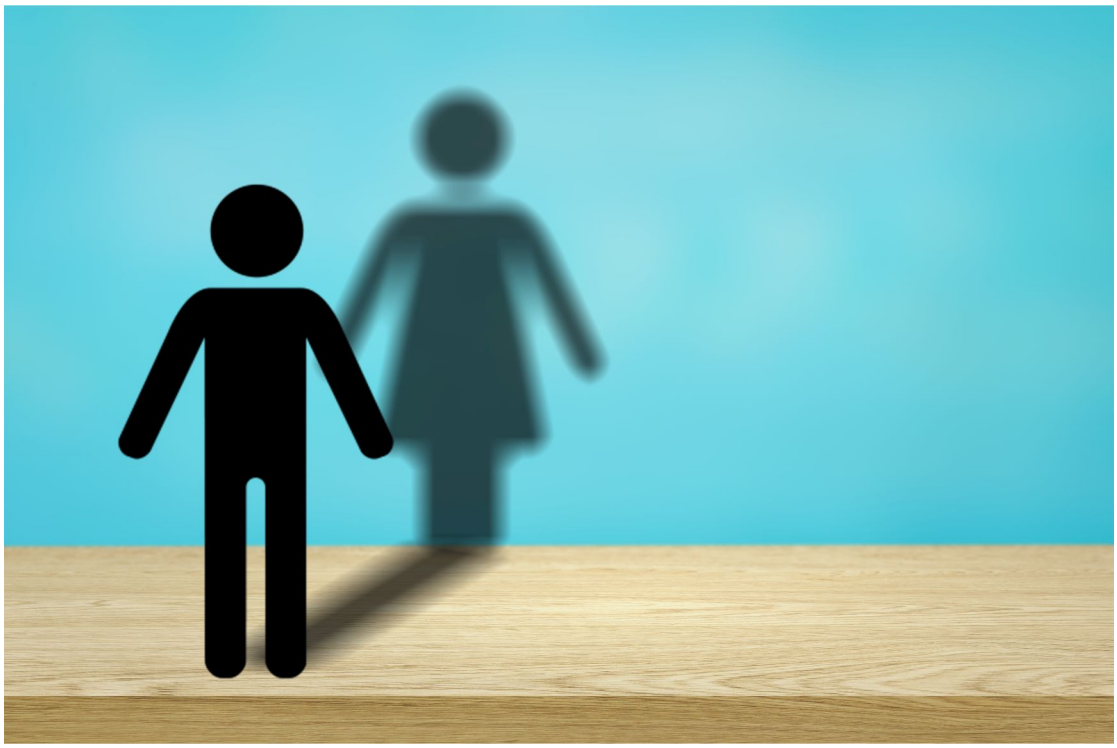
STUDY

Requested by the FEMM committee

European Parliament

The impact of the gender data gap on consumer protection



Policy Department for Citizens' Rights and Constitutional Affairs
Directorate-General for Internal Policies
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The impact of the gender data gap on consumer protection

Abstract

This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the FEMM Committee, considers the impact the lack of gender-disaggregated data has on women and vulnerable social groups, as consumers of products and services. It examines the areas of AI-applications, health, transport, finance and consumer goods, highlighting health and safety risks. Drawing on good practices it makes recommendations for the design of products and services, gender equality and inclusion.

This document was requested by the European Parliament's Committee on Women's rights and Gender Equality.

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CONTENTS

LIST OF ABBREVIATIONS

ADS	Automated Decision-Making
AI	Artificial Intelligence
AGI	Artificial General Intelligence
ANI	Artifical Narrow Intelligence
ASI	Artificial Super Intelligence
BPFA	Beijing Declaration and Platform for Action
DESI	Digital Economy and Society Index
EP	European Parliament
EU	European Union
EIGE	European Institute for Gender Equality
FDA	Food and Drug Administration
FPI	Flagship Programme Initiative
GM	Genetically-modified
GPS	Global Positioning System
HCD	Human-Centred Design
HCI	Human-Computer Interaction
HIV	Human Immunodeficiency Virus
HCV	Hepatitis C Virus
HPV	Human Papilloma Virus
ICT	Information and Communication Technology
IMF	International Monetary Fund
IPV	Intimate Partner Violence

MDG	Millennium Development Goal
NLP	Natural Language Processing
PETBs	Pro-Environmental Travel Behaviours
PPE	Personal Protection Equipment
PLD	Product Liability Directive
PMS	Pre-Menstrual Syndrome
SDG	Sustainable Development Goal
SUMP	Sustainable Urban Mobility Plan
UK	United Kingdom
US	United States
WiD	Women in Digital Scoreboard
WWID	Women who inject drugs

LIST OF BOXES

LIST OF FIGURES

EXECUTIVE SUMMARY

Background

Consumers assume that products are safe and improve their lives as citizens on equal terms. Nevertheless, an increasing volume of findings demonstrates that this assumption is erroneous. Globally, women are overrepresented in car crash fatalities and have less access to financial information and products; they are discriminated against by poorly designed algorithms in the provision of medical and other services and applications; they face gender bias in advertising.[1]

The EU human rights approach, together with the UN Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) set to target gender discrimination at the legal, social and institutional levels in the areas of employment, health and education.[2] However, gender equality has not been achieved. One of the main reasons for this is the lack or scarcity of gender-disaggregated data. Indeed, as reports by UN Women indicate, only 10 out of 54 gender-related indicators can be monitored reliably at the global level.[3]

Citizens as consumers are protected by EU legislation. Nonetheless, this legislation does not inform the processes of product and service design, which are primarily based on the needs of men and are conceptualised and designed by male engineers, designers and practitioners. Women are typically excluded from processes of design and delivery. The lack of sex- and gender-disaggregated data perpetuates this vicious circle, leading to products and services that do not address women's needs and raise issues not only of accessibility, suitability and usability, but also of health and safety.

