *Women in Informatics Research and Education*, *ACM-W*, *Women in Cyber*, *ECSO Women4Cyber*, and *Girls who Code* are formed to increase gender equality in STEM fields and connect females working in these fields ("ACM-W," 2020; "Girls Who Code," 2020; "IEEE Women in Engineering," 2020; "Women4Cyber," 2020; "Women in Cyber – a Manifesto for TODAY," 2019; "Women in Informatics Research and Education", 2020).

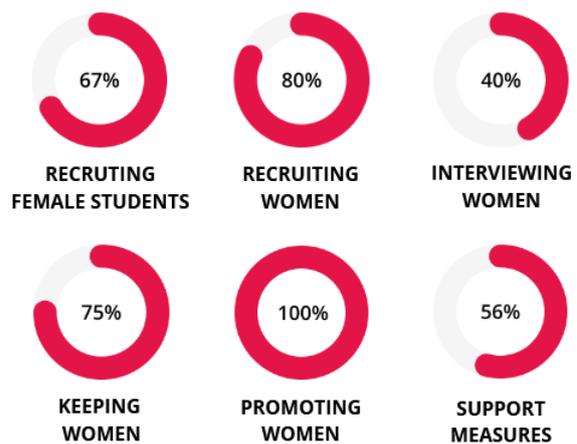
A project funded by the European Commission called *genSET* was carried out, aimed at improving the excellence of European science through the gender dimension in research. Recommendations extracted from this project outcomes included gender diversity in teams, and providing more visibility of women at Institutions ("Increasing Capacity for Implementing Gender Action Plans in Science," 2019; Vasilaki, 2013). One of the recommendations coming from this project was also to create action plans to follow the gender strategies of scientific Institutions.

A guide to improving gender equality in research organisations by Science Europe presents ways of monitoring gender equality, such as defining explicit objectives for gender equality, mandatory actions being taken to meet the objectives, and gender equality data should be collected and made public (*Practical Guide to Improving Gender Equality in Research*

*Organisations*, 2017). Further on, in a publication by Informatics Europe, 48 actions divided into six sections have been proposed to attract more women into Informatics (*More Women in Informatics Research and Education*, 2016). This publication is also used by the Institute of Informatics to measure the actions and monitor the improvement strategically in attracting female researchers and students. The actions from the publication will be presented in the next section.

## 3 Monitoring actions

A checklist of actions from the Informatics Europe publication has been developed at the Institute of Informatics (*More Women in Informatics Research and Education*, 2016). This allows strategical following of actions that are already being carried out, or could potentially be carried out. Brainstorming sessions are organised to discuss possible improvements and provide ideas on how to achieve the proposed actions. In Figure 3, percentages of the achieved levels of suggested actions from the six sections are presented for the Institute of Informatics. Some of the actions are already being carried out, due to the Regulations that need to be followed, and some are being evaluated, planned and performed.



**Figure 3.** Achieved level of proposed actions by Informatics Europe at the Institute of Informatics.

Examples of how the measures are being achieved at the Institute of Informatics will be presented next. The Institute promotes success stories of their female researchers and teachers on various channels. One of the members of the Institute won the IEEE Slovenia and IEEE Region-8 student paper contest award as the *first-ever female contestant to win both competitions over nearly thirty years* (News, 2017). This was presented in promotional materials for High School students entering their studies. The effect of the promotion of a female winner has shown an increment

in the percentage of female students at the Informatics and Communication Technologies Study Programme. Another member of the Institute was awarded the prestigious title of *Female Engineer of the year 2019* in Slovenia, and her story was covered broadly in both national and international media (Office, 2020). The promotion of such success stories encourages female candidates to apply for job positions in ICT and creates opportunities for sharing best practices.

The educational and scientific responsibilities show the high success of Researchers or Professors holding a PhD, with numerous publications, excellent scores for pedagogical work from students and a high percentage of leading international projects at the Institute. Further on, the number of female employees has increased at the Institute in the last ten years as they are provided with numerous advantages, one of them being the maternity leave for women in Slovenia (average 12 months), which is always considered when women candidates are being evaluated for success criteria.

