The Status of Slovenian Women in Science

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ABSTRACT: Our study, The Status of Women in Science in Slovenia, seeks to establish a baseline of data pertaining to the numbers, salaries, positions and environments for women scientists in Slovenia. The survey was modeled on the Massachusetts Institute of Technology (MIT) and Coache (Collaborative on Academic Careers in Higher Education) surveys. It was tested for clarity with a group of 8 young scientists and the resultant study was sent to more than 11,000 registered scientists from around Slovenia using their email addresses. Overall, a greater percentage of women than men reported dissatisfaction with resources, space, and salary. The data here indicate women earn on average 78% of what their male counterparts earn. Women report roughly 10% smaller offices and nearly 47% smaller labs than their male counterparts, Women reported a lack of fairness in evaluations, limited access to awards, advancement, and recognition and leadership positions.

The challenges for the advancement of the status of women in STEM in Slovenia lie in the 'softer' aspects of the inequalities noted in the survey, the access to mentors, the awarding of awards and the general attitude of the society. With fewer of women in most science disciplines, especially physics and engineering, the challenge remains to find ways to support the women who are there so that they can advance in their career. Such supports include structural changes to the organizations to review the pay and resources provided women to insure equality, to provide more flexible work hours, to encourage mentoring and to actively nominate women for prestigious awards. In the field of mentoring, women seem to be more comfortable with outside mentors and this should be encouraged and strengthened. The more women are known outside of their institute, the more it will be possible for them to serve as role models for others, to be visible for nominations for awards and more they will be able to influence the status of women.

Dealing with societal attitudes toward women in science is not easy and it is doubtful that a single effort will encourage change. Every opportunity should be seized by women themselves to promote other women in science, to "Lean In" to seek advancement and

challenge as Sheryl Sandberg notes and to join other women in science events in schools and community groups.

While the status of women in Slovenia is still challenged, the future is bright as science as a whole is valued by the society. The country is still a young democracy and it understands that the full representation of women is part of the economic engine.

LITERATURE

During the last half of the 20th century and continuing until today, the number of women in the sciences and in engineering has been growing. Yet, men continue to outnumber women, especially in the advanced ranks. In 1999, the benchmark MIT study of the status of women in science noted that there are real and specific differences in the resources and experiences for women in science. Many other studies have been undertaken since that time, and most report on inherent or implicit bias at play as part of the constraints on the advancement of women. Reports provide both quantitative and qualitative analysis addressing items ranging from specific resources to personal feelings of women in their current positions.

WHERE ARE WOMEN?

According to the National Science Foundation, women have outnumbered men in undergraduate education over the last 30 years, and taken together across all disciplines women earn about 50% of all undergraduate STEM degrees (Carr, 2013). A significant fraction (43%) of the scientists and engineers in research and development in the United States are in academia (NSB 06-01 2006, NSF05-304, 2005). In addition, American female scientific and engineering researchers tend to be more often in academic and non-profit settings (NSB 06-01, 2006, National Academy Press, 2001). From 1973 to 2003, doctoral women employed in US science and engineering academia increased from 9% to 30% or 754, 6001. By 2003, the engineering, academic workforce was 15.5% female with women making up 4.6% of the engineering faculty at the rank of full professor, 8.9% at the associate rank and 22.8% at the assistant rank for a total of 2,300 women engineering professors(NSB 06-01, 2006). The current status of women in STEM is varied depending on the specific scientific discipline. Figure 1 shows that the numbers of US women in biology has reached parity but other fields host fewer than 40% of work force are women. This is in the face of a typical situation such as the report by the US Bureau of Labor Statistics that women made up over 46% of the total workforce and in Canada women comprised about 47.3% of the workforce. For example, in the fields of engineering, computer science and physics over

80% of the degrees went to men while women earned the majority of degrees in biology, chemistry and some of the social sciences. Since then situation has been erratic at best with more women receiving degrees in astronomy and atmospheric science and fewer women earning degrees in computing and mathematics.