Such issues are pertinent to the field of Artificial intelligence (AI) and the design of relevant systems, which are transforming the world of employment, education, finance, economy, and healthcare. Behind the often-obscure terminology of machine learning, deep learning, and predictive analytics, among others, lies the idea that AI tools are essentially algorithms (codified procedures for executing a task) that feed on data to produce outputs. Therefore, the quality, accuracy and adequacy of the data for these outputs are essential. The importance of disaggregated data cannot be overestimated, as algorithms and AI systems can perpetuate gender stereotypes and inequalities inherited from historical training data.[4]

In a similar vein, traditional practice in transport services and policies related to the organisation and accessibility of public spaces are often gender-blind and do not consider all genders' needs and how they vary from those of men, due to different socio-economic and cultural circumstances.

Additionally, women, intersex and transgender people have been neglected in the medical world. The design of medical treatments and devices, clinical trials, as well as the provision of medical services and the area of occupational health and safety have historically suffered from gender bias. The same

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1 Leurent, H., Price, S. and Marshall, A., 'Five ways consumer advocates can address gender inequality', Consumers International blog, 2022, accessible at http://www.consumersinternational.org/news-resources/blog/posts/five-ways-consumer-advocates-can-address-gender-inequality

2 Odera, A. J. and Mulusa, J., 'SDGs: Gender equality and women's empowerment: What prospects for delivery?' in M. Kaltenbornet al. (eds) *Sustainable Development Goals and Human Rights*, Interdisciplinary Studies in Human Rights, 2020.; Razavi, S., 'The 2030 Agenda: Challenges of implementation to attain gender equality and women's rights', *Gender and Development*, Vol. 24, No 1, 2016, pp. 25-41.

3 http://www.unwomen.org/en/digital-library/sdg-report.

4 Doughman, J., Khreich, W., El Gharib, M., Wiss, M. and Berjawi, Z., 'Gender bias in text: Origin, taxonomy and implications', *Proceedings of the 3rd workshop on gender bias in natural language processing*, Association for Computational Linguistics, 2021, pp, 34-44.

problem is also encountered in the areas of taxation and financial services, as well as the design, testing and marketing of consumer goods.

Consequently, there is an urgent need for gender disaggregated data to inform the design and consumption of products and services and the use of technological systems that guarantee the human rights of safety and non-discrimination in consumption and delivery. Gender-disaggregation of data will help develop policies that contribute to the reduction of inequalities by targeting the relevant social groups and reduce gender inequalities.

Through an intersectional lens, the study will focus on the analysis of the impact of the lack of gender-disaggregated data on the design of products and services. Policy recommendations will be based on the review of good practices and international evidence.

Aims

- to identify the problem of the scarcity of sex- and gender-disaggregated data and highlight its importance from a human-rights, gender equality and non-discrimination perspective with regard to consumption of products and services;
- to examine the impact of this problem in the specific areas of AI, algorithms, robotics and AI-based technological systems; medicine and health, clinical trials and delivery of medical services; policies and organisation of transport, and public spaces; finance and taxation services; design and consumption of a number of consumer goods;
- to draw on good practices that have been adopted, notably at the EU level, aiming at a more gender-sensitive design and delivery that builds on gender-disaggregated data, accommodates the needs and considers the health and safety of all genders; and
- to make recommendations for gender-sensitive, inclusive and equitable policies to meet the need for increasing quality in data collection, which, combined with gender analysis, will include data of intersectional inequalities of women and non-binary people and better demonstrate the complex needs of different genders.

1. 1. GENERAL INFORMATION

KEY FINDINGS

Product and service design are primarily based on men's needs and conceptualised by male engineers, designers and practitioners. Women are typically excluded from the design of products and services. The lack of sex- and gender-disaggregated data perpetuates this vicious circle, leading to products and services that do not address women's needs and raise issues not only of accessibility, suitability and usability but also of health and safety.

Gender bias is encountered in Artificial Intelligence (AI), as natural language reflects the patriarchal division of labour and generates 'gender bias in text', which influences how the world is perceived. Bias in natural language processing (NLP) informs design and product development, while algorithmic bias exacerbates discrimination against women.

In urban mobility, women's transportation needs are quite distinct from men's. There are significant gender differences in modes of transport and travel patterns, which are related to different roles and responsibilities but also to socio-economic status and power. There are also different needs regarding the uses of public space, including safety concerns, that are disregarded in design.

Medical research and practice have also historically demonstrated a male bias, as women have been ignored in medical research, including that on reproductive and maternal health, resulting in adverse outcomes in treatment. The male body has been typically used for the design of treatments and drugs, while the female one has been neglected; the medical establishment has not paid sufficient attention to hormonal and other physiological gender differences.

Finance and taxation processes also reinforce gender inequalities, as they do not examine the unequal gender relations in society and ignore the impact that budgets have on women because of their different roles, responsibilities and capabilities. Critical accounting perspectives argue that accounting, budgeting and financial services have gender effects.

Gender biases exist in the design of a multiplicity of consumer products. Smartphones, safety belts, spacesuits, machines and tools, children's toys, alcohol and tobacco products are designed based on male bodily features, which results in reduced utility and safety for female users.

For all the above areas, gender-disaggregated data can lead to more gender-sensitive design in AI-based products that avoid gender-related risks, algorithmic discrimination, violation of privacy rights; modes of transport, organisation of public spaces and relevant safety issues; clinical trials, medical treatments and regulation of pharmaceuticals; taxation, budgeting processes and financial services; and consumer products to increase utility, serve real needs and enhance safety.

Improved collection methods of gender-disaggregated data and relevant tools are essential to understand better gender blindness and the problems that need to be addressed. Gender-sensitive indicators, transparency in data collection, gender perspective in AI discussions, multi-level tools for appraising the design and adoption of products and services, gender-responsive budgeting in finance, and gender-aware methods in taxation and transport are indispensable. A holistic approach to design and the participation of representatives of all genders in all the design stages constitute the way forward.