Also, there has been a higher percentage of female candidates achieving permanent Assistant Professor positions in 2019 at the Institute in comparison to male candidates. This shows excellent support of the management to achieve higher percentages of female employees in all positions. Joint sporting events are also often organised for staff at the Institute, and support for a personal development plan for researchers is being carried out. These are some of the actions being carried out at the Institute of Informatics. All listed actions are being monitored strategically, based on the publication by Informatics Europe, which has been a foundation for measuring actions attracting females at the Institute of Informatics (*More Women in Informatics Research and Education*, 2016). The actions are divided into six sections:

- Recruiting female students;
- Recruiting women;
- Interviewing women;
- Keeping women;
- Promoting women; and
- Support measures.

In Table 1, six actions present the working ground for **attracting female students** to enrol in the IT studies by using social media, presenting role models and success stories to prospective young students.

**Table 1.** Recruiting female students actions (*More Women in Informatics Research and Education*, 2016)

<b>1. RECRUITING FEMALE STUDENTS</b>
1. Use multiple social media channels to promote events and reach a high number of prospective students.
2. Work with undergraduate open-day coordinators to recruit female student ambassadors and speakers from the

department and industry. While female faculty may choose to volunteer as role models, this costs women their study/research time.
3. Present example stories about women with successful careers in Informatics in recruitment materials and on the departmental website, encouraging female candidates to apply and reducing the stereo - type that Informatics related jobs are for “nerds”.
4. Offer courses and guest lectures on topics that are popular with undergraduate and graduate students and present new opportunities for researchers, such as human-computer interaction, multimedia, lifestyle Informatics, health Informatics or computational linguistics.
5. Include in course descriptions aspects of creativity in tech education and work, such as information and communication design, user interface design or participatory design.
6. Emphasise good prospects for employment in the IT sector for skilled workers and that salaries are above average.

In Table 2, ten actions for **recruiting women** are presented, and the actions point out that women should be broadly welcomed and invited for open job positions.

**Table 2.** Recruiting female students actions (*More Women in Informatics Research and Education*, 2016)

<b>2. RECRUITING WOMEN</b>
1. Advertise openly for all positions, stating that you are an equal opportunity employer.
2. Describe positions in a broad way. State job criteria objectively.
3. State in the recruiting materials and job descriptions that the university/department/institute is committed to facilitating the combination of work and childcare.
4. Emphasise that jobs in Informatics allow for more opportunities for tele-commuting and tele-working, compared to other fields.
5. State that flexible terms of employment are possible, such as working part-time and flexible working hours.
6. Distribute advertisements across a number of channels. For example, send them to women’s networks’ email lists, such as national women in tech networks or networks of female professors.
7. Approach candidates directly. For example, send the advertisement personally to (at least) three women you would like to see in the position. Ask them to apply, or ask them to send it to three other women who they think would be suitable.

8. Allow 3 months for applications to be submitted. Time is needed for the advertisement to reach the right women, and they need time to respond.
9. Take action if too few suitable women apply. For example, extend the deadline for applications and re-advertise the position (inter)nationally.
10. Re-examine the applications and consider re-advertising if the initial list of candidates selected for interview does not include any women.

In Table 3, five actions are presented regarding **interviews** for open job positions.

**Table 3.** Interviewing women actions (*More Women in Informatics Research and Education*, 2016)

<b>3. INTERVIEWING WOMEN</b>
1. Ensure that the composition of the hiring committee is as balanced as possible. For example, ensure that at least 30% of the committee consists of women, with a minimum of two female members.
2. Invite women to the interview not only to see whether they are best for the position, but also to give them experience of being interviewed and increase their status at their own institution.
3. Raise the issue of increasing the representation of women in the department when interviewing women and men and ask how they would approach it. This provides extra tips and also shows the department is serious about the issue.
4. Provide help with solving the “two body problem”, that is helping to find a position for the applicant’s partner.
5. Consider 18 months per child since PhD completion for mothers when comparing candidates for any success criterion, thus reducing the time used to judge the achievements.

In Table 4, sixteen actions are presented for **keeping women**. Supporting females with children, and creating a development plan, as well as maintaining high women’s quotas are significant actions in this section.

**Table 4.** Keeping women actions (*More Women in Informatics Research and Education*, 2016)

<b>4. KEEPING WOMEN</b>
1. Schedule meetings only between 09:30 and 16:30, so carers of young children are able to deal with commuting and childcare.

