



Case Report

Towards gender equality in Mediterranean Engineering Schools through networking, collaborative learning, synergies and commitment to SDGs-The RMEI approach

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ARTICLE INFO

Article history:

Received 27 August 2019

Received in revised form

11 December 2019

Accepted 18 December 2019

Keywords:

Gender equality
Engineering institutions
Mediterranean
Network
Sustainability
Education

ABSTRACT

Gender equality is a critical goal because its implementation can foster positive cascading effects on the achievement of all SDGs, and it is directly connected to the nexus of education-sustainability. This study discusses how the Mediterranean Engineering Schools Network achieved a learning potential, inspired informal and structural changes for gender equality to its members, through a tailored strategy by: a) unraveling the link between gender equality and sustainability, b) harvesting synergies of SDG5 from other SDGs and integrating gender equality in interventions for sustainable development of the region, c) mobilizing network's human resources from professors and students to academic leaders, d) with the support of an EU project. A community of practice was created, the gender equality policy statement unanimously approved, grace due to the commitment of member-institutions leaders to SDGs. Finally, the study reflects on the network's co-creation processes and interventions, challenges, barriers, and lessons learned, and suggests networking, collaborative learning, ethical commitment to SDGs and the synergetic effects arising from appropriately designed tailored policy mixes, as drivers for advancing gender equality in typical male-dominated engineering institutions, where females in leadership and senior positions are in low percentages. Cognitive, affective trust and joy shared among the members of the working group, and the feeling of belonging to the same family were the emotional drivers of paving the way for gender equality. The insights of the study may be useful to leaders, academic and administrative staff of other institutions in advancing gender equality and improving sustainability in their institution.

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1. Introduction

The Brundtland report from the World Commission on Environment and Development defined sustainability in 1987 [1]. The 2030 Agenda for sustainable development (SD) and its sustainable development goals (SDGs) is based on the concept of sustainability,

addressing global challenges from climate change, environment, to poverty, social and gender inequalities and peace. These goals apply to all countries around the world, while each of the 17 SDGs has specific targets to be achieved by 2030. However, reaching the SDGs requires action at all levels, from governments, businesses, civil society to individuals [2]. Moreover, the 17 SDGs implementation requires substantial inputs from higher education (HE). The recognition that education can be a powerful tool in promoting SD, led to the concept of education for sustainable development (EfSD) [3].

The engineering education (EE) plays an important role in shaping the future of the world society, in terms of proposing sustainable technological solutions through generating knowledge and innovations and raising sustainability awareness [4]. Engineers play an important role in SDGs implementation, since their role is

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Abbreviations

EC	European Commission	GEP	Gender Equality Policy
EE	Engineering Education	GEPS	Gender Equality Policy Statement
EfS	Education for Sustainability	GES	Gender Equality Strategy
EfSD	Education for Sustainable Development	GEWG	Gender Equality Working Group
EIGE	The European Institute for Gender Equality	EE	Engineering Education
ESIM	Ecole Supérieure d'Ingénieurs Group of Marseille	HE	Higher Education
EU	European Union	HEEI	Higher Education Engineering Institutions
GA	General Assembly	HEI	Higher Education Institutions
GAME	Giovani Ambassadori per la Mediterranea (Young Ambassadors for Mediterranean)	IWs	Institutional workshops
GE	Gender Equality	MW	Michelangelo Workshop
GEA	Gender Equality Audit	NWs	National Workshops
GEC	Gender Equality Centers/Committees	R&I	Research and Innovation
GEIIs	Gender Equality Innovating Institutions	RMEI	Réseaux Méditerranéen des Ecoles d'Ingénieurs
GEMS	Gender Equality Mission Statement	SD	Sustainable Development
GEP	Gender Equality Plan	SDGs	Sustainable Development Goals
		UfM	Union for Mediterranean
		UN	United Nations
		WP	Work Plan

basically social [5], obviously related to the most of the SDGs, such as clean water and sanitation for all (SDG6), access to affordable, reliable, sustainable energy for all (SDG7), strong and resilient infrastructures (SDG9), inclusive, safe, resilient and sustainable cities (SDG11), inclusive and sustainable production and industrialization (SDG 9, 12), climate action (SDG13). SDG5 is a critical goal because its implementation can foster positive cascading effects on the achievement of all SDGs, directly connected to sustainability. For the achievement of all the goals, men and women, engineers, scientists and managers are calling to equally contribute in proposing sustainable solutions for a brighter future (Fig. 1).

Gender equality (GE) and women's empowerment are fundamental in promoting resilient, democratic societies. When women play an active role in civil society, academia and policy making, education institutions, public sector, decision making, policy, then,



Fig. 1. The role of engineers in SDG6, SDG7, SDG9, SDG11, SDG12, SDG13, towards tackling global and local challenges, and to SDG5 which can create cascading effects for the achievement of all SDGs.

governments tend to be more open, responsive and transparent [2]. Although, GE is the UN SDG5 directly connected to sustainability and the global priority for UNESCO, linked to its efforts to promote the right to education and support the achievement of SDGs, it remains a wicked problem in HE and mainly in HEEIs, which are gendered settings, often due to the societies' tendency to associate engineering and technology with men. In typical male-dominated engineering leadership and senior positions, females are in low percentages. Despite the over half of all PhDs being awarded to women, the percentage of female tenured faculty members are between 20% and 33% in the EU, and falls to 5% in engineering, depicting the difficulty that women have to move up in academia and research hierarchies (glass ceiling) [6]. The 'glass ceiling', with a concentration of women in low academic levels, exists in academia, research and innovation, keeping alive the stereotypes. The rate of improvement in the representation of women in HEEIs is still slow, although the percentage of women at senior levels of academic staff has increased in universities. Yet, women are not achieving full recognition. The implementation of integrating the gender dimension into higher education, research and innovation content is lacking behind, despite national level policies in place [7].

The wicked problem of GE and the persistent under-representation of women in HEEI leadership and professorship positions is a challenge and a topic of interest to academics, and experts on gender equality, requiring further actions [8]. There is a high need to find new learning initiatives aiming at promoting GE in HEEIs and exchange best cases of implementation. The aim of this study is to share the experience gained by the tailored approach taken by the Mediterranean Network of Engineering schools (RMEI) to stimulate the GE principle and initiate practices of GE in relation to its vision, mission and commitment to SD and SDGs. The systematic linking of GE with sustainability and education, as well as the discussion of the role of EE in meeting current challenges are innovative aspects and address current challenges.