1.1. Introduction

Women influence 65-85 per cent of all purchasing decisions globally, estimated at 20 trillion US dollars yearly.[5] Many consumer products are safety-tested taking only the average size of a man into account (e.g., using only crash dummy males for car design). Globally, women are over-represented in car crash fatalities and have less access to financial information and products; they are discriminated against by poorly designed algorithms in the provision of medical and other services and applications; they face gender bias in advertising.[6]

Citizens and consumers are protected by EU legislation, such as the Directive on Equal Treatment in Employment and Occupation[7], the Race Equality Directive[8], the Directives related to equal treatment of men and women concerning access to goods and services[9], consumer protection rules[10], personal data protection and privacy such as the General Data Protection Regulation (GDPR)[11] and the Data Protection Law Enforcement Directive.[12]

On a more global level, UN Member States adopted the 2030 Agenda for Sustainable Development in 2015, an ambitious framework based on human rights with a 15-year horizon, which comprises 17 Sustainable Development Goals (SDGs) and 169 targets to 'leave no-one behind'.[13]

Although gender equality is omnipresent in the body of the EU legislative and policy documents, it is still elusive. It features as the stand-alone SDG 5 in the Agenda 2030, which adopts a holistic approach to development targeting discrimination on the legal, social and institutional levels and includes the areas of employment, health and education.[14]

One of the main reasons for this is the lack or scarcity of gender-disaggregated data; indeed, as reports by UN Women indicate, only 10 out of 54 gender-related indicators can be monitored reliably at the global level.[15] As the then High Commissioner for Human Rights observed in 2013, while the Millennium Development Goals (MDGs) were based on what could be measured, it is essential to 'measure what we treasure' and not to treasure what can be measured.[16]

Lack of sex and gender disaggregated data generates gender-related biases. Designers have traditionally neglected gender considerations and the public debate about such issues and have designed products according to their beliefs of gender or cultural stereotypes and norms. They design

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5 Leurent, H., Price, S. and Marshall, A. 'Five ways consumer advocates can address gender inequality', Consumers International blog, 2022, accessible at http://www.consumersinternational.org/news-resources/blog/posts/five-ways-consumer-advocates-can-address-gender-inequality

6 Ibid.

7 Council Directive 2000/78/EC of 27 November 2000.

8 Council Directive 2000/43/EC of 29 June 2000.

9 Council Directive (2004/113/EC) of 13 December 2004.

10 Directive (EU)2011/83 of the European Parliament and of the Council of 25 October 2011.

11 Regulation (EU) 2016/679 of the European Parliament and of the Council.

12 Directive (EU) 2016/680.

13 Abualghaib, O., Groce, N., Simeu, N., Carew, M.T. and Mont, D., 'Making visible the invisible: Why disability-disaggregated data is vital to "leave no-one behind"', *Sustainability*, Vol. 11, 2019.

14 Odera, A. J. and Mulusa, J., 'SDGs: Gender equality and women's empowerment: What prospects for delivery?' in M. Kaltenbornet al. (eds) *Sustainable Development Goals and Human Rights*, Interdisciplinary Studies in Human Rights, 2020.; Razavi, S., 'The 2030 Agenda: Challenges of implementation to attain gender equality and women's rights', *Gender and Development*, Vol. 24, No 1, 2016, pp. 25-41.

15 http://www.unwomen.org/en/digital-library/sdg-report.

16 Quoted in Razavi, S., 'The 2030 Agenda: Challenges of implementation to attain gender equality and women's rights', *Gender and Development*, Vol. 24, No 1, 2016, pp. 25-41.

for the 'average user', whatever that might mean to them. This leads to gender blindness, which EIGE defines as 'failure to recognise that the roles and responsibilities of women/girls and men/boys are ascribed to, or imposed upon, them in specific social, cultural, economic and political contexts'.[17]

Unless they know the specific needs of the target users and how gender affects the use of technology or products, they will not achieve their aim to appeal to their audience. Lack of adequate data often leads to product and service design that is unbalanced and puts at greater risk the health and safety of those groups of citizens who are under-represented in the available data.

Artificial intelligence (AI), information and communication technologies (ICTs), and robotics have brought about drastic changes in employment, education, finance, economy and healthcare, especially in the last years of the Covid-19 pandemic. Regarding gender equality, they are found to perpetuate gender stereotypes and inequalities inherited from historical training data.[18] The opaque nature of AI systems makes the identification of problematic aspects in their design an overly complex task.[19]

Services related to transport and policies related to the organisation and accessibility of public spaces are often gender-blind: they do not consider women's needs, which are different to men's due to different socio-economic circumstances. Lack of gender disaggregated data obscures such needs and raises significant issues that have to do with safety, accessibility, convenience and quality of life.

In scientific research, sex and gender are often seen as one. Women have been historically neglected in clinical studies, and so are gender identities outside the traditional binary classifications. The design of medical devices, clinical trials, as well as the provision of medical treatments and medical services have historically suffered from a gender bias. The recent COVID-19 pandemic revealed pronounced gender differences and could have been a perfect opportunity for data collection agencies to collect gender disaggregated data; however, this has not happened.

Gender biases are also encountered in the provision of financial services, government budgeting processes and their underlying principles, taxation, tax policies and tax administration processes. The organisation of these often reveals male values, a problem which relates to the lack of adequate data and disregard for women's diverse needs.

The area of consumer products is perhaps the one that is more often highlighted from the perspective of gender bias. Product design is traditionally gendered, as it is based on the anthropomorphic characteristics of the male body structure; gender stereotypes about particular products (e.g., machinery or technological artefacts) generate limitations in functionality for women; processes involved in bringing consumer products into the market, such as advertising, often suffer from gender bias in representation of products. Lack of adequate data in this area also perpetuates stereotypes, wrong assumptions, lack of diversity, and, again, raise issues of safety, availability and accessibility.