2. Overcompensate the imbalance of women in the institute by their overrepresentation at institute colloquia. For example, if 15% of the department is female, then make sure women give at least 25% of the talks. Invite external female speakers as well.
3. Organise a course for all senior staff members on unconscious bias. These can cover all diversity issues not just gender equality issues.
4. Provide support for the creation of a women’s network within the department/institute, including secretarial support and a budget for holding events such as lunches.
5. Distribute welcome packages with a booklet that lists childcare options as well as other useful info provided by faculty/institute members.
6. Hold annual discussions with representatives of the women’s network and the head of the HR department.
7. Encourage senior members of staff in the department to act as mentors. This will create a community where knowledge is passed on to new members, keeping women interested in the department/organisation and in the field.
8. Count the hours spent on female support and network issues in the same way as all other departmental commitments and duties. Do not assume that female employees can deal with this extra load in their “spare” time.
9. Fund childcare as part of conference travel expenses for participating faculty and researchers with young children.
10. Fund travel expenses for a partner to go to the conference location during the breastfeeding period.
11. Inquire if conference venues have childcare facilities and personnel, and request organisers to provide attendees with childcare and breastfeeding options. Ensure that conferences organised by your department provide such facilities.
12. Balance the didactic and scientific responsibilities of all staff and make explicit the priorities for evaluating an individual’s performance (e.g., research excellence, students’ satisfaction with courses, contribution to departmental duties).
13. Create an “ambassador” program, or a personal development plan for researchers with high potential. Ensure that at least 30% are women.
14. Upgrade a postdoc position to a tenure track position when there is an excellent female candidate and she meets the criteria specified. Include a mid-term review of progress against the criteria.
15. Provide visibility and self-promotion training for female researchers in temporary as well as permanent employment.

16. Provide coaching and mentoring to female researchers to make them more aware of their attitudes and concerns, for example, how to combine work and family demands and how to deal with the competition for permanent positions.

In Table 5, two actions are presented for **promoting successful women**.

**Table 5.** Promoting women actions (*More Women in Informatics Research and Education*, 2016)

5. PROMOTING WOMEN	
1.	Ensure a reasonable representation of women in departmental or external committees, whilst also being careful not to unduly overload female members of staff with committee membership.
2.	Look for and propose suitable women when asked to nominate candidates for prizes, awards or prestigious tasks (e.g. for reviewing, representing the department internally or externally). Strive for equal numbers of highly qualified women and men on the short list.

Nine **support measures** actions are presented in Table 6. Connection with other females is crucial in succeeding in the ICT field.

**Table 6.** Support measures actions (*More Women in Informatics Research and Education*, 2016)

6. SUPPORT MEASURES	
1.	Consult the women in your department. For example, organise lunch once a month with a different woman, at a different level, and ask her how she views the organisation, her role and her career ambitions and prospects.
2.	Scout for and follow talented female researchers that could be called upon at some future point in time to complete diverse tasks.
3.	Anticipate the retirement of (male) professors by making an inventory of, and initiate training of potential female successors.
4.	Keep track of national and international networks for female researchers. Encourage women to take part in networks.
5.	Find successful role models and create opportunities for both men and women to share best practices.
6.	Monitor the percentage of women at all levels in the organisation. Create specific but realistic targets and action plans. Make the figures public in annual reports and departmental evaluations.
7.	Assign gender representation as a responsibility to a member of the management

team, as well as ensuring it is in the HR department's portfolio. Encourage gender diversity to be championed by both men and women in the whole organisation.

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| 8. | Support the creation of departmental and institutional policy that takes into account the number of children when comparing CVs in all instances related to hiring and promotions.  |
| 9. | Develop a special program for extra tenure-track positions for high potential talent, where the recruitment criteria are based on excellence rather than topic. Consider at least an equal number of female candidates for these positions. |

## 4 Conclusion

The *initiative Ladies in Informatics* was founded to follow the current trends and best practices detected in other related associations. By connecting with initiatives with similar goals, we are also presenting a story and the actions taken to improve the position of women among researchers and students in STEM fields. The checklist of possible actions is monitored and evaluated continuously. Many important milestones were already achieved; however, we expect that development in the forthcoming years will strengthen the measured criteria even further. The list of actions from the publication (*More Women in Informatics Research and Education*, 2016), presented in Tables 1-6, can be used by related initiatives as a checklist to monitor the actions for attracting female Researchers and students. However, since the trends in the domain are changing rapidly, lists of actions will evolve over time, with the first step of extending a list with new actions extracted from the recommended guidelines followed by the related initiatives.