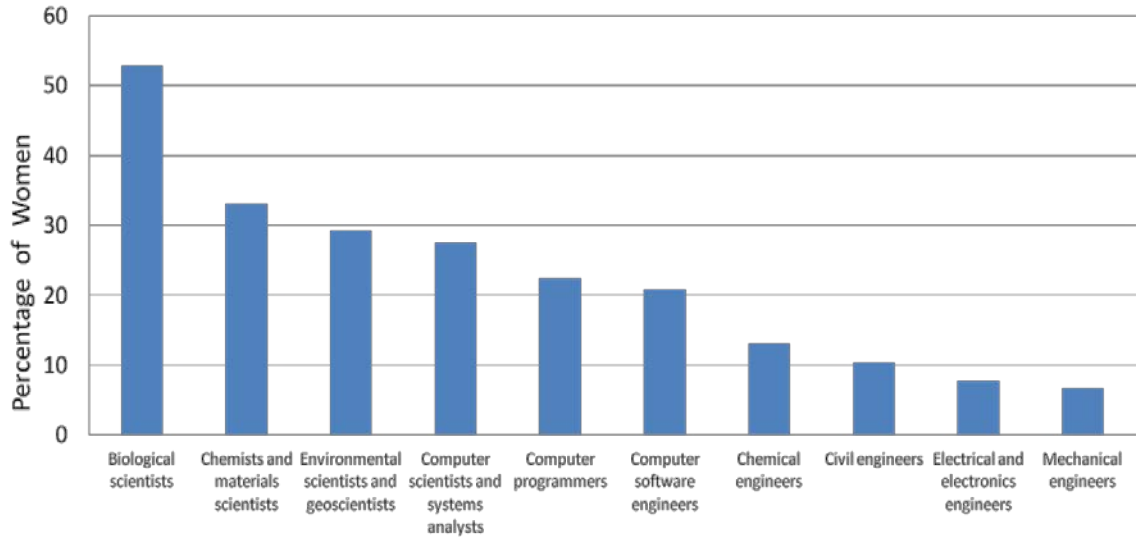

Figure 1: Percentage of Employed STEM Professionals Who Are Women, 2008 (AAUW)

WHY DOES IT MATTER THAT THERE ARE FEWER WOMEN IN STEM?

When the lack of women in STEM fields is noted as a cause for concern, it is often framed in terms of economics as well as national interest. If a country is not fully tapping the talents of its citizens, it cannot work to its fullest potential. The country is not getting the fullest return on its human resource investment. Having women fully represented in STEM can address the skills shortage in STEM. It provides the industry with a broader base of talent upon which to build and create new ideas. Problem solution is partly based on experiences and style. Women and men, in general, approach problems differently. “It is not that their systems are better or worse than men, it is that systems are just different” (JR Becker , 1995, 165). Many articles also chronicle the different leadership styles held by men and women (Bryant, 2013) Innovation leads to strong financial growth and performance. And, ultimately, a STEM workforce that is supported by all of its citizens can lead to increased national economic growth.

WHY ARE THEY NOT THERE?

Why then, if there are women graduating with degrees in the STEM fields, are there not more women in these positions, especially in academic positions (Figure 2) Why are such a large percentage of US women not choosing to work in engineering research as professors? The published history of the status of women in STEM, especially academic positions, has been noted as a "leaky pipeline" (Holton, 1995, p8) rather than due to one or even two specific causes. As early as the mid-1960s reports (Rossi, 1965) indicated that women were not represented in the same numbers as their male counterparts in science and engineering. In fact, Rossi noted that only 1% of the positions in academic STEM fields (except for Biology) were held by women. Certainly they are faced, at the end of their doctoral research studies, with the difficult choice of pursuing positions in academia, working in private industry or government, or selecting a totally different career or life path. Many women doctoral students report that they have no intention of pursuing an academic career based on what they have seen at their own institutions (Thomson, 2000). Two issues arise which may deter them from pursuing academia: small or inexistent numbers of women in their academic field and/ the treatment or challenges they've observed regarding the few academic women they do see at their institutions.

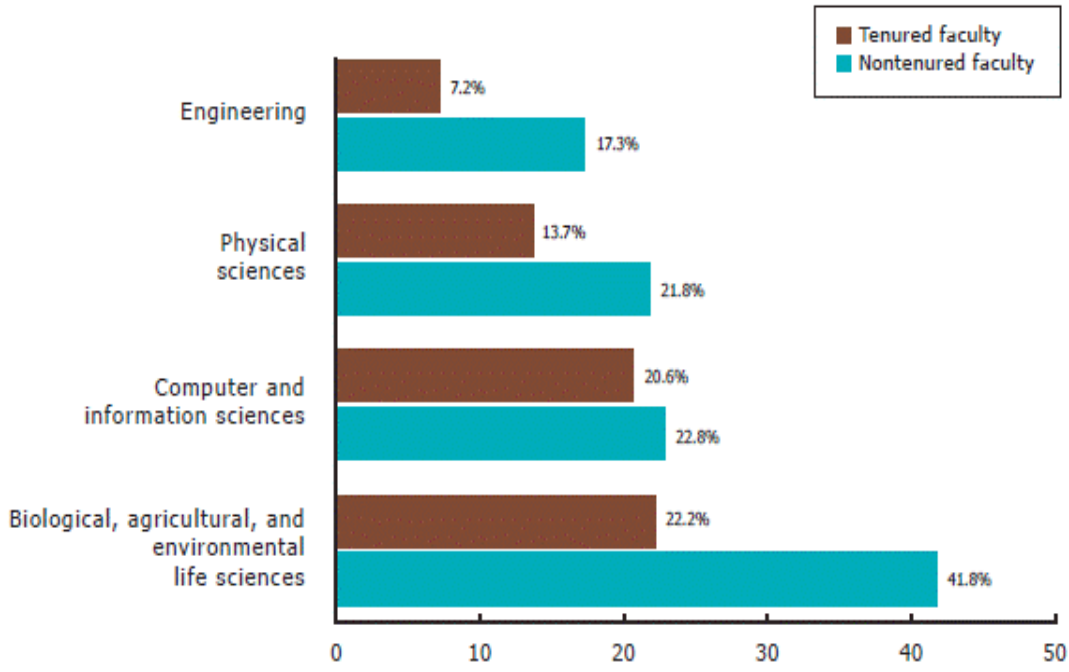

Figure 2: Percentage of Faculty who are Women (Breaking Through Barriers, AAUW)

WHERE ARE THE WOMEN? CURRENT DATA

There is no comprehensive report on the status of women across Europe. But from various reports targeting various disciplines the picture gathered is one of few women in STEM fields. For example, according to materials collected by the Anita Borg Institute (Borg 2014on the status of women in computing fields including information technology, on average 28% of the workforce were women. The report of women as managers in the technical fields shows underrepresentation. Women are 21.6% of all science and engineering managers and of scientists and engineers employed in business and industry in 2003, men, on average, have 12 subordinates. Women have 9 subordinates. In Chemistry in 2007, only 9.2% of all 404 executive officer positions were filled by women; this has risen from 8.7% in 2006. The role of women on boards of directors shows an equally underrepresented situation. In 2007, women were only 12.0% of the 416 board directors. While it was an improvement since a 2006 survey where only 11.1% of its directors were women, it did not surpass the 12.8% measured in a 2003 survey of board directors at chemical companies.

This is not a problem only for the United States. In their report, Tapping Our Talent (2012), researchers report that "Although our universities now graduate large numbers of women in science, technology, engineering and mathematics (STEM), 73%of women graduates are lost from STEM compared with 48%ofmale graduates, with a corresponding loss of researchers. (page 6). The Guardian reported that "Only 13% of the UK's science, technology, engineering and mathematics (STEM) workforce are women. It's not only the underrepresentation of women in these areas that's causing concern, but the high numbers of women scientists leaving their careers, turning down invitations to speak at conferences, and not being represented further up the career ladder – a European Commission study in 2012 found that out of the 42% of women academic staff in the UK, 17% were at the most senior research level, below the EU average." Moreover, In Scotland and similarly in the United Kingdom, less than 30% of those women who graduate in the STEM fields are working in the sector for which they qualified as compared to 52% of male peers. In a report in New Europe (http://www.neurope.eu/article/tech-and-stem-stem-and-tech) it is noted that women make up only about 30% of the IT sector across Europe.

The situation in Slovenia is no less strong. From the small amount of data available it is clear that there are a larger percentage of women working than men (86.6% of all women are working compared to 80.3% of their male counterparts) but they are earning about 77% of

a man's earnings.

WHAT DO THE EARLY SURVEYS SAY?

To understand why women are not more strongly represented in STEM careers, researchers have examined whether there are gender differences in mathematical abilities, why young girls do not show interest in the STEM fields at the same rate as their male peers and whether there is an inequality in the work-life integration or climate or bias in the workplace. In their early studies Linn and Irwing (2004) addressed cognitive differences and concluded that while there are often different cognitive strengths, there are no differences concerning mathematical ability directly related to gender between males and females as relates to mathematics and mathematical ability, though this is often contested and there is no clear consensus. Understanding why girls choose different paths than their male peers is as varied as they are not interested (Turner et al., 2008) because they perceive the field to be too competitive and not socially redeeming, or they are less confident about their STEM abilities, or they do not have access to the various skills (like playing with blocks and building) that foster an interest in STEM or they do not have role models who have chosen a STEM pathway.

The leaky pipeline concerns most related to the research reported here are those that arise due to the climate of the workplace for women in STEM. The benchmark MIT (1999) study of the status of women in science noted that there are real and specific differences in the resources and experiences for women in science. The Coache studies (2007) have also chronicled the status of women working in STEM and identified the lack of clarity concerning the position requirements as well as the rules for advancement (i.e. tenure) as one major imbalance between men and women in the sciences. Additionally they report that women often report less satisfaction in their STEM roles than do their male counterparts.

Preston (2004), among others, noted that work-life integration is difficult for women in STEM fields (i.e. the hours required for lab or field work, the fact that optimal child-birth time often hits just at the end of doctoral studies, dual career couples are often unable to find work in the same locale), women's interests (i.e. collaboration, projects supporting society) are often at odds with the requirements or culture of the position and the lack of mentoring. Others (Moss-Racusin et al, 2012) note instances of bias in hiring.

THE STUDY IN SLOVENIA

Based on what is known of the status of women in STEM in the US and in the EU, we determined that it was appropriate to gather data about the situation in Slovenia and compare it to the world-wide numbers.

Instrument

The instrument was developed based on the MIT survey and the standard COACHE surveys. The first version of our survey, written in English, had 43 questions ranging from demographic data to Likert scale questions on department climate to open ended questions on opinions of the status of women in STEM. Eight individuals were asked to review the survey for readability and comprehensiveness. Based on their input and comparisons to the surveys noted above, the final survey was formulated. While the second survey had the same number of items, changes were made such as finding additional wording to explain a 'mentor'. The final survey was sent out with a cover letter written in Slovenian (Cover Letter, and a copy of the survey questions is available upon request).

The Population

Names and email addresses from over 11,000 registered Slovenian scientists and engineers were obtained from universities, government listings and research institutes. The list was scrubbed for duplicates. Each person was sent an email outlining the project and survey and they were provided with a link to the online form. All participants were promised anonymity and assured that answers would only be used in the aggregate. Where comments were quoted directly, no attribution would be given to the name of the responder. Surveys were sent after the Slovenian National Holiday in early February, 2013.

The Response Rate

After about 10 days more than 200 replies had been collected. A second reminder letter was sent. The current response rate is about 5%. The responses were from 302 (69.1%) women and 134 (30.7%) men. The distribution of fields within science is noted in Figure 3

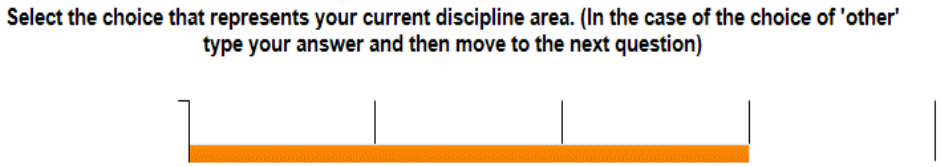

Figure 3: Distribution of discipline areas of respondents

While this is a low rate, two things should be considered. Open surveys are not well known in Slovenia and moreover, Slovenia has only been independent of communist rule since 1991. In that light we believe that the responses provide a realistic insight into the demographics and concerns of the scientists of Slovenia.

Findings: Salary, space and access

When asked whether they felt their resources were adequate to complete their scientific efforts, both men and women are in the majority satisfied with offered set of resources, but many more women (46 % of women respondents) are dissatisfied than their male counterparts (28 %) (Not all respondents answered all questions)

The average salary of the responders is 1785 Euros per month before taxes. The average salary of women who responded on this question is 1571 Euros per month and of men is 1998 Euros per month. More than two thirds of answers on this question are from females. According to the data from this survey, females report salaries about 78% of their male colleagues working in similar positions.

The average office of the responders has 9.91 square meters Women report smaller offices and laboratory space than men. The average office of women who responded on this question has 9.34 square meters and of men has 10.48 square meters. The overall average laboratory research space of the responders has 57 square meters while the average lab of women who responded on this question has 36 square meters and of men has 78 square meters

Findings: Climate

In seeking baseline data concerning the workplace climate, we asked whether respondents felt their evaluation by their supervisor was fair, how interested they felt the senior scientists in their laboratory or department were in their work, and the nature of collaboration with senior scientists. While the majority of men and women felt their evaluations were fair or reasonably fair, more women (11%) felt that evaluations were somewhat or completely unfair as compared to their male counterparts where almost 7% felt that way. While men and women reported that their senior colleagues were helpful and interested and similar percentages reported their senior colleagues to be uninterested, nine percent of women responding indicated that their senior colleagues were either unhelpful as compared to only 3% of their male counterparts. Both men and women reported that their senior colleagues were open to collaboration, especially if individual approached the senior scholar. When asked about their relationships with their peers or junior colleagues, men and women report that they have good and supportive relationships and social life with their peers or junior colleagues.

Mentors do not seem to be very common for Slovenian scientists. Most women and men reported they do not have a mentor, though more women (44%) than men (32) reported having a mentor and both report the mentor is typically someone senior to them. Typically mentors are assigned to the mentee but where the individual has the opportunity or personality to choose a mentor, the mentor is their former PhD advisor. Those who have a mentor report meeting often, at least once a week even if informally. However, a smaller percentage of women report (67.6%) than men (80.9%) report that the mentor is senior to them. Moreover, a greater percentage of women (32.4%) report that the mentor is from within their organization than their male counterparts (23.4%).

When asked how they felt they fit into their department, men and women most often reported that they fit in well, but over 9% of the women reported they barely fit in or did not fit in at all compared to about 4% of their male counterparts.

Women reported needing a career break more than their male counterparts. The primary reason for women is child birth. Men also indicated child birth as their top reason but it was equally matched by illness, family issues and the economy. Twenty five percent of women do not go for a post-doc position abroad because of family and child care issues as opposed to only 8% of their male counterparts. (Ule, 2012)

Among respondents, around 10 % more men (52 %) than women (40 %) were awarded. The type of award – Zois (The highest national scientific award in Slovenia),Pregl (award a prize for outstanding work to Austrian micro-chemists), Presern (highest decoration in the field of artistic and in the past also scientific creation in Slovenia), Krka (special achievement in the field of research work for young scientists) and Fulbright – seem to be equally awarded to men and women. In fact in 2013, for the first time, all categories in the Zois award have awarded to women, even in the life achievement category. However, only men in our survey reported receiving the Golden Emblem IJS (Prize for winning PhD dissertations in the fields of natural sciences, and medicine and biotechnology). However, there were also women recipients. Moreover, Slovenian scientists are rarely awarded international prizes, perhaps because little is published in English.

However, when asked if men and women had equal representations in awards women more often than men said ‘no’. The reasons for this vary but respondents cited that fewer awards were given to women because:

- “Because men are usually the leader of the research projects. (There are fewer women in higher-ranked positions.)”
- “Women have worse access to collect points for awards.”
- “Men are pushier. (Woman are less pushy towards awards.)”
- “Women are considered as something less. It is a cultural thing.”
- “For award you have to be nominated and man will nominate his man colleagues. There is no “old girls” net at one side and women are usually too busy to take part of “bossiness (sic) lunch””

Findings: The Status of Women in Science in Slovenia

The respondents were asked if they believed that men and women had equal opportunities to advance in science. A predominance of women (Table 1) felt that they did not have equal opportunities as compared to their male counterparts (Table 2).

Yes, They have equal opportunities	**No, They do not have equal opportunities**	**Opportunities are not Gender Related**
* If they are prepared to put in similar amount of work. *They have the equal opportunities officially. But the men "know" better how to get to better positions and more money. * Slovenia is not one of gender but of political, ideological etc. nature. *The opportunities in my organization depend on personal affinity of the manager to individuals rather than gender. *Equally represented	*Traditional roles (family, society), women have more work *Women are not taken seriously. *Women seem to have to work harder and achieve more to be recognized. *They generally have less domestic support *Women give priority to their partner wishes. *As a woman, you have to be excellent in order to be considered "good enough" in science; as a woman you have to be almost perfect mother and partner if you don't want to be blamed as somebody who neglects her dear ones for a care.	Probably the cause is in the nature and also depends on conditions. Men should traditionally be the first and the most important and would do anything for the goal, for women I think are more important to have support and recognition to be successful. *More or less, yes. Opportunities to advance are more dependent on success and personal interest and work. *It depends on an individual and ability to distribute family work equally as well as field …

Table1 – Women reply: Do Women Have Equal Opportunities in Science

Yes: Women have equal opportunities	**No, Women do not have equal opportunities**	**Opportunities are not gender related**
*Scoring system is the same	*Traditional roles (family,	*It depends on individual's

for all. *The taboo that women cannot be god scientists is long gone. *I believe the ability to advance in science is up to the individual researchers abilities rather than their gender. *Hard work and achievements are those that count. *No reasons for difference have equal opportunities. *It's the law. *In our organizations women are in many important positions. *Women have the same opportunities, but they do not use them in the same way.	society), women have more work *Women are less aggressive *Women put family in a first place, man put it after job. *Women are considered as something less. *Man favored in science. *Women do not have as high position as man *The criteria in science education are built more on the strength of boys/men. *Men hold all the positions and have negative feelings towards women.	characteristics. *Women have advantage because they are rare and therefore more interesting. *In our organization women personnel prevails. Women research achievements are abundantly superior in every sense. *In strict scientific communities in Slovenia women may have slight advantage because they are often more organized and successful at all important paperwork part.

Table 2 Men reply: Do Women Have Equal Opportunities in Science

The final question in the survey asked respondents for experiences or concerns about the status of women in stem. Their responses fall into three major categories: impact of society, policy and the nature of women. They noted:

Impact of society:

- Women pay high price for success (choosing family or carrier).
- Cannot get a position without connections.
- Family obligations impact status.

- Conservative society. Success is measured in time not efficiency.
- Need more good role models for young women.

Policy oriented experiences and concerns:

- Leadership can have problems with maternity leave which lasts usually 1 year.
- Lack of flexibility in jobs (working time, work from home) in Slovenia.
- We have to promote more scientific study programs in STEM to women.

Nature of women:

- Women have to put much more effort and energy (sic to get ahead).
- Is getting better.
- Women should be more aggressive and ambitious.

The greatest sexism in Slovenia is between females. Women do not support each other well enough; even women prefer to support men.

CONCLUSIONS

This first ever comprehensive survey of men and women scientists in Slovenia provides a clear look at the status and issues facing the recruitment and retention of women in STEM. Our survey shows that women are much more concerned and aware of the problem for women in STEM than men are. Many of the results are consistent with status and opinions across Europe and in the US. For example, the same disparity of salary is seen in Slovenia as world-wide. The data here indicate women earn on average 78% of what their male counterparts earn. Women report roughly 10% smaller offices and nearly 47% smaller labs than their male counterparts, averages that were consistent with the MIT study 15 years ago but are no longer the recorded averages in the US.

The challenges for the advancement of the status of women in STEM in Slovenia lie in the 'softer' aspects of the inequalities noted in the survey, the access to mentors, the awarding of awards and the general attitude of the society. Expanding the visibility of the issues for women in STEM fields can be addressed by encouraging them to publish the data beyond ministry webpages and in internal Journals. The English expression is that "Sunshine is the best disinfectant." With fewer of women in most science disciplines, especially physics and engineering, the challenge remains to find ways to support the women who are there so that they can advance in their career. Such supports include structural changes to the organizations to review the pay and resources provided women to insure equality, to provide more flexible work hours, to encourage mentoring and to actively nominate women for prestigious awards. In the field of mentoring, women seem to be more comfortable with outside mentors and this should be encouraged and strengthened. The more women are

known outside of their institute, the more it will be possible for them to serve as role models for others, to be visible for nominations for awards and more they will be able to influence the status of women.

Dealing with societal attitudes toward women in science is not easy and it is doubtful that a single effort will encourage change. Women in science need to work together, keeping the door open for other women rather than closing the door and enjoying their position alone. Every opportunity should be seized by women themselves to promote other women in science, to "Lean In" to seek advancement and challenge as Sheryl Sandberg notes and to join other women in science events in schools and community groups. Moreover, men have to be made more aware of the issues, problems and concerns so that the male leadership can help to resolve the inequities.

While the status of women in Slovenia is still challenged, the future is bright as science as a whole is valued by the society. The country is still a young democracy and it understands that the full representation of women is part of the economic engine.

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