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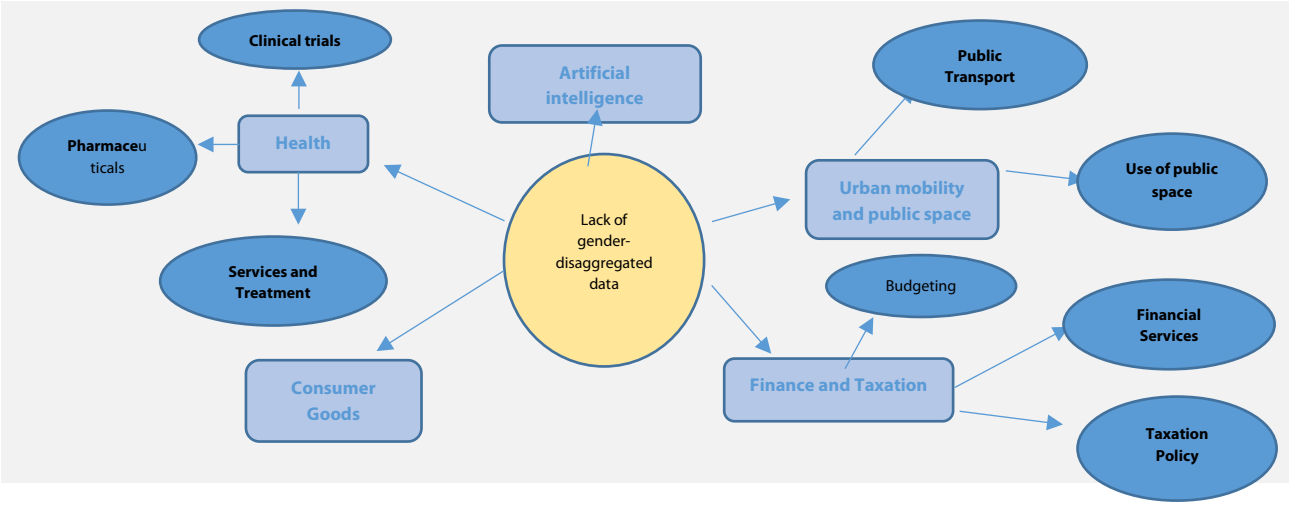
17 https://eige.europa.eu/thesaurus/terms/1157

18 Doughman, J., Khreich, W., El Gharib, M., Wiss, M. and Berjawi, Z., 'Gender bias in text: Origin, taxonomy and implications', *Proceedings of the 3rd workshop on gender bias in natural language processing*, Association for Computational Linguistics, 2021, pp, 34-44.

19 European Parliament, *Civil liability regime for Artificial Intelligence*, 2021/C 404/05, Brussels , 2021.

Figure 1: Main themes of the study



1.2. Definition of basic concepts

Before attempting to present and critically evaluate the impact of the absence of disaggregated data on various aspects of human life, some concepts must be defined.

Sex denotes a set of biological attributes that distinguish humans as male, female, intersex (from 1:1000 to 1:4500, depending on the criteria used). Sex includes anthropometric and biological characteristics that are relevant to the design of products and services. **Gender** refers to the way people perceive their biological sex in a given social context. It refers to attitudes, behaviours, cultural factors, stereotypes and knowledge. It has a performative dimension according to Butler and is reproduced as subjective acts of doing.[20] Both are important in our analysis as certain relevant concepts, such as pain, vary according to sex but also to gender.[21]

Design is 'a creative activity whose aim is to show the multi-faceted qualities of objects, processes, services, and their systems in whole life cycles'.[22] It aims at enhancing sustainability, environmental protection, offering freedom and benefit to all the members of the community, while respecting diversity. Designing products differs from designing services, yet they have in common that they are innovative ways of fulfilling people's needs and solving problems. Such an innovative product is the **Family Wheel**: A concept proposed as a design idea to articulate female needs in ICT use. It is a tool for organising everyday tasks according to one's availability considering communication preferences and distributing tasks across groups of people. This constitutes an example of participatory design that incorporates women's experience and is informed by feminist demands for gender equality, women's empowerment and integration in the digital world.[23]

Developing products and services within a given societal framework may aim at: changing it, contributing to its sustainability, realising strictly defined technical objectives or at sustainable system

[20] Butler, J., *Gender trouble: feminism and the subversion of identity*, 2006, Routledge.

[21] Tannenbaum, C., Ellis, R.P., Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp. 137-146.

[22] In Joore, P. and Brezet, H., 'A multilevel design model: the mutual relationship between product-service system development and societal change processes', *Journal of Cleaner Production*, Vol. 97, 2015, p. 92.

[23] Buchmüller, S., Joost, G., Bessing, N. and Stein, S., 'Bridging the gender and generation gap by ICT applying a participatory design process', *Pers. Ubiquit. Comput.*, Vol. 15, 2011, pp. 743-758.

innovation. Another crucial element is that every product or service reflects the worldview of its designer towards societal values.[24]

Design must be human-centred, a term introduced by Donald Norman, to denote a design that responds to human needs.[25] However, **human-centred design (HCD)** is static and often adopts a binary approach to gender which is not in tune with current societal needs.[26] Power relations and gender inequalities are also reflected in product design. Gender awareness must be incorporated into the design of products to alleviate the effect of gender norms and be consistent with the ongoing non-binary debate around genders. Research has shown that queer perspectives have been little discussed, and the experience of queer users and other alternative gender experiences largely ignored.[27]

Artificial intelligence (AI) is 'a field of research intending to understand and build intelligent entities that pertain to the categories of acting and/or thinking humanly and/or rationally'[28]. AI comprises a vast range of technologies from simple statistics to machine learning and deep learning.[29] There are various evolutionary stages of AI:[30]

- **Artificial Narrow Intelligence (ANI**) or weak AI which consists of the execution of very specific tasks, such a driving a car or winning a chess game.
- **Artificial General Intelligence (AGI) or Human-Level AI** which is sentient and has human capabilities. It can learn and perform exactly like humans. This has not yet been achieved but according to predictions it will be by 2029 followed by a radical transformation of mind, economy, and society by 2045.
- **Artificial Super Intelligence (ASI)** that exists human capabilities and cognitive performance in all domains of interest.