## Acknowledgements

The authors acknowledge the financial support from the Slovenian Research Agency (Research Core funding No. P2-0057) and the European Union's Horizon 2020 Research and Innovation Program under the Cybersecurity CONCORDIA project (GA No. 830927).

## References

- ACM-W. (2020). Retrieved from <https://women.acm.org/>
- Eurostat. (2018). Distribution of persons employed as ICT specialists by sex, education level and age, 2008 and 2018. Retrieved from [https://ec.europa.eu/eurostat/statistics-explained/images/8/8d/V2\\_Distribution\\_of\\_persons\\_employed\\_as\\_ICT\\_specialists\\_by\\_sex%2C\\_education\\_level\\_and\\_age%2C\\_2008\\_and\\_2018\\_%28%25%29.png](https://ec.europa.eu/eurostat/statistics-explained/images/8/8d/V2_Distribution_of_persons_employed_as_ICT_specialists_by_sex%2C_education_level_and_age%2C_2008_and_2018_%28%25%29.png)
- Eurostat. (2020). Girls and women among ICT students: what do we know? . Retrieved from <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20200423-1>
- Girls Who Code. (2020). Retrieved from <https://girlswhocode.com/>
- IEEE Women in Engineering. (2020). Retrieved from <https://wie.ieee.org/>
- Increasing Capacity for Implementing Gender Action Plans in Science. (2019). Retrieved from <https://cordis.europa.eu/project/id/244301>
- Ladies in Informatics. (2020). Retrieved from <https://ladiesininformatics.um.si/>
- More women in ICT: empowering women in the digital world. (2018). Retrieved from <https://www.europarl.europa.eu/news/en/headlines/society/20180301STO98927/more-women-in-ict-empowering-women-in-the-digital-world>
- More Women in Informatics Research and Education*. (2016). Retrieved from <http://www.informatics-europe.org/dl/more-women-in-informatics-research-and-education>
- News, R. W. (2017). Lucija Brezočnik is the first ever female SPC Winner. Retrieved from <https://ieeer8.org/member-activities/women-in-engineering/news-women-in-engineering/lucija-brezocnik-is-the-first-ever-femal-spc-winner/>
- Office, G. C. (2020). Woman Engineer of the Year 2019. Retrieved from <https://www.gov.si/en/news/woman-engineer-of-the-year-2019/>
- Phillips, K. W., Medin, D., Lee, C. D., Bang, M., Bishop, S., & Lee, D. (2014). How diversity works. *Scientific American*, 311(4), 42-47.
- Practical Guide to Improving Gender Equality in Research Organisations*. (2017). Retrieved from <https://www.scienceeurope.org/our-resources/practical-guide-to-improving-gender-equality-in-research-organisations/>
- Top Three Reasons We Need More Women In Tech. (2020). Retrieved from <https://www.forbes.com/sites/forbestechcouncil/2020/03/10/top-three-reasons-we-need-more-women-in-tech/#21bfbb6c15fb>
- Vasilaki, S. M. (2013). Genset: Gender Equality for Science Innovation and Excellence. Retrieved from <https://ercim-news.ercim.eu/en89/ri/genset-gender-equality-for-science-innovation-and-excellence>
- Why We Need More Women In Tech In 2020. (2020). Retrieved from <https://clearsummit.com/posts/why-we-need-more-women-in-tech/>
- Women4Cyber. (2020). Retrieved from <https://ecs-org.eu/working-groups/news/women4cyber>
- Women in Cyber – a Manifesto for TODAY. (2019). Retrieved from <https://www.concordiah2020.eu/workshops/women-in-cyber/>
- Women in Informatics Research and Education (2020). Retrieved from <https://www.informatics-europe.org/working-groups/women-in-icst-research-and-education.html>