2. The engineering education-sustainability nexus

The cultural and social development of a country is associated with the quality of the education system. Education is the key to understanding sustainability and acting for sustainable practices, with inclusivity and equality. To build a sustainable future, all genders must be included in solutions and decision-making for their improved, economic, social, and environmental well-being.

Many HEIs made significant efforts to address sustainability, introduce new programs and courses related to SD and increase the impact of their teaching by collaborating with their communities. Yet, many HEIs need to take the leap for GE. Usually a shift towards sustainability-oriented education includes substantial learning by lecturers, paradigms and mental frameworks [9], while integration of GE in sustainability requires a strong cultural and institutional willingness for change [10].

Advancing sustainability-oriented engineering education requires learning and knowledge for solution-oriented programs with ethical, adaptive and cross-disciplinary approaches [11], for systemic processes of socio-technical changes [12] to be embedded in professional practices of engineers/scientists/managers. The transition to sustainable economies and societies requires the applicability of virtue ethics and knowledge in governance, research, innovation and leadership [13]. Thus, the transition to a new engineering education should encompass diversity and equality [14,15], and integrate the gender dimension in teaching, research content & innovation and technology transfer [16]. Therefore, the role of engineering education in the 21st century is developing appropriate competencies, raising sustainability awareness and providing a transformative learning for sustainable technological solutions, socially accepted [4], in contrast to that of the 20th century characterized by technological advances only [17].

In this respect, HEIs have the responsibility to integrate sustainability into teaching, research, practices, academic staff promotion, using approaches that are inclusive, adaptive and participatory [18], and providing a transformative learning to students. Transformative learning refers to a process of inspiring, catalyzing formal and informal changes and shaping policy, strategy and plans to generate new meanings and new visions of future [19], for bringing a shift from the wicked global challenges into sustainable patterns of living [19]. Transformation encompasses more than a change because it involves a shift in ways of individual's thinking, acting, and enacting relationships with the others, and the ecological system. Moreover, it needs individuals to tap into his/her inner wisdom [20,21], and to experience the inner processes of creation and wisdom that can lead to the awareness of the own worth [22].

Transformative learning can come also from outreach activities, through an openness towards society, with respect to inclusivity and diversity. It can come from 'living labs' that strategic networks can provide, where students can be 'learners' through a collaborative learning and self-assembling connectedness, far from the realm of rigid teacher-student roles, that are the usual roles in HEIs. Then, students can act as change agents, advance their knowledge by sharing and interconnecting with others in the network and society, exchange good practices for the benefit of societies [23], and finally embed GE in their professional and private life.

Although, the role of HEIs is to better prepare men and women to work equally on sustainable solutions and benefit entire societies, embedding also GE in their structures, unfortunately the last remains a wicked persisting problem [24] in many HEIs, due to existing socio-cultural perceptions and bias around genders. The picture will change progressively, if HEIs by assuming their privileged position as key drivers for SDGs, include diversity and equity principles in their governance [25].

Sometimes, inspiring the HEIs' 'brain' to beat GE inertia can come from regional cooperation among several engineering institutions and other social and industrial partners that can create networks based upon a common willingness to share and extend their experiences beyond the context of their initial community in which they work [27], linking GE with knowledge and action, enhancing collective learning, promoting social learning [28].

Trustworthy networks can enhance the willingness of individuals and institutions to act for sustainability and GE in academia utilizing network's human and financial resources for the accomplishment of common goals and visions [29].

European Commission (EC) is making great efforts on supporting the transformation of universities towards GE. The European Institute for gender equality (EIGE) is the EC knowledge center supporting policy makers and all relevant institutions in their efforts to make equality between women and men, by providing specific expertise and reliable data on GE in Europe [26].

3. Case-study

In this article, we contribute to the evidence base not by applying rigorous evaluation frameworks, but by using the case-study methodology to investigate instances where the engineering and GE are tightly coupled. By taking an empirical and intuitive approach to GE social principle, and combining the experience of engineering institutions education and governance that RMEI disposes, along with the experienced challenges for GE, a tailored strategy designed and adjusted to local conditions of the Mediterranean countries and specific characteristics of the engineering education institutions. There are many areas of mutual benefit for engineering education and the social sciences and many potential areas of collaborative research that can contribute not only to engineering learning but to the social sciences. This study bridges engineering with social science in the area of GE. In an era where technology is no longer the exclusive preserve of engineers, it would be rewarding to perform research into the influence that social science has upon engineering.

3.1. Scope definition and objectives of the case-study

The aim of this case-study is to share the experience and lessons that RMEI learnt on GE advancement in Mediterranean HEIs, through top-down and bottom-up approaches and tailored activities, during the last 3 years, with the support and guidance of the EU TARGET project. Under the commitment to SDGs, students-learners, inspired professors, and a community of practice of GE in the Mediterranean was built. The network's metabolism, its social living-lab character, the multiplier effect at member-institutions, the formal and informal changes achieved, are the main dimensions of this case study.

The case study is framed/self-positioned by presenting the RMEI network's vision and mission as the 'enabler' of GE in engineering institutions of the Mediterranean, the EU TARGET projects objectives, as the 'supporter' of GE in R&I, and analytical aspects of the case study are outlined: rationale, social and material context, activities and interactions, work plan and participation. Relevant commentaries are interspersed throughout the article. The article concludes with an exploration of the outputs and outcomes and the potential for contributions from engineering to GE learning and acting. The study follows six comprehensive steps of the triple helix: education, sustainability and GE.

Step 1: Identification of sustainability-oriented engineering education and compilation of a list of principles relevant to GE.

Step 2: Presentation of RMEI network's vision, mission and role in SDGs and GE principle.

Step 3: Sharing the results that the network achieved on the GE.

Step 4: Reflecting and opening a discourse on the triple helix sustainability-engineering education-GE.

Step 5: Framework outcomes and lessons learnt of GE implementation, as guiding principles for other networks and institutions.

Step 6: Comprehensive conclusions.

The findings of this study can create multiplier effects to other academic leaders and administrators of HEELs, professors and students towards sustainability-learning and acting, improving institutions' social character, and achieving higher performance of GE in the academic community.

The academic community has an important advantage in fueling discourses about SDGs, because universities work at the nexus of values, ethics, attitudes, actions. The new scientists/engineers/managers, men and women, are uniquely positioned to act as transdisciplinary, sustainability developers and SDGs implementors.