Automated decision making (ADS) is 'the act of a user who delegates to an entity a decision partly or wholly through the use of software or a service, where that entity uses automatically executed decision-making models to perform an action on behalf of a user or to inform the user's decision in performing an action'.[31]

The definition of **producer** includes manufacturers, programmers, developers as well as back-end operators, while **operators** are all the natural or legal persons who have a degree of control over a risk associated with the operation of an AI system and benefits from its operation.[32]

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[24] Joore, P. and Brezet, H., 'A multilevel design model: the mutual relationship between product-service system development and societal change processes', *Journal of Cleaner Production*, Vol. 97, 2015, pp. 92-105.

[25] Norman, D., *The design of everyday things*, 2013, MIT Press.

[26] Esfahani, B.K., 'Bridging gender and human-centered design: a design verification study', Procidia CIRP 91, 2020, pp. 824-831, available online at www.sciencedirect.com.

[27] Prochner, I., 'Incorporating queer understanding of sex and gender in design research and practice', in Lim, Y., Niedderer, K., Redström, J., Stolterman, E. and Valtonen, A. (eds) *Design's big debates* – DRS International Conference 2014, 16-19 June, Umeå, Sweden. https://designresearchsociety.org/drs-conference-papers/drs2014/researchpapers/122.

[28] Karnouskos, S., 'Symbiosis with artificial intelligence via the prism of law, robots and society', *Artificial Intelligence and Law*, Vol. 30, 2021, p. 94.

[29] European Parliament, *Civil liability regime for Artificial Intelligence*, 2021/C 404/05, Brussels , 2021.

[30] Karnouskos, S., 'Symbiosis with artificial intelligence via the prism of law, robots and society', *Artificial Intelligence and Law*, Vol. 30, 2021, p. 94.

[31] European Parliament, *Civil liability regime for Artificial Intelligence*, 2021/C 404/05, p.109, Brussels , 2021.

[32] Ibid., p. 111.

1.3. Structure, scope and methods

This study aims at revealing the effects of the lack of the parameter 'gender' in the design of products and services, due to the dearth of gender disaggregated data, which can be detrimental for the health and safety of certain categories of consumers, predominantly women.

It investigates the specific areas of AI and the design of AI systems, taxation, finance and relevant services; policies and services related to transport and the urban space; medical products and devices; treatments and medical services. Finally, as the area of consumer protection is vast, the paper focuses on selected consumer products of everyday life such as electronic devices, safety equipment, tools and machinery, toys, cosmetics, tobacco and alcohol.

It looks to highlight the interrelation of economic, social, political and cultural factors that frame the context of the use of such products and services by women, particularly in the EU context, to reinforce the need for sex- and gender-disaggregated data. Moreover, it identifies gender-specific risks and suggests ways to enhance consumer protection concerning those risks.

The study is based on extensive desktop research, consisting of a thorough literature review of scientific journal articles, reports, academic papers, policy documents, EU legislation and international press. In addition, internet sources are consulted (such as websites, blogs, relevant videos and online panel discussions). Quantitative and qualitative secondary data are considered to illustrate the ramifications of the lack of gender disaggregated data in as many key aspects of citizens' everyday life and activities as possible, given the study's space limitations.

EU policies are evaluated from the angle of human rights (privacy and non-discrimination), but also from that of the more neglected in the AI debate social rights, which form a pillar of the European social model.[33] For each of the areas studied, it draws on good practices that have been adopted and suggests regulatory and policy measures to address the gender data gap and lead to a gender-sensitive product and service design which will be safe for all.

The common element in recommendations is the need for multi-faceted policy that takes into consideration ethical and safety dimensions and involves all relevant groups (including women and gender binary categories) in the design or products, services and systems.

[33] Niklas, J. and Dencik, L., 'What rights matter? Examining the place of social rights in the EU's artificial intelligence policy debate', *Internet Policy Review*, Vol. 10, Issue 3, 2021, pp. 1-29.

2. IMPACT OF THE LACK OF GENDER DISAGGREGATED DATA ON DESIGN OF PRODUCTS AND SERVICES

2.1. Why is collection of gender disaggregated data vital?

Women are the majority of consumers of products and services. They often have unique needs and are a very heterogeneous group. Aspects of these needs as differentiated by gender are still inadequately considered when it comes designing consumer goods, services and policies.

Our world is increasingly connected, and data are collected in numerous ways through our everyday activities. Men's over-representation among sophisticated technology users leads to collection of more data related to men when it comes to employment, finance, etc., which generates bias.[34]

This section is dedicated to unravelling such gender biases in design in different areas, such as ICTs and AI, taxation and financial services, medical products and treatments, and consumer goods, to demonstrate the adverse outcomes caused by the absence of adequate and quality gender disaggregated data.

Digitalisation of services is heralded as a democratic way of improving people's lives through the production of smart devices and digital services. The realisation of those promises, however, presupposes equal access to technology, information, skills and resources. Studies have shown there are digital divides related to access, education, age, income and gender. The digital gender gap has recently received much attention by researchers, activists and policy makers. The need for women to be present in designing digital products and services has been highlighted.[35]

Human-computer interaction (HCI) is informed by design policies organised predominantly by male engineers and software developers with negative outcomes as far as woman-friendliness of products and services is concerned. The needs of women when it comes to the use of ICT involve a variety of areas, such as work, care of children and elderly, housework, health, fitness, etc. and work-life balance experiences that ought to be captured at the design stage, which so far has not been the case.[36]

The lack of gender disaggregated data obscures gender poverty differences. Better statistics is required to monitor the progress of Agenda 2030.

2.2. Issues with AI and ADS

There are no new products without a degree of risk, especially at the beginning of their life cycle. This is also valid for AI applications which are at considerable risk of bias, which is prevalent in all aspects of our life.

Gender stereotypes emanate from gender-typical social roles reflecting the patriarchal division of labour in a society. Natural language mirrors this order, as until recently the masculine form was dominant, i.e., 'man' denoted 'human being', while 'he' was the generic form. This predominance of a

[34] A Carnegie Mellon study, for instance, demonstrated that high-paying job adverts target men. See Ely, K. 'The world is designed for men: how bias is built in our daily lives', 8 Sep 2015 https://medium.com/hh-design/the-world-is-designed-for-men-d066640654491

[35] European Parliament, *The underlying causes of the digital gender gap and possible solutions for enhanced digital inclusion of women and girls*, Brussels: European Parliament, 2018.

[36] Buchmüller, S., Joost, G., Bessing, N. and Stein, S., 'Bridging the gender and generation gap by ICT applying a participatory design process', *Pers. Ubiquit. Comput.*, Vol. 15, 2011, pp. 743-758.

specific gender in language as a function of social gender stereotypes is called 'gender bias in text'[37] and influences the way we perceive difference and view the world around us.

Bias in natural language processing (NLP) influences design and product development. Algorithmic bias accelerates the feedback loop and exacerbates discrimination against specific social groups, such as women, ethnic and religious minorities, as well as people at the margins, leading to unfair treatment.[38]

The use of AI in the public sector is not without problems either. Scientific evidence shows that AI applications make errors that can be at the expense of certain social groups. Opacity and lack of explicability of algorithms lead to unfair outcomes and the exclusion of certain categories of citizens.[39] Bias in algorithms has been known for decades. Already in the 1980s in the UK it was found that the programme used to admit students to a medical school was discriminating against women and ethnic minorities. For example, facial recognition systems misclassify gender for darker-skinned women much more frequently than for whiter-skinned men.[40] Efforts must be made towards a more nuanced approach to image and voice recognition that will be more representative of the different segments of the population.

Algorithmic bias also manifests itself in algorithms that send job adverts to users. Usually, men receive higher paying job adverts.[41] Studies have also highlighted the ways in which AI-based credit scoring has produced higher interest rates loan for people from minority background.[42] A substantial amount of further research into the potential legal, gender, economic, social and ethical perspectives is required. If AGI and ASI are achieved the implications on the new era on life as we know it will be vast.

Training data for machine-learning must be representative of populations. Crowdsourcing is often the collection method, and this leads to a less representative demographic sample.[43]

There is a need for a strict legislative and regulatory framework across the EU to ensure that the use of AI and digital technology takes into equal consideration the characteristics and needs of all genders and boosts digital innovation which will allow the Digital Single Market to compete in the global AI race, while maintaining digital sovereignty.[44] All actors and stakes must be part of a public debate and Member State legislations must be harmonised. Central to this debate is the notion of civil liability.

Rigorous investigation of the gender and racial bias of AI applications used in employment, healthcare and financial products and services is necessary.[45] Citizens ought to be aware, vigilant and ready to question recommendations by biased AI applications.

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37 Doughman, J., Khreich, W,, El Gharib, M., Wiss, M. and Berjawi, Z,, 'Gender bias in text: Origin, taxonomy and implications', *Proceedings of the 3rd workshop on gender bias in natural language processing*, Association for Computational Linguistics, 2021, pp. 34-44.

38 Ibid.

39 Guevara-Gomez, A., Criado, I.G. and de Zarate-Alcarazo, L.O., 'Feminist perspectives to artificial intelligence: Comparing the policy frames of the European Union and Spain', *Information Policy*, Vol. 26, 2021, pp. 173-192.

40 Tannenbaum, C., Ellis, R.P, Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp. 137-146.

41 Ibid.

42 Gupta, M., Parra, C.M. and Dennehy, D., 'Questioning racial and gender bias in AI-based recommendations: Do espoused national cultural values matter?', *Information Systems Frontiers*, published online 20 June 2021.

43 Tannenbaum, C., Ellis, R.P, Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp, 137-146.

44 European Parliament, *Civil liability regime for Artificial Intelligence*, 2021/C 404/05, Brussels, 2021.

45 Gupta, M., Parra, C.M. and Dennehy, D. 'Likelihood of questioning AI-based recommendations due to perceived racial/gender bias', JEEE Transactions on Technology and Society, Vol. 3, No 1, 2022, pp. 41-45.

Given the declared commitment of the EU to democracy, rights, and citizenship, the AI debate as a subject of analysis that lays bare the real priorities of EU policymakers. It also provides an opportunity to examine the ways in which social rights intersect with optimisation technologies in the crucial areas of employment and social welfare.[46]

2.3. Urban mobility and use of the public space

Due to the traditional division of labour, women are disproportionately responsible for care work (formal and informal) despite recent progress toward equality. Their transportation needs are as important as those of men, but also quite distinct. There are significant gender differences in terms of modes of transport and travel patterns, and such differences are related to different roles and responsibilities but also socio-economic status and power dynamics.[47] Feminist research has indeed argued and demonstrated that the way in which men and women move is gendered.[48]

Data collection design is often flawed as it focuses on employment-related data and obscures care-related data which often appear as shopping trips for leisure. Women involved in the provision of care at home, which they often combine with part-time work, typically spend larger amounts of their travel time to carry out their caretaking, households and family responsibilities.[49] Women often end up spending more time on transport, particularly as they often do not have access to private cars.[50] Therefore, it is imperative that they do not have transport constraints if they are to attain this tricky work-life balance.[51]

Research has shown that there is a complex relation between gendered mobility patterns, socio-economic factors, and transportation options. Moreover, as many studies have highlighted, travel patterns of people are different in many respects. Gender inequalities in mobility are related to socio-economic income and employment status. Women are more constrained due to economic and cultural reasons even when public transport is available.[52]

Research on transport in urban settings demonstrates that women's needs are rarely taken into account in the design and planning of transport systems[53] – this has implications which can be rather serious, e.g., becoming victims of assault or harassment.[54] Indeed, there is a multitude of incidents, in

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46 Niklas, J. and Dencik, L., 'What rights matter? Examining the place of social rights in the EU's artificial intelligence policy debate', *Internet Policy Review*, Vol. 10, Issue 3, 2021, pp. 1-29.

47 Muhoza, C., Wikman, A. and Diza-Chavez, R., *Mainstreaming gender in urban public transport: Lessons from Nairobi, Kampala and Dar es Salaam*, Stockholm, Stockholm Environment Institute, 2021.

48 Uteng, T.P. and Cresswell, T., (eds) *Gendered mobilities*, Routledge, London, 2016.

49 Hamilton, K. and Jenkins, L., 'A gender audit for public transport: A new policy tool in the tackling of social exclusion', *Urban Studies*, Vol. 37, No 10, 2000, pp.1793-1800.

50 Navarette-Hernandez, P., Vetro, A. and Concha, P., 'Building safer public spaces: Exploring gender difference in the perception of safety in public space through urban design interventions', *Landscape and Urban Planning*, No 214, pp. 1-13.

51 Hamilton, K. and Jenkins, L., 'A gender audit for public transport: A new policy tool in the tackling of social exclusion', *Urban Studies*, Vol. 37, No 10, 2000, pp. 1793-1800.

52 Punzo, G., Panarello, D. and Castellano, R. 'Sustainable urban mobility: Evidence from three developed European countries', *Quality and Quantity*, Vol. 56, 2022, pp. 3135-3157; Arsenio, E., Martens, K. and Di Ciommo, F., 'Sustainable urban mobility plans: Bridging climate change and equity targets?', *Research in Transportation Economics*, Vol. 55, 2016, pp. 30-39; Ng, W-S. and Acker, A., *Understanding urban travel behaviour by gender for efficient and equitable policies*, International Transport Forum Discussion Paper 2018-1, 2018, International Transport Forum, Paris.

53 Gauvin, L., Tizzoni, M., Piaggesi, S., Young, A., Adler, N., Verhulst, S., Ferres, L. and Cattuto, C., 'Gender gaps in urban mobility', *Humanities and Social Sciences Communications*, Vol. 7, No 11, 2020.

54 Muhoza, C., Wikman, A. and Diza-Chavez, R., *Mainstreaming gender in urban public transport: Lessons from Nairobi, Kampala and Dar es Salaam*, Stockholm, Stockholm Environment Institute, 2021.

which women have fallen victims of sexual harassment in public spaces and transport contexts. Such incidents typically go unreported, and they are often not dealt with.[55]

Moreover, there are not enough disaggregated data on the nature of the trips that women undertake (e.g., shopping, care-based, business, or other) that would enable a better understanding of their transport needs.[56]

Safety in transport, is arguably a complex matter, as both perceptions of vulnerability and perceptions of safety differ between men and women, not least because of different prior experiences.[57] Studies on perceived train safety, for instance, have shown that, while technological solutions, such as the presence of video cameras, are seen as positive by both women and men, the former feel considerably safer with the presence of staff or security personnel.[58] Interestingly, as a study of 131 transit agencies in the US has shown, most of these agencies had security devices on their buses but not at bus stops, while women are much more likely to feel safer on the bus and less so at the bus stop – this is an indicative example of mismatch between the needs of women consumers and the frame of mind of the designers.[59]

Perceived safety is also important in the use of public spaces. There are significant differences between men and women as regards perceptions of safety in public spaces. Studies report higher fear on the part of females of falling victims of crime in a variety of environments, including campuses, urban wooded areas, public housing and so on.[60] A UK Department for Transport study showed significant differences in the percentages of women who reported being fearful in public spaces such as multi-storey car parks, waiting at bus stops, walking home from a station. Such fears are more enhanced in low-income women who tend to live in areas where crime rates are high or work long hours and must walk in the dark to return home.[61]

Women are more reluctant to use public space with poor lighting, empty areas, inadequate signs and lack of public toilets. There is little evidence of the impact on perceived safety of interventions that involve improved street lighting or CCTV cameras. [62]

Lack of diversity in urban design has overall consequences in deterring, therefore excluding categories of citizens.[63] For example, some argue that more women than men perceive urban back alleys as less safe. However, this perception is much alleviated when naturalistic vegetation is present, which suggests that urban design in this direction would improve female participation in the urban spaces.[64]

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55 A number of examples presented in Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

56 Hamilton, K. and Jenkins, L., 'A gender audit for public transport: A new policy tool in the tackling of social exclusion', *Urban Studies*, Vol. 37, No 10, 2000, pp. 1793-1800; Gauvin, L., Tizzoni, M., Piaggesi, S., Young, A., Adler, N., Verhulst, S., Ferres, L. and Cattuto, C., 'Gender gaps in urban mobility', *Humanities and Social Sciences Communications*, Vol. 7, No 11, 2020.

57 Yavuz, N. and Welch, E.W., 'Addressing fear of crime in public space: Gender differences in reaction to safety measures in train transit', *Urban Studies*, Vol. 47, No 12, 2010, pp. 2491-2515.

58 Ibid.

59 Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

60 Jiang, B., Nga Sze Mac, C., Larsen, L. and Zhong, H., 'Minimizing the gender difference in perceived safety: comparing the effects of urban back alley interventions', *Journal of Environmental Psychology*, Vol. 51, pp. 117-131, 2017.

61 Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

62 Navarette-Hernandez, P., Vetro, A. and Concha, P., 'Building safer public spaces: Exploring gender difference in the perception of safety in public space through urban design interventions', *Landscape and Urban Planning*, No 214, pp.1-13.

63 Ibid.

64 Jiang, B., Nga Sze Mac, C., Larsen, L. and Zhong, H., 'Minimizing the gender difference in perceived safety: comparing the effects of urban back alley interventions', *Journal of Environmental Psychology*, Vol. 51, pp. 117-131, 2017.

Gender discrimination also occurs in the design and use of public toilets, which historically has not taken into account women's specific special toilet needs and has resulted in health and safety risks for female users. Toilet design is part of urban design – and, while some of the discrimination issues in terms of race and disability have been addressed in some countries, unequal gender access remains; either there are no women's toilets at all or, when available, they are not matched with women's toilet needs.[65]

Thoughtless design has generated toilets that have been uncomfortable and unsafe. Issues to consider include the fact that women need twice as much time as men to use the facilities, that they often face situations requiring a quick access to the toilet, e.g., when they are in menstruation or pregnant. They also are likely to need the toilet more frequently.[66] Data from the UN show that one in three women lack access to safe toilets. Lack of availability of a sufficient number of public toilets could have health implications: bladder and urinary tract infections or dehydration from trying to prolong visit to the toilet by not taking enough liquids.[67]

The case of public toilets clearly illustrates a need for a change in attitudes of all those involved in design and planning. A gender-sensitive re-examination of traditional practice would require understanding of the ways in which a unisex toilet might be a better choice than separate toilets. Innovation based on research into different gender needs with support from different organisations could lead to the incorporation of design and planning into public administration programmes.[68]

A positive development has been the European Commission's Sustainable Urban Mobility Plans (SUMPs) for a new approach to inclusive, holistic, green and citizen-centred urban transport.[69]

2.4. The significance of the lack of gender disaggregated data in health: Design of medical devices and wearables, clinical trials, treatments and services

2.4.1. Relevance of sex and gender data in the health sector

There is a considerable **dearth of data on sex and gender differences in medical research.** Women have been either ignored or included in research focusing on reproductive and maternal health.

Medical practice has traditionally presented a male bias and that has led to treatments that may have suboptimal or even negative outcomes for female patients. The female body has been neglected by the medical establishment. Medical textbooks that predominantly use illustrations of the male body are the norm with references to sex differences in terms of size and reproductive system. Well-known sex differences such as those relating to depression, or the effects of alcohol are absent.[70] Most drug dosages are based on the body weight of a male body; females have a higher percent of body fat than males yet this difference is also ignored. Normal functions of the female body, such as menstruation, have been traditionally in certain cultures and religions a source of stigma and shame for women. A

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65 Anthony, K. and Dufresne, M., 'Potty parity in perspective: Gender and family issues in planning and designing public restrooms', *Journal of Planning Literature*, Vol. 21, No 3, 2007, pp. 267-294.

66 Ibid.

67 Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

68 Anthony, K. and Dufresne, M., 'Potty parity in perspective: Gender and family issues in planning and designing public restrooms', *Journal of Planning Literature*, Vol. 21, No 3, 2007, pp. 267-294.

69 Arsenio, E., Martens, K. and Di Ciommo, F. 'Sustainable urban mobility plans: Bridging climate change and equity targets?', *Research in Transportation Economics*, Vol. 55, 2016, pp. 30-39.

70 Dijkstra, A.F., Verdonk, P. and Lagro-Janssen, A.L.M., 'Gender bias in medical textbooks: Examples from coronary heart disease, depression, alcohol abuse and pharmacology', *Medical Education*, Vol. 42, No 10, 2008, pp. 1021-1028.

human-centred design would not just produce sanitary towels but also try to relieve the stigma in the local socio-cultural context by raising awareness within the community and focusing on the positive association of menses with childbearing.[71]

An example is the common belief that men are much more prone to **coronary heart disease**. Although the percentage of male patients aged 55-64 is double than that of female patients, the picture changes in the age bracket 80-94 in which women's rates are just 10% lower than those of men. Therefore, if researchers want to investigate coronary heart disease in patients aged 55-64, they must include three times more female patients than male patients.[72] Often the same disease presents itself differently in different genders. For example, symptoms of myocardial ischemia in women does not include the crippling chest pain that it does to men, but they experience fatigue and shortness of breath. This is primarily due to females having smaller hearts and arteries than males.

Sex and gender analysis can be beneficial to new therapies, such as in the areas of **pain and depression**. Sex differences in blood, human cells and organ function are often not taken into consideration when it comes to prescribing the dosage of a particular drug according to sex, this may lead to much more harmful effects for one sex. *Desmopressin,* for instance, a medicine used to regulate water homeostasis in the kidney, must be given to older female patients in lower doses than to their male equivalents, as the former would suffer many more side-effects. Similarly, reactions to checkpoint inhibitors used in immunotherapy for cancer differ according to the hormonal profile of the patient, as they are sensitive to the levels of testosterone and oestrogen.[73]

Furthermore, special attention should be paid to **external hormones** that women or men take, such as menopausal hormone treatments, anabolic steroids, and androgens. Moreover, sex differences in brain activity in the stress response circuitry between young men and the same young women in different stages of their cycle vary substantially. For example, among people taking growth hormones, women who take oestrogen orally must take double the dose of men or women who are not taking oestrogen. [74] Transgender people undergoing **gender re-assignment** is on the rise and transgender people must be taken into consideration in research design to ensure that medication is suitable to their hormonal profile.

Disaggregating the data in medical research can reveal crucial gender differences and lead to higher accuracy, avoidance of misinterpretation and confounding of information. It can add scientific rigour to research and design of better treatments and drugs.[75] The sex-informed perspective examines anatomical, physiological, and developmental differences. There is growing evidence that sex and gender analysis in AI uses in the health care sector is essential for the careful design of research methodology, as well as the design of products and services. Available datasets are used by researchers and policymakers to help them decide on crucial issues and design policy interventions.

Furthermore, disaggregation by gender and age can be used to estimate differences in the expected health outcomes and to monitor whether interventions are reaching all the segments of the

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[71] McLaren, M.A. and Padhee, M., 'A sexual and reproductive health rights approach to menstruation', *Gender & Development*, Vol. 29, No 1, 2021, pp. 131-150.

[72] Rich-Edwards, J.W., Kaiser, U.B., Chen, G.L., Manson, J.E. and Goldstein, J.M., 'Sex and gender differences research design for basic, clinical, and population studies: Essentials for investigators', *Endocrine Reviews,* Vol. 39, No 4, 2018, pp. 424-439.

[73] Tannenbaum, C., Ellis, R.P., Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp. 137-146.

[74] