

# WOMEN IN ICT



EDITORS: Potes Barbas, Maria; Teles Vieira, Andreia

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# Introduction

**Maria Potes Barbas**, Polo Literacia Digital e inclusão Social, CIAC, Instituto Politécnico de Santarém

The history of Women in Information and Communication Technology (ICT) is abundant in contributions and achievements, despite numerous challenges and systemic barriers. This handbook's provides a part dedicated to Historical Perspective of Women in ICT that showcases a legacy of innovation and resilience, a part dedicated to Statistics Data Analysis about the ICT Women Workforce, providing numbers about the gender gap between Women and Men and all the barriers Women have to endure to have a career in ICT areas. This Handbook also has a part called Challenges and Solutions: Case Studies of Women in ICT, highlights the critical role of ICT in empowering Women and advancing gender equality, another part is, Inclusive Policies and Environments, that highlights a set of measures to promote inclusive policies for Women in ICT, and the last part of this Handbook is the Student's Perspective on Women in ICT and it refers to a collaborative work with students of the Bachelor's Degree in Multimedia Production in Education and their vision of Women in ICT.

These five parts lead to this handbook, who is also a collaborative work between Portugal, Spain and Romania, and their contributions to enhance Women and their role in the ICT areas.

# 01. Historical Perspective of Women in ICT

Elsa Casimiro, Polo Literacia Digital e inclusão Social, CIAC, Instituto Politécnico de Santarém

## Introduction

The history of women in Information and Communication Technology (ICT) is rich with significant contributions and achievements despite numerous challenges and systemic barriers. This handbook's section provides a historical perspective on the role and impact of women in ICT, highlighting key figures - pioneering women who laid the groundwork for modern computing and those who continue to shape the field today -, milestones, and ongoing efforts to bridge the gender gap in this critical domain. The narrative spans from early innovators like Ada Lovelace to contemporary leaders in the tech industry, showcasing their resilience and ongoing quest for recognition and equality.

## Early Contributions and Pioneers

Women have been integral to the development of computing from the very beginning.

In the 18th century, Nicole-Reine Lepaute, a French mathematician and astronomer, accurately predicted the return of Halley's Comet, showcasing early female involvement in scientific computation.

In the 19th century, Ada Lovelace (1815-1852) is recognized as the world's first computer programmer. She worked on Charles Babbage's early mechanical general-purpose computer, the Analytical Engine. Her notes on the engine include what is recognized as the first algorithm intended to be carried out by a machine. Lovelace understood that this machine had the potential to perform tasks beyond simple arithmetic calculations, envisioning its use in various applications, including composing music and creating graphics. Her insights marked the beginnings of computer programming and demonstrated an early recognition of the broader capabilities of computational machines (Williams et al., 2016).



Ada Lovelace: The World's first computer programmer

Within the domain of technology, Edith Clarke (1883-1959), the first female electrical engineer and professor of electrical engineering in the United States, invented the Clarke calculator, a graphical device for solving line equations, and made significant contributions to electrical engineering.

The early 20th century saw women like Grace Hopper, Hedy Lamarr and the "ENIAC girls" make significant strides.

Grace Hopper (1906-1992), a prominent figure in the post-war era, was a Navy rear admiral and pioneering computer scientist. She developed the first compiler for a computer programming language and was instrumental in the development of COBOL, one of the first high-level programming languages still in use today (Hicks, 2018).



Grace Hopper: The Esteemed Computer Scientist

Hedy Lamarr (1914-2000), known more widely as an actress, co-developed a frequency-hopping system during World War II, which laid the groundwork for modern wireless communication technologies like Wi-Fi and Bluetooth (Abbott, 2019).



Hedy Lamarr: The Inventor of WiFi

The ENIAC programmers, a group of six women including Kathleen McNulty, Betty Jean Jennings, and Frances Bilas, were among the original programmers for the ENIAC, the first general-



purpose electronic digital computer (Sax et al., 2017). They played a crucial role in programming and operating the ENIAC.

During and after World War II, women continued to contribute significantly to computing. At Bletchley Park, women like Joan Clarke played crucial roles in codebreaking efforts that were vital to the Allied victory. In the 1960s, women were prominent in software development, as evidenced by their dominance in early programming roles and significant projects at NASA, such as the contributions of Margaret Hamilton, who developed the onboard flight software for the Apollo missions.

### **1960s to 1980s: Expansion of the Computer Industry**

This period saw an increase in the number of women entering programming and software development roles, although they often faced significant gender stereotypes and barriers to advancement (Cheryan et al., 2017).

Margaret Hamilton (1936) led the software engineering division of the MIT Instrumentation Laboratory, contributing critical software for NASA's Apollo missions, epitomizing the integral role of women in early space exploration (Sax et al., 2017).

Annie Easley (1933-2011), a highly inspirational woman in STEM, started her career working as a human computer in the 1950s, performing computations by hand for researchers. She later worked as a computer programmer supporting NASA, developing and implementing the code used in researching energy-conversion systems and power technology, such as battery technology used for early hybrid vehicles.



Annie Easley: The NASA Rocket Scientist

Sister Mary Kenneth Keller (1913-1985), one of the first women to earn a Ph.D. in computer science in the United States, contributed to the development of the BASIC programming language, making computing more accessible.



Sister Mary Kenneth Keller: One of the first women to earn a Ph.D. in computer science, with major contributions to develop the BASIC computer programming language.

Adele Goldberg (1945), a prolific computer scientist, with her programming language Smalltalk-80, inspired the first Apple computer. Reportedly reluctant to show Steve Jobs the language when he asked for a demonstration, she eventually did, and her ideas formed the basis for the Apple desktop.



Adele Goldberg: The inspiration for Graphical User Interfaces (GUI)

Mary Wilkes (1937) is a lawyer, former computer programmer, and logic designer known for her work with the LINC computer, now recognized by many as the world's first "personal computer." In 1965, she became the first-ever person to be a home computer user, initiating the concept of the home office so integral to our working lives today.



Mary Wilkes: The First Home Computer User. Mary Wilkes at home with the LINC

### **Challenges and Decline (1980s-1990s)**

Despite their early prominence, the latter half of the 20th century saw a decline in women's participation in ICT. This shift was due to various factors, including the professionalization of computing and the cultural perception of computing as a male-dominated field. By the 1980s, the number of women in computer science had significantly decreased, coinciding with the rise of personal computers marketed primarily to men and boys. The cultural shift towards viewing computing as a male-dominated field contributed to a decrease in female participation.

### **1990s and 2000s: The Internet Boom**

The rise of the internet in the 1990s opened new opportunities for women in ICT. Despite this, gender disparities persisted, with women often underrepresented in leadership positions and technical roles (World Economic Forum, 2021). Tech giants like Google and Microsoft began recognizing the need for greater diversity, but the industry continued to struggle with creating inclusive environments (NCWIT, 2020).

### **Modern Contributions and Continuing Challenges**

Anita Borg (1949-2003), a computer scientist who advocated for the inclusion of women in technology, founded the Institute for Women and Technology (now the Anita Borg Institute for Women and Technology) and co-founded the Grace Hopper Celebration of Women in Computing.



Anita Borg: Computer scientist who advocated for the inclusion of women in technology; Founder of AnitaB.org Institute for Women and Technology; Co-founder of Grace Hopper Celebration of Women in Computing

The 21st century has brought renewed efforts to address gender disparity in ICT. Initiatives like Girls in ICT Day aim to inspire and encourage young women to pursue careers in technology. Organizations such as SheCodes provide training and resources to upskill women in coding, helping to bridge the gender gap in the tech industry.

Notable women in tech today include Sheryl Sandberg, COO of Facebook, and Ginni Rometty, former CEO of IBM, who have become role models and advocates for women in the industry. Their success stories highlight the potential for women to lead and innovate in ICT, although challenges remain.

Studies indicate that women still face barriers such as slower salary progression, lower chances of career advancement, and a lack of representation in leadership roles.

### **Inclusion Movements and Diversity Efforts**

Organizations such as Girls Who Code, AnitaB.org, and Women Who Tech have gained prominence, advocating for the inclusion of women in ICT through various programs and initiatives (Girls Who Code, 2019). Social media platforms have amplified the voices of women in ICT, enabling them to share experiences, form support networks, and push for greater gender equality in the tech industry (ONU Mulheres, 2020).

### **Significant Contributions and Persistent Challenges**

Women have been behind numerous innovations and patents in ICT, though their contributions have not always received due recognition (Abbott, 2019). While there is a growing number of women in leadership roles and as founders of tech startups, they remain underrepresented compared to their male counterparts (AnitaB.org, 2021). Women in ICT often face wage disparities when compared to their male colleagues, reflecting broader issues of gender inequality within the industry (World Economic Forum, 2021). Despite advancements, women

are still significantly underrepresented in executive roles and on corporate boards in the tech sector (NCWIT, 2020).

## Supportive Initiatives and Policies

Various educational initiatives and mentorship programs have been established to encourage girls and women to pursue careers in ICT, providing essential support and resources (UNESCO, 2019). Many companies have implemented diversity and inclusion policies aimed at creating more equitable workplaces and supporting women in ICT roles (AnitaB.org, 2021).

## Conclusion

The historical perspective of women in ICT showcases a legacy of innovation and resilience. While significant progress has been made, the journey remains fraught with challenges that require ongoing attention and action. Acknowledging and celebrating the contributions of women, both past and present, is crucial for building a more inclusive and diverse future in technology. Recognizing the historical and ongoing contributions of women in ICT is crucial for inspiring future generations and promoting a more inclusive and diverse technological landscape.

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## 02. Statistics data analysis about the ICT women workforce

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On March 9, 2021, the European Commission presented its vision for the EU's digital transformation by 2030. One of the targets set for 2030 includes "having 20 million ICT specialists employed in the EU (with convergence between women and men)". The goal is for both genders to be equally represented in this sector, thereby reducing existing gender disparities (2030 Digital Compass: the European way for the Digital Decade (COM(2021) 118 final).

According to the Eurostat Regional Yearbook 2023 edition (Eurostat, 2023), in 2022, 32.8% of the people employed in high-technology sectors in the EU were women. This proportion varied across NUTS 2 regions, from a high of 50.2% in the Hungarian region of Nyugat-Dunántúl (the only region in the EU where there were more women than men employed in high-technology sectors) to a low of 8.3% in the Greek region of Thessalia.

According to the latest data from Eurostat (Eurostat, 2023), the share of women working in ICT is slightly increasing compared to previous years (19%), although it is unequivocal that the proportion of men (81%) is much higher in this field of work. According to the same data, the highest shares of women working in ICT were observed in Bulgaria (29,1%), Romania (26%) and Estonia (26,8%), while the smallest shares were found in Malta (13,8%) and Hungary (14%).

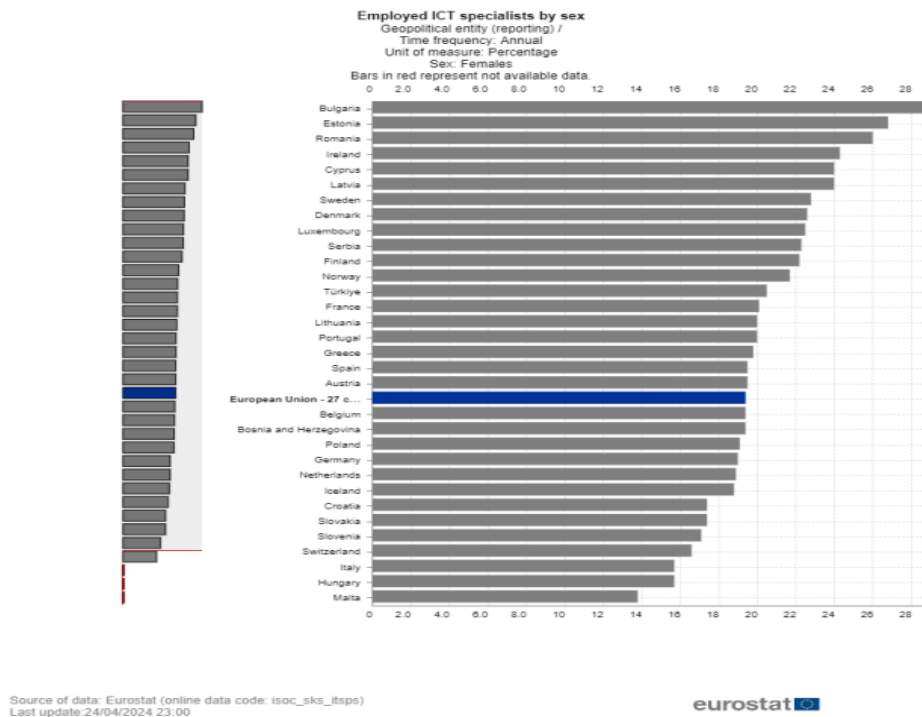
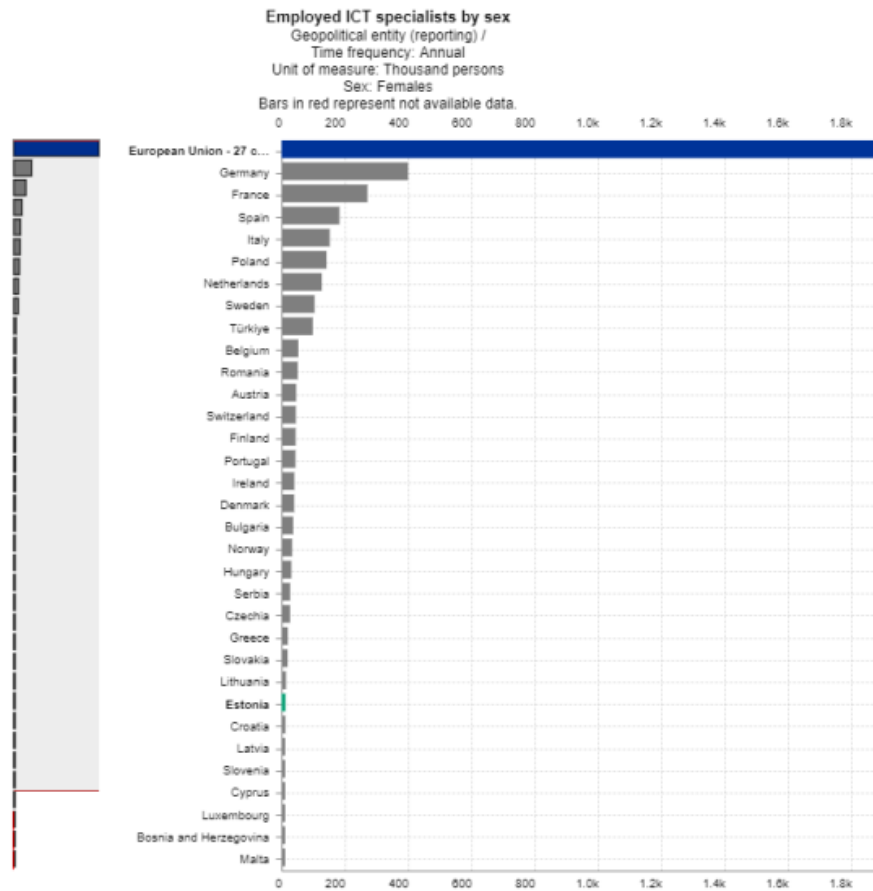


Figure 1 Employed ICT specialists by sex females | Source: Eurostat

If we systematize the data in terms of numbers rather than percentages, we will observe that Germany (399.6 thousand women) has the highest number of employed women in ICT, followed by France and Spain.



Source of data: Eurostat (online data code: isoc\_sks\_ittps)  
 Last update: 24/04/2024 23:00



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 General disclaimer of the EC website: [https://ec.europa.eu/info/legal-notice\\_en.html](https://ec.europa.eu/info/legal-notice_en.html)

Figure 2 Employed ICT specialist by sex females, unit of measure persons | Source: Eurostat

If we refer to employed persons with an ICT education, we can mention the data revealed in the material "More men with an ICT education employed than women" (Eurostat, 2022), published in October 2022. According to the document, "in 2021, there were 2.79 million employed persons with an ICT education, 3.3% more than in 2020. Men represented 84.1% (2.35 million) of the EU's total workforce with an ICT educational background, an increase of 1.3% from the previous year (2.20 million in 2020), while the number of women in employment with an ICT education declined. In 2021, women represented 15.9% (442,800) of the ICT workforce compared with 17.2% (463,800) in 2020.

Looking at the EU Member States, Czechia (92.6%), Slovenia (90.8%), France (89.7%), Belgium (89.2%), and Poland (89.1%) had the highest shares of men in the total number of employed persons with an ICT education. Women accounted for more than a quarter of employed persons

with an ICT education in Bulgaria (36.6%), Greece (29.4%), Denmark (28.0%), Romania (27.2%), and Cyprus (26.9%)”.

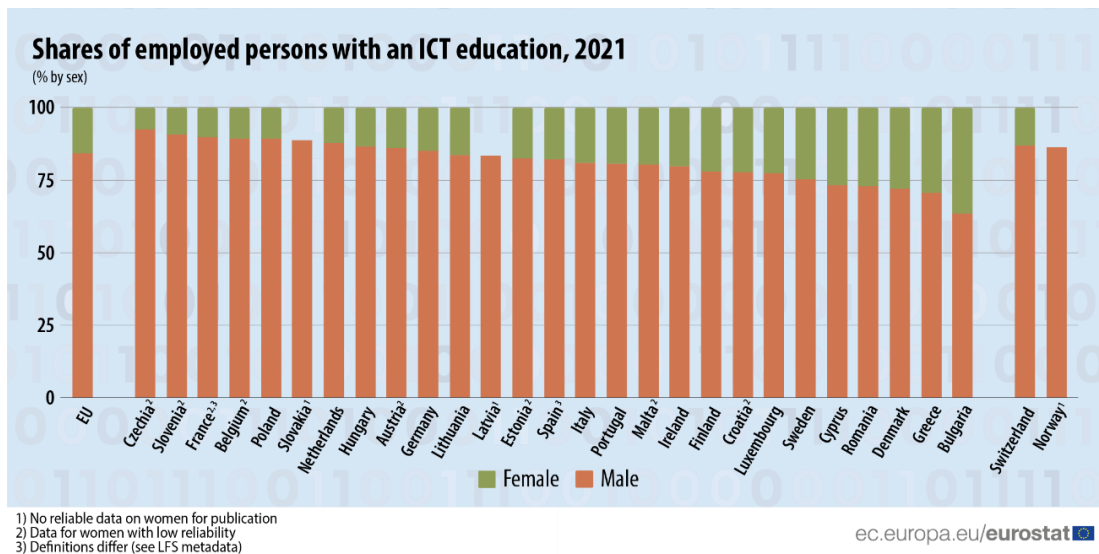


Figure 3 Employed persons with an ICT education, 2021, in UE | Source dataset: [isoc\\_ski\\_itsex](https://isoc.ski.itsex)

Women who choose a career in ICT face many more obstacles than men. These include:

### 1. Salary differences for the same work;

There are recorded gender-based wage disparities, with women consistently earning less than men for similar work (Sköld & Tillmar, 2015). The paper "Career resilience of female professionals in the male-dominated IT industry in Sweden: Toward a process perspective" also highlights that the continuing separation of roles into so-called 'female' and 'male' responsibilities is evident from the fact that 25% of women work part-time, compared to only 8% of men (Tokbaeva & Achtenhagen, 2021).

### 2. Public policies are not adapted to the needs of women in ICT;

In the article "Women in the ICT Sector in European Union States: Facing Gender Inequalities" (Gaweł & Kapsdorferová, 2024), the authors highlighted that addressing the underrepresentation of women in senior management positions, politics, or entrepreneurship is an essential step towards achieving gender equality by breaking down barriers, combating prejudice, and implementing inclusive policies.

### 3. The difficult balance between family life and work in this field,

which sometimes requires mobility for long periods of time and even to places far away from your home. Author MK Ahuja, said that "Career choices are made during university education and entry-level jobs. It is defined as the 'likelihood that a woman will choose IT as a career'.



Career persistence becomes an issue when a woman is faced with issues related to starting and raising a family” (Ahuja, 2002).

#### 4. Harassment.

In the article "Inclusion of women to ICT engineering – lessons learned" (Lagesen, Pettersen, & Berg, 2021), the authors describe that the gender-related harassment and sexism is the 'woman problem' in ICT. The explanation came also from the stereotypical image of computer scientists as male, asocial hackers has been found to alienate women from the field (Gansmo, Lagesen, & Sørensen, 2003). Thus, a dominant narrative of a multitude of barriers in the form of resistance, gender stereotyping, a hostile and off-putting culture combined with an unattractive image of computer scientists has led to a negative circle of exclusion of women in ICT (Lagesen V. , 2006).

The European Union is committed to promoting the gender equality principle in all its actions, stressed the importance of women in ICT and elaborat a resolution in 21 January 2021 on closing the digital gender gap: women’s participation in the digital economy (2019/2168(INI)). And also the resolution from 10 March 2022 on the EU Gender Action Plan III (2021/2003(INI)). Is very important in monitor progress of member states in reducing the gender gap, so EU had initiatives such as the Women in Digital Scoreboard<sup>1</sup>, part of the Digital Economy and Society Index (DESI).

The web-article from 2021 (European Commission, 2021), reveals that the gap is significantly smaller for the use of internet and internet user skills. 85% of females used the internet regularly in 2020 compared with 87% of males. A 4-percentage-point difference can be observed in the digital skills indicators: 54% of females have at least basic digital skills (58% of males), 29% above basic digital skills (33% of males) and 56% at least basic software skills (60% of males) as of 2019.

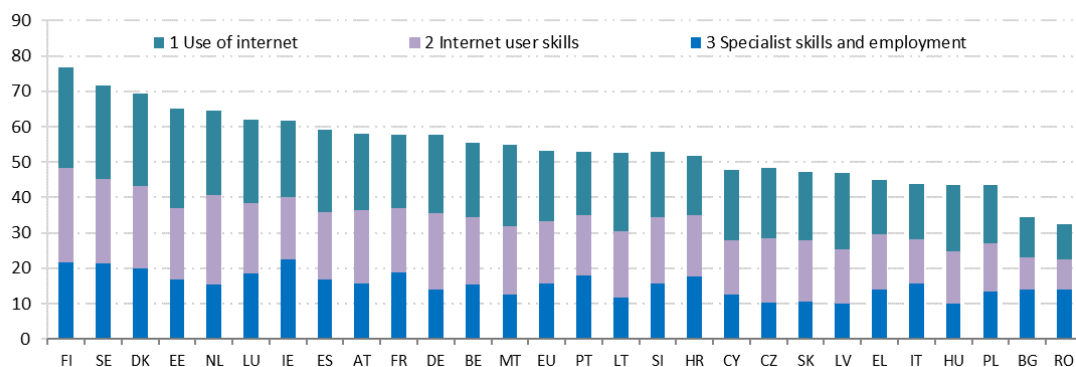


Figure 4 Women in Digital Scoreboard — ranking of Member States-2021 | Source: <https://digital-strategy.ec.europa.eu/en/news/women-digital-scoreboard-2021>

The inclusion of women in ICT is a goal of the EU that will not be easy to achieve. However, through combined efforts of the public and private sectors, it could be attained. Examples of best practices are provided by NGOs and private companies that promote women's participation in this sector, offering scholarships and even awards to women who have demonstrated their value.

<sup>1</sup> <https://digital-strategy.ec.europa.eu/en/news/women-digital-scoreboard-2021>

Furthermore, public policies should provide incentives to ICT employers to attract female employees, as well as measures to ensure a better work-life balance (such as on-site childcare facilities, financial support for babysitting, etc.).

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## 03. Challenges and Solutions: Case studies of women in ICT

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### 1. Case Studies

The field of Information and Communication Technology (ICT) is pivotal in shaping the modern world, driving innovation, economic growth, cultural and social transformation. Despite its importance, ICT remains a male-dominated industry, with women underrepresented at all levels, from education to professional roles. This part of the handbook addresses the gender gap in ICT by looking at challenges faced by women in ICT and success key factors that contributed to their success, but also policy recommendations to support and empower women in this dynamic field.

According to the World Economic Forum's Global Gender Gap Report 2021, "progress has stagnated, with widening gender gaps on the Political Empowerment subindex globally, which has led to an increase in the estimated time to close the global overall gender gap to 135.6 years" (p. 40). The underrepresentation of women in ICT limits their opportunities and hinders the diversity and innovation potential within the industry.

According to the European Commission ("Women in Digital"), women constitute 51% of the EU population but only 1 in 3 STEM graduates and 1 in 5 ICT specialists are women. The percentage of women in ICT roles has remained relatively unchanged over recent years. It recommends:

#### Equal Opportunities

Ensuring everyone has a fair chance to thrive in the digital world.

#### Highly Skilled Workforce

Europe aims to increase ICT professionals from 9 million in 2022 to 20 million by 2030.

#### Diversity for Innovation

Diverse and gender-balanced teams produce better and more inclusive digital solutions.

#### Policy Framework

Digital Decade Policy Programme 2030 and Women in Digital Declaration, signed by 26 EU countries, Norway and UK, to promote gender equality in the ICT sector.

It has diverse programs to address the challenges:

Funding Programs, such as DIGITAL Europe Program; Horizon Europe (supporting initiatives like Women TechEU for women-led tech start-ups); Creative Europe MEDIA Program that fights gender stereotypes and provides mentorship and training for women in creative industries.

Digital Skills & Jobs Platform: Provides resources, training opportunities, and support for digital skills development.

European Network of Women in Digital (EWiD): Encourages more girls and women to explore digital studies and careers.

European Digital Skills Awards: Celebrates projects that promote digital skills, including initiatives like 'Girls Code It Better'.

Women in Cyber: Supports female cyber managers and graduates, promoting their achievements in cybersecurity.

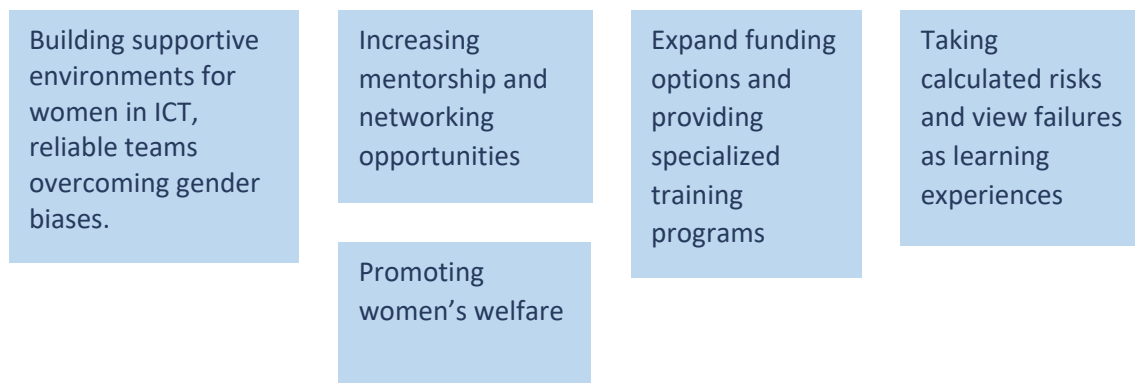
The European Commission emphasizes the need for increasing the number of women in ICT through education and training, promoting policies that support gender equality in digital fields, and ensuring digital transformation benefits everyone and achieves gender balance.

Through successful case studies, we look at valuable insights into overcoming barriers and achieving success for women in ICT.

The Asia-Pacific Economic Cooperation Case Studies of Successful Women Entrepreneurs in the ICT Industry (2018) presents the success stories of women entrepreneurs in the ICT sector, identifying challenges faced by women, key success factors and policy recommendations in 21 Asia-Pacific Economic Cooperation Countries.

According to this report, based on face-to-face interviews or skype interviews made to 24 women of 21 countries, the common challenges for Women in ICT are difficulties in accessing funding, gender discrimination, lack of mentorship and coaching networks; deficiency in necessary ICT skills and business experience; fear of failure related to business risks. Among the Key Success Factors, it underlines government support; support from entrepreneurial networks; active use of ICT to enhance business; customer-Centred Approach; Personal drive and commitment to ICT entrepreneurship.

The main policy recommendations are:



One of the examples that illustrates the diverse applications of ICT in various sectors and the pathways through which women have navigated and succeeded in the digital economy is Carmen Gloria Aracena Alvarez, an Electronic Engineer from Chile, driven by a strong passion for entrepreneurship and innovation, who faced gender discrimination and difficulties in obtaining funding, managed to get government and coaching networks support for using ICT tools to enhance business operations and reach, focusing on meeting customer needs. Like many other women in this report, she had to overcome the fear of failure through perseverance and resilience.

Samuel Musungwini, Tinashe Gwendolyn Zhou, Linnet Musungwini (2020) present the challenges that Women face in ICT from women perspective. The case study of the Zimbabwean Banking Sector and Telecommunications Industry shows the low representation of women in ICT jobs in Zimbabwe, despite women constituting a larger percentage of the population. It explores the obstacles women face in ICT-related careers within the banking and telecommunications sectors and provides recommendations for encouraging more women to pursue and succeed in ICT.

The authors underline that women are under-represented in ICT roles in the banking and telecommunications sectors; the majority of women in ICT are in lower-skilled roles, with fewer in medium and highly skilled positions; that 66% of women reported having high-level ICT skills, 26% medium, and 8% low.

From women perspective, the main challenges are i) the lack of digital exposure and career guidance (major challenge); ii) discouragement from society; iii) gender stereotyping; iv) lack of mentors and role models; v) work-life balance; and vi) organizational constraints. And the best practices for encouraging women in ICT are: i) early exposure to ICT, starting from primary school; policies ensuring equal gender representation in ICT courses and programs; parental involvement in supporting and encouraging girls to pursue ICT careers; career guidance sessions in schools to inform girls about ICT opportunities; mentorship programs run by successful female role models in ICT; involvement of women in ICT activities, through boot camps, hackathons, etc.

The study highlights the need for comprehensive strategies to address the gender imbalance in ICT.

In Module C1 on Women's Empowerment, SDGs and ICT (UN-APCICT/ESCAP, 2016), Faheem Hussain highlights the critical role of ICT in empowering women and achieving the Sustainable Development Goals (SDGs), mainly SDG 5.

The Barriers to Women's Empowerment are mainly:

## **SDG 5**

Gender Equality focuses on achieving gender equality and empowering all women and girls. It aims to end all forms of discrimination and violence against women and girls, eliminate harmful practices, and ensure women's full participation and equal opportunities in leadership and decision-making. Empowerment through ICT: ICTs are pivotal in promoting women's empowerment by providing access to information, education, and economic opportunities. They help women gain better status within their societies and excel professionally. ICT tools support various aspects of women's lives, from education and health to entrepreneurship and political participation.

- Discriminatory social norms and culture: socio-cultural traditions often restrict women’s movements and opportunities, confining their roles within a limited space. This impacts their decision-making capabilities and their ability to participate fully in social and economic activities
- Gender-Biased Laws and Regulations: Many countries still have legal barriers that hinder women from enjoying the same rights and privileges as men. These laws affect women's ability to own property, obtain credit, and participate in the workforce.
- Limited Access to Public Services: Women and girls often face limited access to quality education and healthcare services, which hampers their ability to utilize ICT effectively and benefit from its opportunities.

The recommendations to Women’s Empowerment are mainly:

#### **Supportive Policies and Programs:**

Gender-responsive policies and programs that promote women’s access to education, healthcare, and economic resources are essential for their empowerment.

#### **Access to ICT:**

Providing women with access to ICT tools and training is crucial for their empowerment. ICT can help bridge the digital divide and enable women to participate in the digital economy.

This Module includes various case studies illustrating how ICT has empowered women in different regions. For example, the Women’s Digital Literacy Campaign has provided basic ICT training to over one million women, helping them to improve their livelihoods and participate in the digital economy, through workshops and training sessions on basic computer skills, internet usage, and digital tools.

There are other case studies;

- E-Health Services, in rural areas, to improve access to healthcare for women through digital platforms, implementing telemedicine services, online health consultations, and digital health records. This improved health outcomes and reduced travel time and costs for women in remote areas.
- Women’s Entrepreneurship Program, to promote women's entrepreneurship through ICT, by training on digital marketing, e-commerce platforms, and financial management software.
- ICT Training for Women Farmers, in Kenya to enhance the productivity and income of women farmers through ICT, by training on the use of mobile apps for weather forecasting, market prices, and agricultural best practices, that increased agricultural productivity and improved market prices for women farmers.
- Digital Skills for Young Women, in Nigeria to equip young women with digital skills for better employment opportunities, by providing courses in coding, graphic design, and digital marketing, that enhanced employability and increased job placements in tech-related fields to provide safe spaces for women to learn and use ICT, setting up ICT centers with computers and internet access, offered training programs, that empowered women with ICT skills, increased access to information and opportunities for social and economic development.
- e-Commerce Platform for Women Artisans, in Tanzania to enable women artisans to sell their products online, by developing an e-commerce platform, trained women on

product listing, online marketing, and order management. It expanded market reach, increased sales, and higher income for women artisans.

These case studies illustrate the diverse applications of ICT in empowering women across different regions of the world. They emphasize the importance of digital literacy, healthcare access, entrepreneurship, agricultural productivity, and employment opportunities for women. Despite facing challenges such as limited connectivity and societal barriers, these initiatives have made significant strides in improving the socio-economic status of women, contributing to the achievement of not only SDG 5, but several others, mainly those below.

#### **SDG 4**

**Quality Education: Educational Pathways:** The research underscores the importance of encouraging young women to pursue education in ICT fields. It identifies factors influencing career choices and highlights the need for gender-sensitive educational policies and practices to support women's participation in ICT. **Skills Development:** The study advocates for improved access to quality education and training for women, which is essential for closing the skills gap and ensuring women are well-prepared for ICT careers.

#### **SDG 8**

**Decent Work and Economic Growth: Economic Participation:** By focusing on women's involvement in ICT, the study contributes to broader efforts to increase women's participation in the labour market, thereby supporting economic growth. ICT is a high-growth sector with significant potential for job creation and economic development. **Workplace Policies:** The recommendations for creating supportive workplace environments, such as flexible working conditions and mentorship programs, align with the goal of promoting inclusive and sustainable economic growth, employment, and decent work for all.

#### **SDG 10**

**Reduced Inequalities. Cultural and Economic Barriers:** The text identifies and addresses cultural and economic barriers that contribute to gender inequality in ICT. By proposing solutions to these challenges, it supports efforts to reduce inequalities within and among countries.

ICTs are vital for achieving gender equality and empowering women. By addressing the barriers and leveraging the enablers, ICT can support women in gaining the skills, knowledge, and opportunities needed to improve their socio-economic status and contribute to sustainable development. The integration of ICT in policies and programs is essential for ensuring that women are not left behind in the journey towards achieving the SDGs.

Elli Georgiadou, Norihan Abu-Hassan, Kerstin Viola Siakas, Xueming Wang, Margaret Ross and Prem Anand Anandan (2009) conducted a four cross-cultural case studies about Women's ICT career choices, comparing the under-representation of women in computing, information technology in Western countries to the situation in Asian countries, particularly Malaysia and China.

They surveyed female students studying computing/IT in the UK, Greece, Malaysia, and China, asking questions about career choices, maternity leave, family support, cultural influences, economic factors, political/government policies.

Regarding the reasons appointed by students for choosing ICT careers, they found:

- 1) a high agreement in all countries that ICT offers future job opportunities (UK: 60.7%, Greece: 50.8%, Malaysia: 75%, China: 63.1%).
- 2) Perceived job availability influenced career choice (UK: 60%, Greece: 55.9%, Malaysia: 53.3%, China: 77.9%).
- 3) Significant in the UK (85.2%) and Malaysia (78.1%), but less so in Greece (28.8%) and China (51.4%).

The influences on Career Choices were the everyday use of computers, extrinsic Motivators, cultural Influences, the fact that it was not seen as a job for women, considered too mathematical.

The economic factors are also considered important. For instance, childcare financial problems: was acknowledged as a significant issue in the UK (78.6%) and Greece (52.5%), less so in Malaysia (40.6%) and China (22.4%). And the political and government policies were reported to have minimal influences in the UK and Greece, but were notable in Malaysia and China. Respondents from Malaysia were unsure about the influence of government policies, while Chinese respondents had higher agreement on government information as a major influence.

The authors concluded that: "to increase the participation of women in IT, issues of career choice, maternity leave affecting, future careers, family, culture, economic reasons, political reasons/, government policies need to be addressed accordingly" (2009, p. 288).

Suman Jain (s.d.) describes some case studies from India and Africa of ICT and women's empowerment. They underline the importance of knowledge, networking and empowerment (ICT serve as a powerful tool for building women's abilities and skills to participate in economic and political processes, by providing them platforms to articulate and share experiences. The access to ICT is crucial for breaking traditional barriers to information because of women low levels of education, lack of freedom of movement, and poverty. For instance, India's SEWA project uses technology to improve market access and efficiency in rural women's micro-enterprises (e-commerce offers significant opportunities), but gender segregation persists, with women often occupying lower-skilled jobs in the ICT sector. The authors also assert the problems with the linguistic barrier of local different languages.

The OECD report Bridging the Digital Gender Divide: Include, Upskill, Innovate (2018), prepared at the request of the Australian government, emphasizes the importance of addressing the digital gender divide to ensure that women can fully participate in and benefit from the digital economy, by implementing targeted policies and fostering international cooperation.

The findings of the report underline that women face significant barriers to accessing and using digital technologies due to affordability issues, lack of education, and social and cultural norms; that digital technologies offer "leapfrog" opportunities for women, enabling them to earn additional income, increase employment opportunities and social well-being, access knowledge and develop education and skills; the fundamental need for policies to promote flexible work opportunities and support services to enable women to balance work and family responsibilities.



The recommendations have 5 main dimensions:

National Digital Strategies that aim to close the digital gender gap in access, affordability, and usage of digital technologies

Development of STEM Education to increase female enrolment in STEM fields and address gender biases in education

Labour Market Policies to facilitate women's participation in the workforce by promoting flexible work conditions

Collect gender-disaggregated data to inform policy decisions and monitor progress in bridging the digital gender divide

International Cooperation encouraging G20 economies to share best practices and policies that reduced digital gender gap; Coordinated efforts to tackle structural root causes of gender inequalities.

The Swedish International Developmentt Cooperation Agency' Gender Toolbox (SIDA, 2015) discusses the implications of ICT on gender, emphasizing that ICTs are not gender-neutral and exploring how existing power relations influence who benefits from and shapes the development and use of ICT. It underlines the importance of integrating gender perspectives into ICT programs to promote women's empowerment and gender equality. It lists some projects, such as the World Wide Web Foundation, that integrated and improved gender indicators within the Web Index, promoting women's empowerment through the web; Grameen Bank in Bangladesh that gave women micro-loans to purchase cell phones, providing telecommunication services and increasing their income and social status; Harassmap in Egypt that used SMS to map sexual harassment incidents, providing victims with assistance and advocating for increased police presence and community awareness; ICT programs in Kenya for distance education and health information dissemination, significantly impacting rural women.

The Challenges described are that women globally earn less than men, have less access to financial assets, and face higher illiteracy rates, all of which limit their use of ICT; language barriers, especially in rural and minority areas, hinder women's use of the internet and mobile technologies; online violence, harassment, and misogynistic hate speech pose significant risks to women using the internet for political participation and accessing services.

The policy recommendations are mainly:

Promote gender equality in ICT policies and decision-making.

Enhance digital safety measures for women to protect against online violence.

Support networks of women's rights advocates to address gender and ICT policy issues.

The integration of gender perspectives into ICT initiatives is crucial for promoting gender equality and empowering women. By addressing the unique barriers women face and implementing targeted interventions, ICT can become a powerful catalyst for social, cultural and economic change.

## 2. Inspiring Projects

The projects of Women in ICT that are presented below underscore the transformative potential of ICT in empowering women across various sectors. By providing digital literacy, supporting entrepreneurship and improving agricultural productivity, these initiatives not only address immediate social, cultural and economic challenges but also pave the way for long-term gender equality and sustainable development.

VicICT4Women (Cath Wood Design, Krystle Northover, Stephanie Chan and Julie Garaway, 2023) aims to support and promote women in ESTEAM (Environmental Science, Science, Technology, Engineering, Arts, and Mathematics) careers. Founded in 2005, the organization provides programs and initiatives to facilitate the entry, retention, and progression of women in technology.

The key programs of VicICT4Women are:

- Go Girl, Go for IT that targeted Girls in years 5-12, to inspire and immerse 2,300 female students, through two events in 2021-2022, in IT through interactive workshops and presentations.
- Grad Girls that targeted 121 University and TAFE STEM female students, through 16 events in 2021-2022, to empower them for transition from university to a career in ICT, with monthly sessions, office tours, and mentoring.
- Mentor(SHE:), that targeted 204 mentors and mentees (102 pairs) in 2021-2022, to support professional growth of women in STEAM fields through mentorship, webinars, and networking events.
- What's Hot in Tech (WHIT) that targeted 167 career-minded professionals, through three events to showcase emerging technologies and industry trends through interactive round-table discussions and networking.
- Importance of Women in IT (IOW) that reached 545 career-minded professionals, through 14 events to celebrate and support women in technology through networking events featuring guest speakers sharing their career insights.

As recommendations, the report states the following dimensions:



Vivian Anette Lagesen, Ivar Pettersen and Line Berg (2021), who studied the Inclusion of women to ICT engineering in one of the largest universities in Norway, present the case of a long-term project called Ada, aimed at recruiting and retaining women students in ICT engineering programs (such as , Informatics, Cybernetics and Robotics, Electronic System Design and Innovation, Computer Technology, and Communication Technology).

They identified factors and barriers for success in recruiting and retaining more women into ICT at the University, through the ADA project, established in 2010. Their goal was to increase the number of women students applying to ICT programs at the university and reduce dropout rates from the programs. They used strategies like the creation of a supportive peer community for women; a Technology Week for top-performing female students from upper secondary schools, with workshops, hands-on experiences, presentations by women role models, and social activities, an annual networking trip to Oslo for meetings with industry representatives, politicians, and other influential figures.

The project was partly funded by private ICT companies interested in recruiting women and articulated with industry sponsors to fund various activities and events.

This project case study identified persistent stereotypes that ICT is a male-dominated field that can discourage women from pursuing careers in this area. Overcoming these stereotypes requires targeted efforts to change perceptions among potential female students and the broader community.

Regarding results, the share of women applicants to the ADA programs has increased more significantly than in other engineering programs at the university and other ICT programs in Norway. A higher proportion of women in the ADA programs correlates with lower dropout rates among women students, suggesting the effectiveness of the project's retention efforts. Efforts to create a welcoming and supportive environment for women have led to a more inclusive culture, benefiting both women and men in the programs, but the study underlines the importance of recruiting more women faculty members to provide academic role models and ensure long-term sustainability of gender balance in ICT and the need for continuous effort and support to maintain the positive outcomes of the project.

Other examples are Sonja Bernhardt, CEO of ThoughtWare from Australia, who used ICT to develop a unique software platform, contributing significantly to the healthcare sector, who overcame initial market entry challenges and adjusted business strategies to meet market demands; Eva Wong (Borrowell) and Alison Loat (Ai-Media), from Canada who innovated within financial investment and social enterprise for education sectors using ICT, who faced many difficulties in scaling their businesses and securing sufficient funding; Leody Fu, Founder of AppMagics, from Republic of China, who specialized in virtual reality technology, who dealt with the fast-evolving technology and secured investor confidence; Jayoung Yoon, CEO of Style Share of Republic of Korea, who created an online popular; fashion platform, integrating social media with fashion retail, reaching a wide user base, and had to manage rapid growth and technological advancements in the fashion industry; Carmen Gloria Aracena Alvarez, from Chile, founder and CEO of Tecnocal, faced the challenges of a male-dominated industry, but used networks and government ICT policies support to develop her business.

Suman Jain (2007) describes the The Nabanna Project in India is an example of a successful ICT initiative empowering rural women. Women gained respect in their communities, enhanced their job market prospects, and increased their incomes through ICT skills. The project fostered a sense of unity and collective empowerment among women. The key Issues that had to be

addressed were providing equitable access to ICT technology and involving women in decision-making processes, overcoming cost barriers and developing technical education and training for enabling women to use ICT effectively.

The author also presents other projects from India and Africa. In India, the diversity of the projects...

- India Shop (Tamil Nadu), a e-commerce website designed to sell products made by rural women's cooperatives and NGOs, that empowered rural women by providing a platform to market their products widely, increasing their income and economic independence.
- Dhan Foundation and Swayam Krishi Sangam Project, with handheld devices and smart cards, to improve microfinance projects to empower poor women, that enhanced efficiency of microfinance, providing women with better access to funding.
- Self-Employed Women's Association (SEWA), who developed Community Learning Center and a School for self-employed women, have the Theliphone Project that provides mobile phones to women in the informal sector, to improve their access to education and technology, aiding in their economic empowerment.
- Self-Help Groups (Andhra Pradesh), that market products at home and abroad successfully, attracting interest from major multinational corporations for their selling skills, highlighting the effectiveness of grassroots marketing strategies.

As for the Africa Projects:

- African Women's Network of the Association for Progressive Communications implemented training workshops to support electronic networking among women's groups, so as to enhance women's abilities to use ICT for networking and advocacy.
- Multimedia Caravan Project, in Senegal, provided rural women with opportunities to develop ideas on using ICT to meet development needs, enabling rural women to engage with ICT and explore its applications in improving their livelihoods.
- Weaving Training, in Kenya, trained women and men weavers to use internet for learning new techniques and accessing market prices, improving the skills and economic conditions of weavers by connecting them to broader markets.
- Uganda Media Women's Association established the "Mama FM" radio program, focused on development issues like human rights, governance, nutrition, and health, increasing women's access to crucial information and providing a platform for active participation and learning.

There is also an important example from other region of the world: the UNDP Telecenter Project (Ukraine), applied ICT to agriculture and farm management to support women farmers, addressing major obstacles like lack of information and networking tools, enabling women to become successful entrepreneurs in a new market economy.

These projects illustrate the diverse applications of ICT in empowering women across different regions, focusing on improving access to technology, education, and economic opportunities. The success of these initiatives underscores the importance of targeted efforts to bridge the digital divide and support women's empowerment through ICT.

Sylvia Maier and Usha Nair-Reichert (2008), provide an overview of best practices for ICT-based business initiatives, specifically focusing on e-commerce and e-retailing projects aimed at empowering women in the Global South. It highlights the significant role of ICTs in development, poverty eradication, and women's empowerment. They describe several case studies such as the Village Pay Phones (VPPs) in Bangladesh; the Computer Facility at Kasargod, Kerala, India;

the e-Seva Centres in Andhra Pradesh, India; The Women Weavers in Morocco; the Cottage Industry—Global Marketplace; the Rupununi Weaver’s Society in Guyana

The findings show that the best practices for successful ICT Projects are: i) Training and Empowerment; Expanding Market Access by using ICT to reach broader markets, eliminate middlemen, and ensure better profits; Sound Managerial Practices such as management styles, good public relations, commitment to business, product quality and reputation.

The figure below shows the challenges and best practices of e-Commerce/e-Retailing according to the authors.

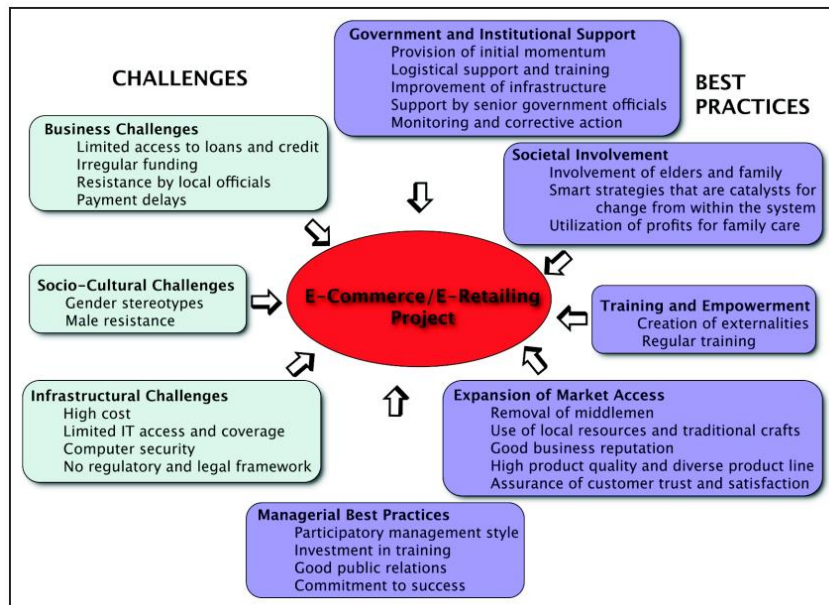


Figure 1 Challenges to and Best Practices of e-Commerce/e-Retailing (Maier, Nair-Reichert, 2007, p.53)

### The e-Women in ICT Project

The e-Women in ICT Project is a 24-month Erasmus+ project. Its primary goal is to reduce the gender gap in ICT and entrepreneurial skills and opportunities. The project involves partners from Portugal, Spain, and Germany, and focuses on developing intellectual outputs such as educational toolboxes, an online multi-device platform, and gender-sensitive pedagogical models. Key activities include blended mobility of VET learners and a series of educational and training events to support women in ICT. The website of the project offers information about the projects’ team, Objectives, results, etc., but we’ve asked the Portuguese coordinator to present the project in a short video: <https://youtu.be/6QXvYZfxWE>

We intend to complete this section with short videos by all local coordinators of the international partners of the project.

The positive outcomes of these projects show the importance of interventions in bridging the digital divide, fostering inclusivity, and creating opportunities for women to fully participate in and contribute to the digital society.

## Conclusion

The case studies and projects highlighted in this text underscore the critical role of ICT in empowering women and advancing gender equality, as aligned with the Sustainable Development Goals. These initiatives illustrate the transformative potential of ICT in diverse areas such as digital literacy, healthcare access, entrepreneurship, agricultural productivity, and employment opportunities.

By addressing barriers such as limited connectivity, societal norms, and gender-biased laws, these projects have significantly improved the social and economic status of women around the world. The positive outcomes demonstrate that targeted ICT interventions are essential for fostering inclusivity, bridging the digital divide, and enabling women to fully participate in and contribute to the digital rapid transformation. Through collaborative efforts, innovative solutions, and supportive policies, these projects highlight that empowering woman with ICT skills and resources is not only crucial for individual growth but also for driving broader social, cultural and economic sustainability on a global scale.

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[2] Cath Wood Design, Krystle Northover, Stephanie Chan and Julie Garaway (2023) VicICT4Women Annual Report 2022. Victorian Women in ICT Network. [https://women4stem.com.au/wp-content/uploads/2024/05/VicICT4W\\_Annual\\_Report\\_2022\\_Final.pdf](https://women4stem.com.au/wp-content/uploads/2024/05/VicICT4W_Annual_Report_2022_Final.pdf)

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[4] Mackey, A., & Petrucka, P. (2021). Technology as the key to women's empowerment: A scoping review. *BMC Women's Health*, 21, 1-17. DOI: [10.1186/s12905-021-01225-4](https://doi.org/10.1186/s12905-021-01225-4)

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[6] SIDA - Sweedish International Developmentt Cooperation Agency (2015). Gender Tool Box. SIDA. <https://cdn.sida.se/publications/files/-gender-and-ict.pdf>

[7] Suman Jain (s.d.). ICTs and women's empowerment: Some case studies from India. <https://graduatewomen.org/wp-content/uploads/2014/01/jain.pdf>

[8] Sylvia Maier and Usha Nair-Reichert (2008). Empowering Women Through ICT-Based Business Initiatives: An Overview of Best Practices in E-Commerce/E-Retailing Projects. The MIT Press. Volume 4, Number 2, Winter 2007, 43-60.

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[10] World Economic Forum (2021). Global Gender Gap Report 2021. ISBN-13: 978-2-940631-07-0. [https://www3.weforum.org/docs/WEF\\_GGGR\\_2021.pdf](https://www3.weforum.org/docs/WEF_GGGR_2021.pdf)

## 04. Inclusive policies and environments

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Creating inclusive policies and environments for women in Information and Communication Technology (ICT) is essential for promoting gender equality and harnessing diverse talents in the field. Here are several inclusive policies and strategies that organizations and institutions can implement to foster a supportive environment for women in ICT. It requires a comprehensive approach that addresses recruitment, retention, development, and cultural change. By implementing these strategies, organizations can create a more equitable and productive workplace that benefits from the full potential of a diverse workforce.

### Inclusive Policies for Women in ICT:

- 1. Equal Opportunity Employment:**
  - Enforce policies that ensure equal hiring opportunities for women.
  - Implement blind recruitment processes to minimize unconscious bias during hiring.
- 2. Gender Pay Equity:**
  - Conduct regular pay audits to identify and rectify gender pay gaps.
  - Establish transparent salary bands and ensure equal pay for equal work.
- 3. Flexible Work Arrangements:**
  - Offer flexible working hours and remote work options to accommodate different needs.
  - Provide part-time opportunities and job-sharing arrangements.
- 4. Parental Leave and Support:**
  - Provide generous parental leave policies for both men and women.
  - Offer support for returning to work, such as phased returns or reduced hours initially.
- 5. Career Development and Mentorship:**
  - Implement mentorship programs that pair women with experienced professionals in ICT.
  - Offer leadership training and career development workshops specifically for women.
- 6. Anti-Harassment and Discrimination Policies:**
  - Enforce strict anti-harassment policies and provide safe channels for reporting incidents.
  - Promote a zero-tolerance policy towards discrimination in the workplace.
- 7. Diversity and Inclusion Training:**
  - Conduct regular training sessions on unconscious bias, diversity, and inclusion for all employees.
  - Encourage inclusive behavior and create awareness about gender issues in ICT.



## Creating Inclusive Environments:

- 1. Supportive Workplace Culture:**
  - Foster a culture that values diversity and inclusion at all levels of the organization.
  - Celebrate achievements of women in ICT through recognition programs and awards.
- 2. Inclusive Infrastructure:**
  - Ensure facilities are accessible and inclusive, including restrooms and lactation rooms.
  - Provide technology and tools that support diverse working styles and needs.
- 3. Networking Opportunities:**
  - Organize networking events and forums specifically for women in ICT.
  - Support participation in industry conferences and professional groups for women.
- 4. Encouragement from Leadership:**
  - Ensure senior leaders champion diversity and inclusion efforts.
  - Include diversity goals in the performance metrics for leaders and managers.
- 5. Inclusive Recruitment Practices:**
  - Use gender-neutral language in job postings.
  - Partner with organizations that focus on promoting women in technology.
- 6. Educational and Outreach Programs:**
  - Collaborate with schools and universities to encourage girls and young women to pursue careers in ICT.
  - Offer scholarships, internships, and apprenticeships targeted at women.
- 7. Research and Data Collection:**
  - Collect and analyze data on gender diversity within the organization.
  - Use data to inform policies and track progress towards gender equality goals.

### Examples of Best Practices:

The information provided is based on best practices and general strategies recommended by various organizations and thought leaders in the field of diversity and inclusion, particularly in the context of women in ICT. Here are some references and sources that you can refer to for more detailed and specific information:

- 1. World Wide Web Fundation**
  - The Digital Revolution: Implications for Gender Equality and Women’s Rights After Beijing 2020
  - [Gender and ICT Policy Playbook](#)
- 2. European Institute for Gender Equality (EIGE)**
  - Main page: <https://eige.europa.eu/>
  - [Work-life balance in the ICT sector](#)
- 3. Collaboration on International ICT Policy for East and Southern Africa (CIPESA)**
  - Main page: <https://cipesa.org/>
  - The Collaboration on International ICT Policy for East and Southern Africa (CIPESA) works to promote effective and inclusive ICT policy and practice for improved governance, livelihoods, and human rights in Africa.

4. **Observer Research Foundation (ORF)**
  - Main page: <https://www.orfonline.org/>
  - [Inclusive digital policies are key to mould women leaders](#)
5. **World Economic Forum (WEF)**
  - "The Global Gender Gap Report 2020": This report provides insights into the gender gap in various fields, including ICT, and offers recommendations for closing these gaps.
  - [WEF Global Gender Gap Report](#)
6. **McKinsey & Company**
  - "Women in the Workplace 2020": This report offers data and insights on gender diversity in the workplace and highlights best practices for creating inclusive environments.
  - [McKinsey Women in the Workplace 2020](#)
7. **AnitaB.org**
  - "Top Companies for Women Technologists": This program identifies and recognizes companies that are making significant progress towards gender equity in technology.
  - [AnitaB.org Top Companies for Women Technologists](#)
8. **Catalyst**
  - "Quick Take: Women in Technology": This resource provides statistics and information on women in the technology sector, along with recommendations for creating inclusive workplaces.
  - [Catalyst Women in Technology](#)
9. **National Center for Women & Information Technology (NCWIT)**
  - "NCWIT Tips: 8 Ways to Give Women in Tech Their Fair Share of Voice": This guide provides practical tips for creating inclusive environments for women in technology.
  - [NCWIT Tips](#)
10. **Harvard Business Review (HBR)**
  - "How to Keep Women in Tech": An article that explores strategies for retaining women in the technology industry.
  - [HBR How to Keep Women in Tech](#)
11. **Google's Women Techmakers Program**
  - Offers resources, events, and programs to support women in technology.
  - [Google Women Techmakers](#)
12. **Microsoft's DigiGirlz Program**
  - Provides opportunities for high school girls to learn about careers in technology and connect with Microsoft employees.
  - [Microsoft DigiGirlz](#)
13. **Intel's Diversity in Technology Initiative**
  - Focuses on increasing diversity in the technology sector through recruitment, retention, and advancement programs.
  - [Intel Diversity in Technology](#)

## 05. Students' perspective on ewomen in ICT

**Multimedia Students Perspective about Ewomen in ICT** | This chapter was written as part of a course unit by students in the multimedia area. It is their perspective on the chosen topic: Ewomen in ICT.

### Background and Good Practices

ICT women are women who work or have an interest in Information and Communication Technologies (ICT), covering professions such as programming, data analysis, software engineering, among others.

#### 2 GOOD PRACTICES IN PORTUGAL:

**“Portuguese Women in Tech**, launched in April 2016 by Liliana Castro and Inês Santos Silva, aims to support women in technology by offering them visibility, networking and mentoring through training and other opportunities.”

*Portuguese Women in Tech. (n.d.) A nossa história. Portuguese Women in Tech.*  
<https://www.portuquesewomenintech.com/our-story>

**“Women in Tech Portugal**, although a worldwide organization, is present in Portugal and its aim is to promote the participation and advancement of women in the technology industry. It was created to tackle the significant challenge of gender diversity in the technology industry, where in Portugal only 24% of the workforce is made up of women.”

*Women in Tech Portugal. (2022) Quem somos. Women in Tech Portugal.*  
<https://www.portuquesewomenintech.com/our-story>

### Women in ICT – Statistics

Study: Pioneers - A portrait of Portuguese Women in Tech

Portuguese Women in Tech, together with Deloitte and Polar Insight, carried out a study on the Portuguese technology market. 541 women were surveyed. Here are some of the results:

**48%** Of the women in technology, they decided to pursue a career because they are passionate about the area.

**10%** They are the only women in the departments where they work;

**78%** Women have heard comments and jokes and observed sexist and rude gestures in the job market at least once;

**46%** Of women have experienced discrimination in previous recruitment processes;

**39%** Of the women who work in technology, they were, or are, a minority in their university classes;

Renault. B., Gaia.P., Tattersfield.J., Santos Silva. I., Castro.L. (n.d.) Pionners A Portrait of Portuguese Women in Tech. Portuguese Women in Tech. <https://mailchi.mp/portuguesewomenintech.com/pioneers>

## **MetaRed Portugal**

According to the MetaRed Portugal website, MetaRed is an association of Portuguese higher education institutions, both public and private, also open to other public administration entities that increase activities that are relevant in the area of ICT (Information and Communication Technologies), especially higher education. This association aims to be a "meeting point" for debate, reflection and collaborative work on the use of ICT in higher education, respecting the principle of autonomy of institutions, their individual freedom to make decisions, and promoting the sharing of good practices. MetaRed was born at the invitation of a proposal from some universities, with the support of Universia, which, based on similar experiences from other countries such as Spain and Mexico, and many others, focuses on the concern and awareness of higher education institutions, about the role that technologies play in their institutions, and thus proposing to promote a more limited and more effective collaboration between its members and the general community.

MetaRed Portugal. (n.d.) Quem somos. MetaRed Portugal. <https://www.metared.org/pt/que-e-metared.html>

## **MetaRed Portugal**

### *METARED MISSION AND VISION*

#### **MetaRed Mission**

- 1.** Advising and proposing to the Rectors of the Portuguese universities and Presidents of the Portuguese Polytechnics, topics that are considered appropriate in the field of information and communication technologies to improve the quality, effectiveness and efficiency of higher education institutions.
- 2.** To study the needs and applications of these technologies in management, teaching and research, proposing joint actions and actions.
- 3.** To foster, promote and lead cooperation at national and international level, not only between HEIs but also involving other relevant partners, namely from the supervisory authority in particular and from the public administration in general.
- 4.** Foster joint participation in applied research projects, studies and benchmarking initiatives, promoting collaboration, sharing and adoption of good practices.
- 5.** Promote the realization and participation in training sessions, conferences and seminars as well as the articulation with suppliers and manufacturers of solutions in the field of information and communication technologies."

MetaRed Portugal. (n.d.) Quem somos. MetaRed Portugal. <https://www.metared.org/pt/que-e-metared.html>

### **MetaRed Vision**

MetaRed's vision is to be the "Meta Network" of academic networks in Portugal, ensuring its proper articulation between Universities and Polytechnics of initiatives that are relevant in the field of ICT. The objective is to create cooperation, maximize opportunities and facilitate the sharing of good practices, involving other significant stakeholders of the Public Administration, namely regulatory entities, as well as private entities with initiatives and solutions, relevant to the topics addressed, always focusing on the independence and impartiality of the network.

MetaRed Portugal. (n.d.) Quem somos. MetaRed Portugal. <https://www.metared.org/pt/que-e-metared.html>

## **WOMEN IN ICT PORTUGAL**

According to the study "Digitalization and Information and Communication Technologies", and according to the information contained in the graphic on the side, we can conclude that the number of men graduates in the field of ICT is higher than the number of women graduates in the field of ICT.

However we see an oscillation in the numbers, from 2016 to 2019 the numbers in men tend to decrease, while in women it tends to increase. From 2020 onwards, the number in the case of men decreases again and in the case of women it increases again.

Igualdade de Género em Portugal. (2022). Digitalização e Tecnologias de Informação e Comunicação. Boletim Estatístico. [https://www.cig.gov.pt/wp-content/uploads/2022/12/BE2022\\_4.pdf](https://www.cig.gov.pt/wp-content/uploads/2022/12/BE2022_4.pdf)

### **ICT women trained at ESES**

"As a woman, an IT specialist, I feel that there is still a need for greater demonstration of work to affirm value and representativeness in management positions." Andreia Rainha, Degree in Multimedia Education and Communication - Information Systems and Technologies Specialist, IT and Administrative Modernization Division| Santarém Municipality;"

"At other times in my professional life, I've felt a great lack of appreciation for being a woman. I found it very difficult to assert my ideas, to show their validity. I felt that my male peers didn't have this difficulty and were listened to more quickly. I felt that I worked harder and without proper recognition. It was a clearly sexist structure and I realized that over time." Sofia Martins, Degree in Multimedia Education and Communication - Project Manager - Web Business Unit| Innovagency"

## WOMEN IN ICT IN SPAIN

Women in the Information and Communication Technologies (ICT) sector in Spain are playing an increasingly important role. As in many other countries, there is a growing movement to promote female participation in this field. However, despite the advances, women are still under-represented in many areas of ICT in Spain.

Currently, these companies established in Spain have an average presence of 30% women in their workforce, according to a study carried out by Accenture, which shows that there is still room to achieve real equality figures.

One of the companies that is above average is Minsait, a leader in digital transformation belonging to Indra, which has a higher number of women than other companies in the technology sector. Currently, women represent 34% of a workforce of more than 46,000 people worldwide, half of them in Spain. Furthermore, in its recent Equality Plan, the company is committed to increasing this figure to 37% by 2024. Other measures included in this plan include the promotion of equality, improvements in work-life balance, training in female leadership and policies that promote inclusion.

Servimedia. (2023, março 8) Espanha: Tecnológicas estão empenhadas na contratação de mulheres. Sapo. <https://eco.sapo.pt/2023/03/08/espanha-tecnologicas-estao-empenhadas-na-contratacao-de-mulheres/>

For its part, Capgemini in 2022 had a presence very similar to that of Minsait, with 33% of its workforce made up of women. In addition, one of the objectives the company has set itself is to achieve 40% female professionals in its teams by 2025, as well as 30% in executive leadership positions.

**Female Professionals: 40%**

**Male Professionals: 60%**

**Female Leadership: 30%**

**Male Leadership: 70%**

Another technology company, NTT Data, a company specializing in systems integration with more than 18,000 employees in Spain, has 29% female profiles among its professionals, a slightly lower percentage than the average.

**Female Professionals: 29%**

**Male Professionals: 71%**

These companies are therefore aware of the commitment they must make to continue supporting women in their teams. Implementing measures to promote inclusion and equality, improving work-life balance or running campaigns to encourage interest in STEM careers are some of the measures they can implement if they want to improve their ratios of female employees in their companies.

Servimedia. (2023, março 8) Espanha: Tecnológicas estão empenhadas na contratação de mulheres. Sapo. <https://eco.sapo.pt/2023/03/08/espanha-tecnologicas-estao-empenhadas-na-contratacao-de-mulheres/>

## **WOMEN IN ICT International**

Digital inclusion and tackling gender stereotypes are crucial issues that have gained prominence on global political agendas. Recently, on September 25, 2015, the heads of state and government of the 193 UN member states signed the 2030 Agenda during the Sustainable Development Summit in New York. This agenda recognizes the potential of Information and Communication Technologies (ICTs) to accelerate human progress and reduce the digital divide, including the gender divide.

In the European context, the annual European Girls and Women in ICT Day event was launched on April 22, 2021, as part of the European Commission's Women in Digital Declaration resolution. This initiative aims to address the challenges and opportunities that women face in the digital labor market. Despite the difficulties imposed by the COVID-19 pandemic, the European Union continues to promote events to stimulate and empower women in the field of ICT.

Gender equality is not just a goal, it is fundamental to the global economy, to guaranteeing the rights of all girls and women, and to building inclusive economic and social systems. However, there are still significant challenges, with around 3.7 billion people cut off from the main benefits and resources of the digital world. This is evidenced even in the disparities between men and women in terms of ICT competence, as the data presented shows.

Lima, B. S. de. (2021). Do constrangimento ao sucesso: Um estudo sobre a trajetória das mulheres nas TIC [Dissertação de mestrado, Iscte - Instituto Universitário de Lisboa]. Repositório do Iscte. <http://hdl.handle.net/10071/23998>

This graph shows the gender differences in relation to high digital skills (above basic level). The dimensions assessed are: information, communication, problem-solving and the use of software to create content. The EU average for men is 35.8%, compared to 30.9% for women. The most egalitarian European countries in terms of high digital skills are: Slovakia, Lithuania and Cyprus, whose percentage figures for men and women are level, with a slight difference. There are also two exceptional cases where the percentage of women considerably exceeds that of men in terms of high digital skills: Estonia and Bulgaria: Estonia and Bulgaria. Portugal is below the EU average for the percentage of men (33.9%), and almost at the same level as the EU for the percentage of women (30.4%).

In today's society, access to information has become essential and is a key resource for everyday activities. Information and Communication Technologies (ICT) play a fundamental role in facilitating access to knowledge, increasing productivity and influencing people's power. It is therefore imperative to recognize the impact of digital competence on the economy and society, as even a basic knowledge can broaden opportunities, especially in education, through online courses and open educational resources. These tools are particularly valuable for people with

special needs or who live in remote areas. ICT-oriented education is not only relevant, but also essential, due to the versatile nature of the sector, which contributes to a constantly evolving labor market and economy. This versatility emphasizes the need for continuous lifelong learning.

## Prospects for the future

The prospects for ICT women are quite varied. After some research we came to the conclusion that there are quite controversial opinions. Professor Isabel Pedrosa says that the trend is downwards, since in the European Union the percentage of women in higher education courses related to Information Sciences and Technologies is 16.7%, and this figure used to be over 20%. According to the researcher, in January 2021, a strategy for gender equality was approved for the period 2020-2025. The main idea would be for women to be more represented in jobs involving technology. "I hope that this strategy contradicts my current opinion and contributes to these figures improving during and after the strategy's lifespan, given the various initiatives and working groups in place to promote the attractiveness of technology-related professions among young women," says Professor Isabel Pedrosa.

Mulheres ainda estão pouco representadas no mundo das tecnologias. (n.d.) Instituto Politécnico de Coimbra. <https://www.ipc.pt/artigos/mulheres-ainda-estao-pouco-representadas-no-mundo-das-tecnologias/>

Isabel Pedrosa also points out that there is a great lack of "role models" of successful women in the field of technology, and that there is a generalization of the area as being poorly paid, or with too much effort involved for what is received in return, and that many students are influenced to agree with this thinking by family members. The European Parliament has published an infographic showing the participation, challenges and opportunities of ICT women. Women continue to be under-represented and earn less than men in the technology sector. This infographic shows that in 2015, 17.2% of ICT students were women, and in 2016, this figure dropped to 16.7%. On average, women earn 18.9% less than men in the IT and communications sector. The parliament also made a point of showing that Portugal is below the European average for women in the digital world. The truth is that all these predictions vary according to several factors, including current trends, inclusion efforts and changes in corporate culture.

Mulheres ainda estão pouco representadas no mundo das tecnologias. (n.d.) Instituto Politécnico de Coimbra. <https://www.ipc.pt/artigos/mulheres-ainda-estao-pouco-representadas-no-mundo-das-tecnologias/>



# Conclusion

Ana Torres, Polo Literacia Digital e inclusão Social, CIAC, Instituto Politécnico de Santarém

This handbook highlights the significant contributions of women throughout history, from pioneers such as Ada Lovelace and Grace Hopper to the women who programmed the ENIAC computer. These contributions have had a lasting impact on the development of technology. However, despite their invaluable contributions, women have faced barriers such as gender stereotypes, the pay gap, and under-representation in leadership positions in the ICT sector.

The statistical analysis presented in the handbook reveals the gender imbalance that still exists in ICT. Although there has been a slight increase in the number of women in ICT positions in recent years, men continue to dominate the sector. Countries such as Bulgaria and Romania serve as examples with higher percentages of women in ICT, providing valuable insights for other nations seeking to improve gender diversity. However, the overall representation of women remains low, especially in senior positions and technical roles.

In modern times, efforts have been made to address these disparities. Organizations such as Girls Who Code, AnitaB.org, and Women Who Tech have played a vital role in advocating for the inclusion of women in ICT. These organizations offer training, resources, and networks that support women in overcoming barriers and advancing their careers. Initiatives such as the Grace Hopper Celebration of Women in Computing and Girls in ICT Day aim to inspire the next generation of female technologists and create a more inclusive talent pool.

Public policies also contribute to promoting gender equality in ICT. The European Union, through initiatives such as Digital Compass and the Women in Digital Scoreboard, has set ambitious targets for gender parity in the digital economy. Policies that support work-life balance, such as on-site childcare and financial support for babysitting, are crucial to enabling women to pursue and maintain careers in ICT.

The challenges women face in the ICT sector are multifaceted, including the pay gap, lack of tailored public policies, and the difficulty of reconciling work and family life. Harassment and a hostile working environment further exacerbate these issues, creating a negative cycle of exclusion. Addressing these challenges requires a holistic approach involving policy changes, corporate responsibility, and shifts in societal perceptions.

In essence, the inclusion of women in ICT is not only a question of equity but also of economic and social development. Diverse teams are proven to be more innovative and effective, leading to better business results and a more competitive industry. By ensuring that women are equally represented in ICT, we unlock a wealth of talent and potential that can contribute to tackling pressing global challenges.

While progress has been made in recognizing and supporting women in ICT, achieving full gender equality in this field remains a journey in progress. Celebrating the achievements of women, both past and present, is essential to inspire future generations. Continued efforts in education, policy, and business practices are crucial to creating an environment in which women can thrive in the ICT sector. The pursuit of an inclusive and diverse technology landscape will not only benefit women but also strengthen the innovation and resilience of the ICT sector as a whole. By removing systemic barriers and promoting inclusive policies, we can build a future in which women can contribute to and lead the digital economy.