3.2. The RMEI network

The Network of Mediterranean Engineering Schools (RMEI) was created in June 1997, with the initiative of the Ecole Supérieure d'Ingénieurs Group of Marseille (ESIM), France, supported by the Chamber of Commerce and Industry Marseille-Provence, the City of Marseille, the General Council of Bouches du Rhône and the Regional Council of Provence-Alpes-Côte d'Azur (<http://www.rmei.info/index.php/fr/>). The network receives also support from UNESCO because it holds the UNITWIN/UNESCO Chair 651 on Innovations for Sustainable Development Goals. The network succeeded to be addressed to 98 members engineering schools and universities from 16 Mediterranean countries (France, Spain, Portugal, Italy, Greece, Cyprus, Maroc, Mauritania, Tunisia, Algeria, Egypt, Lebanon, Palestine, Libya, Egypt, Israel, Turkey), but in the last years the active members decreased to around 40, due to many challenges Mediterranean countries face (economic crisis, political crisis, peace crisis). It is managed by a 10-member board of directors. Based on a strong set of common values among its members, and relations based on trust, the network envisions building SD and peace in Mediterranean through education and collaborative learning.

The network's mission is the promotion of SD in the Mediterranean countries by bridging the Mediterranean people through their common history and values, and cultural heritage. The members of RMEI share a common will to give back to the Mediterranean basin a social and economic place of choice in a new peace and respect for the future, by practicing the rules of SDGs.

Nowadays, the Mediterranean is facing many challenges beyond climate change, including processes of conflict and migration, deep-rooted changes in the demographics and gender inequalities resulting from one-dimensional attitude towards genders to the detriment of women and girls [30]. RMEI objective is to play a role in inspiring, and catalyzing formal and informal changes towards GE, by utilizing its human potential, fostering the sharing of knowledge among the members, facilitating multidisciplinary synergies, especially in education, research and innovation consortia of academic bodies-members. What mainly differentiates the network from hierarchies is the way the information flows and responsibilities are distributed. Responsibilities are distributed in the base of expression of willingness, readiness and commitment and the information flows in a friendly face-to-face way.

The Mediterranean countries have been characterized as relatively 'inactive' in developing gender equality policies in R&I. The widening gap between 'proactive' countries and 'inactive' countries is a worrying which if nothing is done may have negative implications on the quality and excellence of R&I throughout Europe.

3.3. The EU TARGET project

TARGET is a four years project, started on 2017 and is ending on

2021. It is a Swafs-03-2016-2017 Coordination and Support Action project funded by the European Commission Program H2020 and stands for "Taking a Reflexive Approach to Gender Equality for Institutional Transformation" (<https://www.gendertarget.eu/>). It aims contributing to the advancement of GE in research and innovation by supporting a reflexive gender equality policy in seven gender equality innovating institutions (GELIs) in the Mediterranean regions, including research performing organizations, research funding organizations and the RMEI network as partner. The TARGET approach goes beyond the formal adoption of a gender equality policy (GEP) by emphasizing a reflexive process towards equality at the institutional level, and the establishment of a community of practice. Actual change is the result of increased institutional willingness and readiness to identify, reflect on and address gender bias in a sustained way.

Starting point of the process is a tailored gender equality policy/strategy (GEP/GES).

3.4. Rationale for RMEI's gender equality policy/strategy (GEP/GES)

For the RMEI network envisioning SD through education, the 21st century unprecedented climate change, environmental, resources and social challenges call for technological acceleration, GE and diversity, vital to creating sustainable, resilient and democratic societies, for future generations to thrive.

The network embraces a diversity of cultures, religions, political and socio-economic differences that exist among the Mediterranean countries. Thriving for SD in Mediterranean, RMEI considers that GE in HEELs is important because women represent more than half of its population and engineers (men and women) need to work together in bringing sustainable proposals to the society, benefiting from equal treatment and opportunities. It recognizes that GE is not only a fundamental human right but is a significant factor for the development of societies and enhancing the performance of businesses and institutions [30]. Therefore, achieving GE is a fundamental contribution to address the pressing global and local challenges of environmental, climatic, economic and social character that Mediterranean is facing today and need to be tackled by all stakeholders, among them engineers, of both genders.

Objectives such as the promotion of gender balance in universities, decision-making, and the sharing of responsibilities (professional, personal and family), have not fully achieved, and in some Mediterranean countries this is not a visible objective, inhibiting women from the full exercise of their legitimate aspirations.

In this context, RMEI with the support of the EU TARGET project has designed a tailored approach to bring the change of GE, that has as main axes:

- Awareness and collaborative learning of GE.
- Building up gender competence to reflect on practices.
- Implementing gender balance in the network's governance.
- Catalyzing the development of GE committees in member-institutions

3.5. Vision, mission, and goals of GEP/GES

RMEI envisions a more holistic integration of SDGs principles in HEELs and harvesting GE from the synergies with other SDGs [31] by leading awareness, fostering cultural shifts, building capacity and developing a community of practices of GE, where men and women can collaborate with the vision: 'Together towards a sustainable world'.

The vision, mission, and goals of RMEI towards a comprehensive GEP/GES are:

Vision: Implementing GE in engineering education for providing sustainability and peace, supporting the transition to sustainable economies and resilient societies.

Mission: The provision of collaborative learning and exchange of good practices of GE processes to enable the sustainable development and peace in the Mediterranean.

Goal 1: To support GE and educate the new generations of engineers with the values of sustainability, equity and inclusivity.

Goal 2: To translate knowledge into implementation.

Goal 3: To develop an inspiring working group within the network encouraging SD innovations and GE in research and education.

Goal 4: To build a Mediterranean community of GE practice.

The vision of RMEI is reflected in the GEP/GES.

3.6. Methodology for a tailored GEP/GES

The SMART goal setting [32], was used for GEP/GES goals' structure and trackability, transparency throughout of verifiable trajectories towards GE, and clear milestones. Every goal/objective brought closer to reality by using a reflective approach of transformation on GE, from intermediary step to overarching objective. According to the SMART goal setting, the following questions were used to raise replies:

- *Who:* Who is involved in this goal?
- *What:* What do I want to accomplish?
- *Where:* Where is this goal to be achieved?
- *When:* When do I want to achieve this goal?
- *Why:* Why do I want to achieve this goal?
- *How:* How many/much?
- *How:* How do I know if I have reached my goal?
- *What:* What is my indicator of progress?
- Do I have the resources and capabilities to achieve the goal? If not, what am I missing?
- Have others done it successfully before?
- Is the goal realistic and within reach?
- Is the goal reachable given the time and resources?
- Are you able to commit to achieving the goal?
- Does my goal have a deadline?
- By when do you want to achieve your goal?

