

The A-Z of why Gender Matters in Research and Innovation

This A-Z is a very brief introduction into the rich and extensive evidence that is available to demonstrate how gender shapes and is shaped in research and innovation. The examples were assembled by Dr Elizabeth Pollitzer from Portia Ltd, the Coordinator of the genSET project. It is hoped that they will communicate to policy makers discussing HORIZON 2020 Article 15, as well as the future of ERA, the benefits and opportunities of using the gender dimension as a stimulus for enhancing R&D&I. To obtain details of the sources used here, please send an email to info@portiaweb.org.uk.

A is for **Agreement** in the scientific community on the need to identify **appropriate animal models** (nonhuman primates, rats, mice, rabbits, swine, hamsters, gerbils, quail, and fish) that can be used to *screen for gender-based differences and be more predictive of the human experience*. A is also for advancing fair **assessment** of women's and men's scientific work, and for the already existing equality laws, for instance the **Amsterdam Treaty**, to be more diligently applied.

B is for **Biological sciences** where women tend to cluster. B is also for **biomarkers** as investigative and therapeutic tools with an *estimated market value of \$26 billion*. Significant physiological differences hold between women's and men's biomarker profiles. B is also for **breast cancer screening** using *technology developed for mine detection*, thanks to both consisting of material with the same dielectric constant.

C is for **Cultures** in research and innovation that allow *8 out of 10 men advance to A Grade positions even though 50% of PhD degrees are granted to women*. C is also for **chicks**, *50 million are hatched each day in US alone* and the poultry industry would like an automatic way of separating female eggs/chicks from male. C is also for **crush** dummies that are based on a man's body, and **car** seat belts that have not been made for pregnant women.

D is for **Diversity** in teams and how it positively impacts on creativity and performance. D is also for prescription **drugs withdrawn** from the US market between 1997-2000, *8 of the 10 posed greater health risk for women than for men*. D is also for radiation **dosimetry** models, and improved biodosimetric techniques to assist in long-term effective epidemiologic investigations of *radiation cancer risks*.

E is for **Education of women** in European universities, with nearly 60% female graduates and increasing **employment rates**, which economists at Goldman Sachs described as a more effective social policy than quantitative easing. E is also for higher **environmental awareness** of women in the spheres of waste, consumption and mobility, and for **exclusion** of women from **energy economy**. E is also for gender aware and fair **ERA**.

F is for **Fairness** in assessment and in access to opportunities: expert evaluators of **Framework Programme** said it did not advance women as much as men. F is also for **FoldIT** gamers, *57,000 of whom, with 30% women*, solved a protein structure problem that the scientists could not solve for the last 10 years. F is also for **French lawmakers** considering legislation that would require at least *40% of companies' boards* to be made up of women within six years or risk not being able to add new male directors.

G is for **Gender awareness** and **gender specific medicine**, which examines how normal human biology and physiology differs between men and women and how the *diagnosis and treatment of disease also differs between women and men*. Key areas of impact are cardiovascular disease, mood disorders, the immune system, lung cancer as a consequence of smoking, osteoporosis, diabetes, obesity, and infectious diseases.

H is for **History of the measures** taken over the last 20 years to tackle gender inequalities in science at EU and national levels, but *still less than 20% of women reach full professor positions*. H is also for **HIV/AIDS** epidemic, where gender plays an integral role in determining an individual's vulnerability to infection. H is also for **heart disease**: more women (15%) than men (11%) admitted to hospital die of heart attack within 30 days. H is also for **HORIZON 2020, Article 15!**

I is for **Innovation Union**, which should benefit women and men equally. I is also for collective **intelligence**, which *increases when there is gender balance in the group*, i.e. neither women nor men are in a significant minority. I is for **inclusive** ways to draw all creative talent to solve research and technological problems. Among the 25,000 problem solvers on www.innocentive.com, which broadcasts problems **industry cannot solve**, *women submitted better solutions* overall than men.

J is for **Justice** and equality policies. J is also for **journals**, such as *The Lancet*, that have adopted editorial policy requiring authors to include information on gender aspects in their research reports. J is also for **junior scientists** (graduate students and postdoctoral fellows), among whom *women worry much more than men that a science career will prevent them from having a family*. 29% of women but only 7% of men

K is for **Knowledge making in science**, where extensive research evidence is available to demonstrate a variety of *gender bias and gender related errors created by mistaken adoption of male as the norm, or exclusion of females from research design and content*. K is also for **knowledge transfer** from the labs to the markets and society, which should be responsive to the needs of women and men.

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L is for **Leadership** styles, which differ between women and men: the presence of women improves performance and cultures but *there must be at least 30% of them so that they are seen first as co-workers and not as women*. L is also for 'leaky-pipeline', which captures the fact that fewer women than men succeed at each career step, and whilst 50% of women obtain a PhD degree, less than 20% gain Grade A position. *Fewer than 14% of heads of universities in Europe are women*.

M is for **Merit** based recruitment and promotion that prevents the effects of implicit gender stereotypes, gender bias and gatekeeper conditions to influence promotion decision. M is also for better career **models** that allow women and men to combine working in research with their life aspirations. M is also for new **markets** for science knowledge, which are gender aware, and where this knowledge is used to explore opportunities.

N is for **Norms** used in research, which are frequently 'male'. For example, our understanding of pain starts with the male rat model; calculations of radiation dosage are based on an absorption model of a middle aged man; in most anatomy books majority of images are of a man's body. N is also for nanotechnology (**nanomaterials, nanotools, nanodevices**) with the *worldwide sales revenues of \$11,671.3 million in 2009*. Many current nano products have been targeted at women.

O is for **Organisational** structures, practices and cultures that are deployed in knowledge production and their influences on: what is prioritised, how resources are allocated, who makes the decisions, how much collaboration there is. *L'Oreal has shown that labs are more productive, in terms of research papers and the patents produced, when they are gender balanced*.

P is for **Practices** in innovation and **patents** and **products** derived from scientific knowledge. Among the *submissions to the European Patent Office only 8% are from women*. A 2005 Eurobarometer survey claimed that women are "anti-innovation" and "reluctant" to accept innovation - such views must be challenged. Research shows that female researchers in universities can produce patents at the same rate as their male colleagues when encouraged to do so.

Q is for **Quality** in research and innovation, which means knowledge that is free from gender bias and gender errors, which addresses women's and men's needs equally, and which does not put at a greater risk women (or men). Q is also for **quotas**, seen by many as the **quickest way** of fixing gender inequalities in careers and scientific systems.

R is for **Risk** and **attitudes to risk** that differ between women and men, in particular attitudes to cognitive risk. *Generally, women tend to minimise loss and men tend to maximise gain*. This means that gender balanced teams should be the best in research and innovation. Women's more cautious attitude to cognitive risk may explain why fewer apply for advanced **research grants** but are more successful than men, when they do.

S is for **Selection** decisions, which impact on people's careers and on research priorities and funding allocation. S is also for **stem cell** research, where breast milk is proving to be a reliable source of cells, and cells from female muscle tissue have shown better regenerative properties than those from male tissue. *The donor gender and the recipient hormonal milieu may explain gender-related disparities in clinical outcomes*.

T is for **Talent** of women, which is often valued as less important than men's. T is also for **transplantation** where *more women than men are donors but fewer receive or survive a transplant*. T is also for **toxicology**. Women have been excluded from many drug studies but our understanding of toxic effects is based on such (male) studies. **Toxicokinetic differences** mainly involve metabolism, but in addition, lifestyle, psychosocial, and hormonal factors modify the kinetics and responsiveness, so both sex and gender factors can play a role.

U is for **Unexpected findings** in research, which happen often, to which female researchers tend to respond in a different way to the way that male researchers do. *Women tend to probe more deeply to explain the reasons for the unpredicted results, men tend to change methodological strategy*. Research would benefit if it **utilises** these lessons by promoting gender balanced research and innovation teams.

V is for **Valorisation** of useful connections between disciplines, for example through Networks of Excellence, such as Photonics4Life, which can act as a *bridge between the fields where women are underrepresented, such as photonics and where they are in a majority, i.e. life sciences*. The biophotonics market has been **valued** at \$63 billion. Knowledge of the biological differences between women and men, and of their preferences can increase opportunities for using scientific knowledge in a multidisciplinary way.

W is for **Womenomics**. Globally, women control about \$20 trillion in annual consumer spending, but they are undervalued and underestimated in the market place. W is also for **World Economic Forum Gender Equality Index**, which shows that the most successful countries are those that have in place strong gender equality policies.

Y is for **Young investigators** and the innovative ways in which women can be supported and advanced in research through EU measures such as *Marie Curie Actions*, and at national-level through initiatives such as *Young Investigator Network* at the Karlsruhe Institute of Technology, or *EMBO Young Investigator Lecture Grant*, which can be made, if needed, more gender aware.

Z is for **Zero-tolerance** of gender inequalities in research and innovation - the best strategy for giving women the same opportunities to participate in and benefit from the scientific enterprise, as men.