Voices Shaping the Future of Laser Manufacturing – Lara Rehab Al Botros

WMG (Warwick Manufacturing Group) at the University of Warwick is a world-leading research and education department dedicated to creating a better tomorrow through innovation, collaboration, and lifelong learning. Working closely with industry, WMG tackles complex manufacturing, technology, environmental, and societal challenges through applied research and knowledge transfer. Its industry-focused degree programs equip students with the skills needed for future careers, while its partnerships with businesses help drive innovation, growth, and real-world impact. Founded in 1980 by Professor Lord Bhattacharyya, WMG has grown into a globally recognized center for research, education, and industrial collaboration.

As part of the *Voices Shaping the Future of Laser Manufacturing* series, we interviewed Lara Rehab Al Botros, Lead Engineer at the laser beam welding group at WMG. Lara will share her experiences from a deep-tech photonics company and give us her perspectives on Gender Balance and her ideas to continue promoting equal opportunities, visibility and diversity within the European innovation ecosystem.

1. Could you briefly describe your role in Lasers4MaaS and your involvement in the project activities?

Lara: I am a Lead Engineer at the laser beam welding group at WMG.

Within the Lasers4MaaS project, my role is mainly technical, focusing on laser welding process development and optimization, as well as process validation and evaluation using microscopy, metallography, tensile testing and non-destructive testing. My work involves collaboration and supervising the work of project engineers and technicians while providing guidance on experimental methods and best practices.

And as a laser safety officer, I ensure compliance with health and safety, and laboratory operating procedures including laser safety regulations. This includes conducting and documenting risk assessments.

2. How would you describe gender balance in your organization, particularly in technical or leadership positions related to photonics and advanced manufacturing?

Lara: The gender balance at WMG like the broader STEM and manufacturing sectors skews male. However, WMG holds an Athena Swan Silver Award for advancing gender equality. And while

WMG is actively working to push past industry averages through focused recruitment and outreach, it is still lacking in women in senior positions. This could be due to the challenges faced by women in early career stages to achieve promotions and support due to career breaks and family responsibilities.

3. Do you consider gender balance and diversity important for innovation in industrial photonics? Why?

Lara: Yes, gender balance and diversity are crucial for innovation in industrial photonics. As a diverse team brings together varied perspectives, expertise and talents, which drives technological breakthroughs, enhances creativity and problem solving, broadens the application market relevance, and offers better decision making.

4. Do you feel women and underrepresented groups have equal opportunities to contribute to technical decision-making, work package leadership, dissemination and visibility activities, industrial stakeholder engagement, and innovation discussions?

Lara: While awareness is growing, systemic inequalities, unconscious bias, and low representation at the senior leadership level prevent many diverse voices from getting equal participation in technical decision-making. For example, in meetings where women are heavily outnumbered, their ideas are easily dismissed and talked over.

5. Have you observed barriers to participation or advancement in your sector?

Lara: One of the biggest barriers that I have personally faced is flexible working patterns, as the expectation in research and industry is to work full time for the same hours daily. This has at some point hindered my career progress due to the lack of support for flexible working to accommodate caring responsibilities. However, the idea of flexibility in research and manufacturing roles is growing, especially with a new generation of men who also want to have a work life balance that enable them to focus on their family life. This shift in the current atmosphere is providing more opportunities for flexible working, enabling fellow women colleagues to progress in their careers while maintaining their other responsibilities.

Another barrier that I have observed in the technical sector is the double standard and bias used in hiring, and promotion. Average men are hired or promoted in STEM while women are held to outstanding standards, this is driven by unconscious bias, differing communication styles, and historical pipeline cultures.

6. Are there specific challenges in industrial deep-tech environments that affect gender balance?

Lara: Yes, women in industrial deep-tech face unique barriers, including fewer educational pathways into STEM, where they often face discouragement form educators and pairs which

reduces the number of women in STEM education. Because the deep-tech environment is also male dominated, women often miss out on the informal high-trust networking that leads to securing leadership roles. The lack of women role models and the low visibility of their achievement make it much harder for women to envision a clear and accessible path to executive positions. The working culture in deep-tech sectors undervalue work-life balance, which disproportionately affects women, who often still carry the burden of domestic caregiving responsibilities.

7. Are gender aspects sufficiently considered in technology development, user engagement or deployment pathways where relevant?

Lara: Unfortunately, gender aspects are historically not sufficiently considered in technology development due to lack of representation which heavily skews research towards male-centric perspective. As many technology assessment frameworks lack gender equality metrics, they lack the input from a diverse user base. This results in product designs that are not fit for purpose when it comes to women users.

8. What obstacles remain to achieving better gender balance in photonics and advanced manufacturing ecosystems?

Lara: The lack of senior role models and of the visibility of women's achievement which makes it harder for younger students and researchers to envision a career path for themselves in the sector. The lack of inclusivity in the workplace, where women are alienated and excluded without any peer or managerial support. The unconscious bias against women and the outstanding standards that they are held to, hinders their recruitments, promotions, grant applications and career progress.

9. What additional actions should Lasers4MaaS implement?

Lara: Provide more exposure for a diverse partners group with visibility of women's achievements in the project in various roles. This would highlight role models for early career researchers and provide career pathways ideas for students.

Engage in outreach programs to reach a wider audience and inspire women to join STEM education and career paths.

10. What practices should continue beyond the project?

Lara: The practices that should continue beyond the project should tackle the issues that cause gender imbalance, like providing inclusive job descriptions to encourage a range of different gender applicants and using a diverse interview panel for hiring. Using skill based hiring and blind application and CV processes. Provide transparent merit-based promotion criteria so women actively pursue leadership roles. Offer flexible working hours and remote working options to accommodate caregiving responsibility. Offer return to work support program and childcare vouchers to support coming back from career breaks.

11. What recommendations would you give for future EU projects in this area?

Lara: Promote women-led start-ups and innovation by partnering with female researchers to commercialize their innovations.

Include educational outreach initiatives to promote STEM to a diverse of students in early education, and to modernize the STEM subjects to appeal to a wider audience.