Using SMART setting goals, it was necessary to conform to the criteria of: Specific (S), Measurable (M), Attainable (A), Relevant (R) and Timely (T) goals [32]:

- *Specific goal (S)*

A well-defined, clear, and unambiguous opening of a GE discourse was set, for a reflective learning and community of practice development in the Mediterranean territory and advancing structures and member-institutions of a cultural change, formal or informal.

- *Measurable (M)*

A setting of specific questions in a tailor-made survey (gender equality audit (GEA)) to collect data and organize qualitative and quantitative indicators that can measure the progress towards the accomplishment of the GE goal was set.

- *Attainable (A)*

Attainable specific actions to be planned by the gender equality

working group (GEWG) in collaboration with the member-institutions.

- *Realistic (R)*

Development and approval of a gender equality policy statement (GEPS) to be set and adopted by all member-institutions within reach, realistic, and relevant to life purposes.

- *Timely (T)*

A clearly defined timeline, including a starting date and a target date, duration, end date, to be well defined by the workplan.

For a GE advancement, RMEI was based on the following strategic principles [33]:

a) Applicability, Practicability

The transformation targeting by RMEI with the support of TARGET project need to have reflexive approach and be focused on an open ongoing dialogue with feedbacks on the approaches and tools developed, from the perspective of engineering (applicability, practicability), in terms of consolidating a sustainable line of action to support institutional change in member-universities. Attention should be put, this feedback to specifically consider the cultural differences between countries and efforts to be adequately addressed in the supporting activities.

b) Debate and Consultation

TARGET tools must be adopted by the network's member-institutions, through internal debate and consultation by encouraging the engagement to GE as a commitment to SDGs and ensuring a wide transparency and dissemination.

With the above methodology interventions and coordinated actions are structured, depicted in the workplan.

3.7. Interventions with coordinated activities- workplan

The following interventions consist the work plan for GE advancement in RMEI:

- Creation of a GE working group (GEWG)
- Data collection via a GE audit (GEA)
- Development of a GE strategy (GEP/GES)
- GE policy statement (GEPS)
- Creation of a GE community of practice (CoP)
- GE centers/committees (GEC)
- GE national workshops (NWs)
- GE institutional workshops (INWs)
- Michelangelo workshops (MWs)

3.7.1. Creation of a gender equality working group (GEWG)

First, a gender equality working group (GEWG) was created including senior and young scholars, women and men, with various scientific expertise and from different Mediterranean countries, for being the agents of change in their institutions of origin. The creation of the GEWG aimed at:

- Introducing and advocating the improvement of decisions and policies within RMEI to reflect GE specific issues.
- Fostering awareness-raising and capacity development in relation to GE.

- Inspiring cultural changes towards GE around the Mediterranean basin.
- Supporting structural changes related to GE within RMEI and member-universities.
- Attention was put to maintain the diversity in the GEWG.
- Members of the group are both females and males.
- They are junior and senior professors.
- They are active members of the RMEI.
- They express willingness, readiness and sensitivity towards GE issues.
- They are active members in their university.
- They are inspired to spread and mobilize other members in their university towards GE.
- They are leaders of RMEI.
- North and south engineering schools and universities are represented.
- Different cultural, religious and political backgrounds are represented.
- Various scientific expertise is represented.

In all, GEWG is a multidisciplinary team of inter-generational, inter-gender, inter-disciplinary character.

Its first activity was the exploring of the state of the art of GE in Mediterranean HEELs by data collection.

3.7.2. Data collection via a gender equality audit (GEA)

The first task of the GEWG was the collection of quantitative and qualitative data on gender issues (sex segregated data on students, staff, management of RMEI universities, gender studies, gender policies etc.) in the member-universities with a GE audit (GEA), by a tailor-made questionnaire that served as a baseline analysis of the state of the art of GE in the network.

The aim of the data collection was to identify key issues that RMEI should focus on. Data collected twice by the survey I and II launched during the years 2018 and 2019 respectively, for the depiction of the current situation on GE in Mediterranean engineering schools and universities. Based on the acquired data, relevant gender gaps were identified, and a first discussion of GE priorities took place.

Data collection was conducted through rigorous procedures towards including also qualitative indicators. It needed the framework to be tailored to adjust to local conditions, and be designed with context sensitivity, considering the challenges in assessing impact of GE interventions in research and innovation [16].

A GEP and GEPS priorities discussed, and many activities were planned.

3.7.3. Gender equality strategy (GEP/GES)

A GE plan/strategy (GEP/GES) for RMEI reflected on and formulated by the GEWG, with the aim of driving the awareness and mobilization of a change on GE at two levels:

- The level of the network itself (board, working group, policy, strategy)
- The level of the universities that are members of the network (development of committees/centers).

RMEI as a network has the potential for direct and indirect structural change related to GE through the creation of formal rules and a culture aiming at fostering GE among the network's representatives on boards and working groups acting (*level 1*). It also has the potential to inspire a GE change in member-universities all around the Mediterranean, acting at *level II*.

The GEP/GES is tailor-made to the network's mission and vision, specific characteristics of the Mediterranean region and role of

engineering education for sustainability and peace in the region. It is embedded in a framework which supports reflexivity at the institutional level, supporting the multi-dimensional capacity in building activities to develop competence within the network and member-institutions. The strategic lines of the GEP/GES are depicted in [Table 1](#).

3.7.4. Gender equality policy statement (GEPS)

In order to formalize the members' commitment towards GE and have a framework for the organization of GE activities in the network, a GE policy statement (GEPS) was developed by the GEWG. 12 persons, 7 women and 5 men, were involved in the creation of the GEPS and 4 meetings were necessary for the design of the final version. Policy makers, rectors, deans and authorized professors-members representing Mediterranean engineering schools in the general assembly(GA) of the network, 40 voters in total, approved the GEPS unanimously, in 2019, expressing in that way the common will of Mediterranean engineering institutions to create changes of GE in the context of their commitment to SD and SDGs.

The GEPS designed in a way to connect GE with sustainability and education, SD and other SDGs and it complies with the network's vision for sustainability in education and SD in Mediterranean, where scientists, engineers and future managers will play a major role, recognizing that men and women engineers need to work together towards addressing the Mediterranean and global challenges.

The GEPS calls for action to pursue SD with a view to strengthening peace, stability and prosperity in the Mediterranean, taking into account the threats and weaknesses in the region, as well as its strengths and opportunities, and the need to reduce the gap between developed and developing countries in the region and between men and women. It is presented in [Table 2](#).

During the 2nd year of TARGET project implementation (2018–2019), the GEPS brought to the attention of members-institutions and was adopted by some of them, including universities in Palestine, Tunisia, Maroc, Spain, France, Greece, Italy. However, this is an on-going process, and other institutions hopefully will adopt the GES.

RMEI inspired some universities to proceed with structural activities for GE at their institution, starting with the development of gender equality centers or committees (GEC).

3.7.5. Gender equality centers/committees (GEC)

GE committees or centers (GEC) initiated at some member-institutions, among the most active in RMEI's by the representatives in the GEWG and with the agreement of the institution's leadership, under the objective of implementing gender balance in recruitment, promotion, empowerment of women and specific support to institutional learning with targeted measures. New GE committees organized in 6 member-institutions, while some already existed in 4 Mediterranean universities, with the objectives to:

- Collect data at the level of the institution and reply to the GEA.
- Contextualize the barriers to the academic careers of women.
- Set up safeguards to prevent sexual harassment.
- Foster gender balance in decision-making board.
- Promote the participation of women in research projects.
- Increase mobility considering gender balanced selection procedures.
- Networking and mentoring for female students.
- Foster work-life balance for the members.

To inaugurate the GEC and give publicity within institution and

Table 1
RMEI's gender equality plan/strategy (GP/GES).

I. At the level of the network (Level I)

- Establishing a working group on gender equality within RMEI
- Boosting institutional leadership change.
- Inclusion of gender perspective in the management of human resources.
- Enhancing synergies of SDGs innovations with gender equality.
- Incorporation of cross-cutting values of integration and social responsibility.
- Learning potential for the students of the network (GAME)

II. At the level of universities-members of the network (Level II)

- Mobilizing professors and students.
- Organizing workshops by bringing local stakeholders to the dialogue
- Developing activities in collaboration with the institutions GE committees

Table 2
The RMEI's gender equality policy statement (GEPS).

Mediterranean basin has been the cradle of important civilizations, it is an exceptional eco-region, has unique natural and cultural heritage, and the feeling shared by its inhabitants of belonging to 'the same sea' (Mare Nostrum).

At the crossroads of three continents, the Mediterranean Sea brings together countries and peoples of various levels of economic and social development, different religions, languages and cultures, who share a common civilization.

The Mediterranean region is the interface of north and south, east and west. People of the Mediterranean wish to embrace common values of equity among countries and generations, mutual respect between people, solidarity, and peace.

The Mediterranean is nowadays in front of great challenges. These challenges are environmental, economic and social. Sustainable development, including economic vitality, based on green economy, social cohesion, gender equality, environmental protection, sustainable management of natural resources, to meet the needs of the present generation without compromising the ability of future ones, is the vision of RMEI.

The main mission of RMEI is to enhance the ethics of responsibility of Mediterranean Youth through Education and Culture. Universities play a key role in contributing to social transformation and sustainable development through education, research and innovation. This role is fully reflected in the formulation of sustainable development goals of the United Nations. Universities-members of RMEI express their commitment to embed the UN world agenda 2030, at the center of their mission and, develop their activities within this framework.

The gender equality policy of RMEI complies with the vision for a sustainable development, where engineers, scientists, managers (men and women) play a major role. Women need to be considered equal to men at all levels of their activities and life and gender dimension in teaching, research and innovation related to Sustainable Development should be strengthened.

The RMEI gender equality policy calls for education strategies and related actions to pursue SDGs. Today, 27th of March 2019 in Rome, RMEI member-universities endorse this statement, and agree to work towards gender equality in their institutions.

the country, tailored national workshops organized by the GECs with the support of GEWG and TARGET project.

3.7.6. Gender equality national workshops (NWs)

Workshops were organized at some member-institutions with the support of RMEI aiming to provide national stakeholders with the knowledge and support for GE in academia. Thematic workshops conceived with the support of TARGET project, with double aim to:

- Inaugurate the GEC and to give publicity within institution and the country.
- Bring various stakeholders together, from ministers, academia, associations, industry in a GE dialogue, aiming at fostering institutional and structural change towards gender equality and formalizing a common will on gender equality.
- In addition, the GEPS statement was brought to the attention of local stakeholders during the national workshops (NWs) at the member-institutions, mainly at those willing to open a broad dialogue on GE at their institution and country of origin.

These workshops aimed at gathering various stakeholders (experts, leaders, professors, public sector, association, policy makers, ministries etc.) to exchange on the GE. For the national workshops, a stakeholder approach was adopted. As stakeholders we define those who deliver, influence, or are impacted by the policy/program/project represented in the workshop by assuring that organizations with gender expertise were adequately represented and that the discussions content were meaningful to all participants and sensitive to local culture and customs.

By organizing national workshops, RMEI has chosen to rely on its high learning potential and strong cultural bonds among the

members to raise-awareness on the following:

- Inequality in recruitment practices.
- Barriers to women's career progression in academia.
- Gender imbalances in decision-making bodies.
- Gender dimension in research content.
- Gender dimension in teaching content.

Key-priority issues to promote GE and counteract gender bias were identified prior to the workshop, put on the consultation agenda, and raised during the consultation process paying attention to the context particularities. The participant list was set in order to make sure that various stakeholders and fields were gathered around the table but also that the women and men represented were of different ages, social, ethnic, economic, cultural and academic backgrounds.

In order to promote the political interest in the targeted issues, institutional decision-makers and political actors were involved in the workshop or have been reached out to. Moreover, a specific attention has been given to the content of the discussions. Main gender stereotypes hindering gender equality in the targeted Mediterranean academic world have been identified and discussed. Shared priorities have been communicated in a simple and clear way. Potential institutional resistance to the GE measures have been anticipated in the context of the workshop.

The results of these discussions (presentations, interviews etc.) were then disseminated widely and communicated to RMEI members.

3.7.7. Gender equality institutional workshops (IWs)

A central tool to support the creation a reflexive learning approach are the institutional workshops (IWs) organized at the

network's-level, open to the whole RMEI's community. The focus is on the development of knowledge, capacity and competences on GE. IWs serve as 'spaces and platforms' to discuss all issues of GEP/GES, exchange best practices of GEC complemented with the capacity building workshops.

3.7.8. Gender equality capacity building workshops (CBWs)

Capacity building activities are implemented with additional workshops addressing knowing, capacity building, reflexivity and sustainability. Draft tools for each stage of the process are presented and discussed in the capacity building workshops and feedback is incorporated. The GEWG members have the opportunity participate to the CBWs organized by the members of the TARGET project consortium.

3.7.9. Michelangelo workshops (MWs)-The students' creativity

Dedicated workshops with the title 'Michelangelo workshops' are organized by the Mediterranean students who belong to the sub-network GAME, standing for young ambassadors for the Mediterranean (Giovanni Ambascadori per la Mediterranean). The MWs are devoted to bridge science, society, culture, awareness of GE and create relations among the young students. The subjects discussed so far in those workshops are the nexus of sustainability-GE, resilience-gender differentiated vulnerability to climate change disasters, empowering students to apply GE in their future work and life.

4. Discussion on outputs/outcomes

The outputs, outcomes related to the network's interventions for GE include an increased awareness and interest in GE that has created. The results/achievements of the network on GE learning and acting are presented here. Changes have achieved at many levels, starting from the network's structure and governance, to member-institutions, students and individual professors inspirations and awareness, demonstrating that RMEI by becoming a living lab for transformative learning on GE, reached some GE goals that comply with its vision and mission for SDGs.

Realizing the importance of promoting change through systematic and coordinated actions for the promotion of GE in HEELs of Mediterranean countries (*primary diagnosis of the situation*), the RMEI created and launched a tailor-made questionnaire (*audit*), with well-defined questions (*definition of variables that will be examined*), to be updated every year. The network took a reflexive approach to the institutional transformation on GE, by designing, implementing activities and monitoring of policies for GE at the level of the network and at the level of member institutions. This was done always within the limits of its influence and facilitated collaboration with member-institutions.

The network relied on its high learning potential and strong cultural bonds with the members and among the members to raise awareness and increase the capacity on GE. Targeted dissemination activities and the communication strategy focused on high visibility. To initiate a GE discourse at national level, the dissemination strategies included workshops, involving representatives in key positions within organizations, association on GE, local experts, students.

The achievements are fostered by the network's vision and mission and commitment on the SDGs. The GEWG is committed to advance GE at the network's level and at the level of member-institutions. The selection of the members of the GEWG was made in the basis of their expressed willingness and readiness to participate. From around 40 active members from 16 countries, 12 member-institutions are participating in the GEWG, from 11 countries (Engineering schools from Spain, Greece, Italy, France,

Maroc, Tunisia, Egypt, Lebanon and Palestine). These are the most active institutions in the network, interconnected with each other, fully committed to UN SDGs implementation. Nevertheless, the number of countries representation in the GEWG (11 over 16) is very satisfactory.

With the repetitive GEA, the network obtains quantitative data on the sex composition of students and staff of all members, GE plans and practices, problems and barriers existing in Mediterranean Engineering institutions, helping a comprehensive understanding of the most relevant problems to be addressed.

The GEA shows that GE asymmetries exist in Mediterranean HEELs, creating an ever more pressing need for promoting GE, and the lack of legislation for GE implementation in some Mediterranean HEELs, along with culture and religion differentiated approaches to genders, are important barriers for GE advancement. European Mediterranean countries are more advanced in GE due to existing European legislation, and in many cases national legislation. Non-European Mediterranean countries are lacking behind in the GE efforts due to cultural barriers and related legislation not set. 38 institutions over 40 replied to the survey which is considering as a very good number, taking in account the inactive role of some member-institutions, their lack of related data and also the lack of authorized persons in the institution with assumed responsibility to reply to the questionnaire. Furthermore, the replies to the questionnaire pointed out that there is a lack of work-life balance, childcare in all institutions.

GE is a wicked problem in Mediterranean HEELs due to socio-cultural beliefs and bias, family dynamics, and other cultural issues. The problem of violence against women is an important issue in some universities, mainly in countries of the south Mediterranean. Communities of practice exist in the north Mediterranean universities, animated by some inspired scholars, while GEP/GES are rare. Only the Technical University of Catalunya (UPC), in Spain, is in the pathway of designing the 3rd GEP.

For the first time in the history of the network, 50% women were elected in the board, in the elections of the year 2018, one year after the TARGET project started. Women also elected for the president and vice-president's position. This shows that tools like European projects have the legitimacy to catalyze the change towards GE balance in governance, that otherwise is somehow difficult to be expressed.

GEPS presented and approved (by voting) by the top-managers of the member-institutions present in the GA 2019 and by nominated professors to participate in the GA and vote in the name of their top-manager. The GEPS unanimously approved by all legal participants in the GA2019, 40 in total. 40 representatives were present in the GA from 16 members and 9 countries.

Although the changes at the network's structure are very tangible with the election of a new board 50/50 gender-balanced, women elected as the president and vice-president for the first time in the network's life since its creation on 1997, the changes at the member-institutions are at the start-up phase. In some HEELs a structural change started with the GE centers/committees (GEC) development that professor-members of the GEWG have initiated, always with the commitment of the top-management of their institutions. Structural changes are top-down processes and need the commitment of universities' top-management. The number of the institutions that paved the way in that direction are 8 (4 in Tunisia, 2 in Morocco, 1 in Lebanon, 1 in Palestine), while related committees already exist in universities of the European Mediterranean countries (France, Spain, Italy, Greece). Of course, this is an ongoing process and it is expected that other HEELs will be inspired to take the leap in the next years.

Although, the network can inspire and stimulate the creation of structures for GE in the member-institutions, the responsibility for

the continuation and sustainability of those structures remains at the institutions and depends on the top-management openness and willingness to continue and further foster GE plans. Political and cultural contexts can hinder initiatives on GE. Mediterranean countries are facing many social upheavals, threatening also the GE principle, as not being a priority activity. Already, many HEEIs are becoming inactive to the network's activities and lose the interconnectedness with other institutions due to mentioned challenges. Besides, the network has not the legal right for interventions to the member-institutions management.

The building of communities of practice (CPs) is a down-top process and needs inspired professors and students to make the efforts, in contrary with the structural changes that is a top-down process. CPs created based on tailor-made activities and a continuous, open and critical discussion. A dynamic, comprehensive and iterative process about GE is adopted which might serve as a model or starting point for action regarding the other institutions, while an ongoing discourse on GE and the role of engineers is opened.

GES application provided training of young students through workshops, summer schools, and activities. Engineering schools' students, the youth of RMEI, learned to act with the principle of GE, by submerging in living-learning in connection with the network, digesting their universities' practices with interaction with the learning community of RMEI. In doing so, students are becoming 'learners' that can act as change agents, advancing their knowledge by sharing and interconnecting with others in the network, having the opportunity to participate and learn from workshops, seminars, and schools organized by the network. The network becomes a living lab for GE learning, encouraging member-institutions to challenge and question their informal norms. It also creates the potential for direct and indirect structural change related to GE, through the creation of formal rules and culture aiming at fostering GE among the network's representatives, on boards and working groups.

Students, professors-members of the GEWG are engaged with the GE, contextualize any experience in the domain of SD and GE, learn to critically read, and analyze some accounts of GE issues and situations, identify topics of interest in some gender inequality situations, identify structures and types of organization that are meaningful in the domain of GE advancement in their university and in the network.

The network succeeded to increase the pace of GE thinking and acting which was slow. This was achieved by joint efforts with the institution's leaders and inspired individuals to address the GE gap, with a systemic strategy aiming at longer-term institutional change, with a firm commitment from policymakers and top institutional leaders. This is credited as well to the vision and values of RMEI. What differentiates RMEI from other networks is that it envisions sustainability through education. It envisions men and women to work together towards a sustainable world proposing sustainable innovations for facing Mediterranean and global challenges. It envisions women engineers to be considered equal to men at all levels of their activities and life and is calling for action to pursue SD goals, to strengthen peace, stability, and prosperity in the Mediterranean region.

A sense of the mission is felt by the professors and students who take part in GE workshops and activities, a sense of meaning for the persons concerned, a higher goal that transcends the horizon of the individual. Enthusiasm, joy, satisfaction, and the feeling of a belonging to a family expressed by the all actors. Of course, these feelings cannot be measured, but they are, for sure, the essences of a metabolized learning to an embedded knowledge. By creating trust, joy and the feeling of belonging to the same community, the network succeeds to enhance the willingness of people and institutions to act.

The novelty, applicability, and significance of the GES enables the network's transformation at the level of its governance and values, and provides inspiration, catalyst and the basis for an ongoing GE change at member-institutions, underpinning members participation in activities, networks, and projects of SDGs of a Mediterranean without borders. The novelty, applicability, and significance may inspire other institutions to proceed with a GE change.

The quantitative assessment of anticipated impacts by providing indicators and metrics is fundamental to assess interventions and the effectiveness of the GEP adopted. The anticipated GE advancement impact of the strategic lines' GEP application for the case of RMEI needs to be assessed by metrics applied to all activities. However, provision of indicators for monitoring and assessment is out of the scope for this study and it will be the objective of a future study. The study is focused to provide the tailored RMEI approach and strategy also requiring an in-depth understanding of the sources of synergies and barriers encountered, and consideration of the specific characteristics and complexity of the region and the engineering context.

5. Conceptual frameworks and lessons learned as guidelines for good practices

The findings are presented as conceptual frameworks with the aim to make them more meaningful, ensuring generalizability and applicability, enhancing the empiricism and rigor of the study, including the variables linked to multidisciplinary knowledge.

Sharing lessons learned allows to take advantage of best practices because we learn from our own experiences as well as the experiences of others. Although, capturing lessons learned from this case study is an on-going effort, some lessons already have learned and are shared in this section, as opportunities for good practices to successfully be used by other institutions, networks and individuals.

i) Unraveling the link of GE with the nexus Education-Sustainability

The 21st century's unprecedented global challenges beyond climate change call for technological acceleration and equal societies to face systemic challenges, where sustainability is a key element. Sustainability transitions deal with the dynamics and governance of transformative, systemic, and socio-technical change processes, directly connected with GE. Integrating GE with sustainable development in education requires profound conceptual understanding of both concepts and their interlinkages. The gender sustainability-education nexus can be understood by recognizing systematically women's positive impacts on SD.

ii) Harvesting synergy from SDGs interactions and R&I activities with GE

Identifying the links of R&I activities of engineering education and practice innervations that when applied at the different stages of SDGs chain can harvest and give rise to synergies with clean water and sanitation for all (SDG6), access to affordable, reliable, sustainable energy for all (SDG7), strong and resilient infrastructures (SDG9), inclusive, safe, resilient and sustainable cities (SDG11), inclusive and sustainable production and industrialization (SDG 9, 12), climate action (SDG13). To address the intersection between GE and SD, the synergies of GE with other SDGs goals should be understood and experienced in practice, as well as analysed through a policy coherence and inclusiveness framework.

iii) Responsibility

The connectivity paradigm in unraveling the links between GE and SDGs is very important for taking the responsibility in advancing GE in HE. HEELs have the responsibility to integrate GE into their teaching, research, practices, community engagement and to bring a real transformation that involves a shift in ways of thinking, acting, and enacting equitable relationships. Learning and acting of GE creates an interconnected and knowledge-based world economy that can distribute opportunities for men and women.

iv) Commitment to DSGs

Responsibility assumed by the members of the network gives them a sense of identity and self-esteem, commitment to SDGs and equity, value and respect for diversity, beyond the concern for the environment and commitment to SD.

Institutions-members of RMEI expressed their commitment to embed GE with the UN world SDGs agenda 2030, at the center of their mission and develop their activities within this framework. If someone is committed to SDGs, it is difficult to deny the gender dimension because promoting GE is crucial to accelerating SD. Responsibility assumed by the members of the network gives them a sense of identity and self-esteem, commitment to SDGs and equity, value and respect for diversity, beyond the concern for the environment and commitment to SD.

v) Values and Ethics

The SDGs offer a compelling vision and frameworks to achieve sustainable and equitable societies. Based on a strong set of vision's common values among RMEI's members, and relations that are based on trust, the network envisioning building SD and peace in Mediterranean through education and collaborative learning, managed to inspire the value of GE as cornerstone for the achievements of all SDGs and SD. The adoption of the GES is a result of the members commitment to the values of sustainability and SD. SD is an ethical concept and values and beliefs underpin it. For a network's member, discovering his/her own values in the domain of SD can give insights into what is important in a situation and what is shared and not shared with other individuals and network.

vi) Cooperation through Networking

Cooperation among several HEELs and other non-academic partners can create networks, based upon a common vision and values that can link knowledge with action, enhance collective action, promote social learning on SDGs. The approach of the RMEI network in implementing GE, its outreach activities to inspire and catalyze informal and formal changes at the member-institutions is offered as a paradigm.

vii) Regional characteristics

The network achieved tangible results in the Mediterranean HEEL space on GE learning and acting synergistically with other SDGs. The Mediterranean territory is large, and the network has the potential to spread the changes all around the Mediterranean basin. Although, in Europe-based Mediterranean countries GE policies have slowly, but surely developed, in other Mediterranean countries of the Arabic world this development is almost at the zero level with only some exceptions related to anti-harassment measures taken.

viii) Respecting complexity

By respecting the complex relationships between territorial/country, cultural, social, economic and political actors, and considering the local dynamics, history, expectations and requirements, specific concerns and barriers, the GEPS can easier approved.

ix) Integration of top management

The active participation of members of top management is important for the GEPS adoption and related structural changes initiation. To achieve an institutional change, knowing the institution, creating interconnectedness with the network, securing top-level support and generating effective management practices, are crucial components. Without top-commitment, institutional change strategies can get lost. Deep and fast changes cannot easily be delivered, because transformation is a long-term strategic process requiring sustained commitment and efforts along with specific competencies by the leaders of the institutions.

x) Human resources

In all cases, human resources are needed for such achievements. Networks have the necessary human resources.

xi) Financial resources

In addition to human, financial resources are needed for the activities. To enable activities fostering changes, financial support is needed. The support of the EU project enabled RMEI to start-up structural and cultural change towards GE in many Mediterranean universities. The financial support of the TARGET project was very important because it enabled the RMEI to perform the necessary activities that could not have happened with the low budget of the network. Moreover, being partner of a collaborative project, can help in knowing and learning capacity building by the other partners and experts of the partnership, on how to develop effective tools for each stage to be customized to the specific institution, (gender audit, monitoring, and self-assessment, tailored GEP/GES, etc.), which knowledge does not belong to the traditional sphere of engineering education but is a subject of social sciences.

xii) Experience

Informal and formal changes in most of the member institutions can start despite the insufficient experience and knowledge on GE, due to exchange of experience and learning from other partners' best cases in the network, filling the gap of the missing experience.

xiii) Cognitive-emotional stimulation

The process of change undertaken by RMEI showed the importance of the favorable cognitive-emotional environment that if created among the participants can help accelerating the change. Satisfaction and joy should emerge and be shared among members who work for the change, by cultivating the feeling of belonging to the same family, sharing the same values and visions. Understanding emotional as well as intellectual ways of knowing are relevant to systems practices, decision making and behavior. At a rational level, contextualizing of values and hence perspectives, can bring systemic insights into the SD situation.

xiv) Perceptions

Changes towards creating equitable opportunities for both men and women are slow because the GE issue is a wicked problem. It

takes long to integrate GE principles in HE institutions, because this needs also a change at the level of the society's perceptions on gender and at the family's dynamics, along with existing bias uncovering. Societal, cultural, religion, democratic, environmental, economic features and gender bias and perceptions play a great role in the degree of GE advancement. Beyond efforts that education is making, GE and women's empowerment in a region should involve local, regional and national compliance with the laws. Giving women equal access to all opportunities should, therefore, be a key response to the region's economic, environmental, and societal challenges.

5.1. Practical-management related lessons learned

Lessons learned are the documented information that reflects both the positive and negative experiences. Some practical complexities, which are a direct consequence of the need for participation and communication with transparency, are shared here because they proved to be very important for this study.

xv) Encouraging participation

A world of gender parity can only be achieved with the active participation of all genders. Furthermore, participation not only of those already convinced of the value of GEPs but of many stakeholders (associations, agencies, public sector, business, etc.) who see new opportunities for benefits, should be encouraged. In the under-discussion case study, students are encouraged to participate in the established and inclusive GAME network, to organize the Michelangelo workshops, feeling comfortable expressing their ideas on GE, beating stereotypes, and sexism.

xvi) Effective and easy communication.

The work and results should be communicated in attractive way using a variety of easy communication, face-to-face actions, including social media along, YouTube, videos, newsletters and organizing thematic videos by interviewing experts and seniors.

xvii) Transparency

Transparency is an important concept for building trust among the members and face-to-face meetings of the group for building knowledge. Utilizing social networking to promote, share, post and acknowledge the cause of GE and raise awareness of any event is important.

6. Conclusions

HEE is currently undergoing changes, driven by globalization and the increasing need to address the societal challenges of the 21st century, shaping thus the 21st century engineering education that must encompass sustainability, diversity and gender equality into the technological innovations.

RMEI network designed an empirical tailored approach to advance GE to member-institutions and inspire individuals. A GEPS adopted by the university leaders who are committed to embed the UN world agenda 2030 at the center of their mission.

The following general conclusions can be shared:

- Networks of universities with a common vision can have a pivotal role in catalyzing changes and metabolizing learning of GE into practice.
- Key persons and students of the network that have understood their role, can act as multipliers of GE.

- Formal and informal changes can be catalyzed by inspiring the GE principle by showing the connection with SD.
- Creating a sense of meaning for the persons engaged for the GE is important.

The findings of this study may be useful to academic leaders and administrators, professors, students of HE towards impeding holistic sustainability learning with GE and acting accordingly in their personal and professional lives, while improving universities' social character.

Acknowledgments

TARGET project '**T**aking a **R**eflexive approach to **G**ender **E**quality for **i**nstitutional **T**ransformation' is acknowledged. TARGET is a SwafS-03-2016-2017 Coordination and Support Action funded by the European Commission Program H2020. Acknowledgements are also expressed to all members of the *Gender Equality Working Group* (GEWG) of RMEI: Prof. O. Boiron from ECM-France, and Executive Director of RMEI, Prof. Fatma Asfour, director of the Cairo University Center for Hazard Mitigation, Environmental Studies and Research-Egypt and vice-president of RMEI, Prof. Mara Lobardi, from Sapienza University-Italy and President of RMEI, Prof. Massimo Guarascio (leader of GAME) from Sapienza University-Italy, Prof. Najoua Essoukri Ben Amara and Ass. Prof. Ghiss Moncef from ENISO-Tunisia, Prof. Khalid Najib and Ass. Prof. Ibtissam Medarhri from ENSMR-Maroc, Ass. Prof. Tilda Karkour Akiki from Holy Spirit University of Kaslik-Lebanon, Ass. Prof. Khaled Al-Sahili, Dean of Engineering School, Najah University Nablus, West Bank, Palestine, Prof. Juan Jesus Perez, Vice-Rector of Universitat Politècnica de Catalunya-Spain, Emeritus Prof. Leo Vincent, ex-president of RMEI, Irene Jorge Fernández, International Projects Unit, Research and Innovation Support Service Universitat Politècnica de Catalunya-Spain; to GAME students, Mrs Oumaima Bukamel (internship student), and all colleagues from RMEI for their contribution to the TARGET gender equality activities in RMEI and their Universities. Thanks also to the reviewers whose comments improved the article.

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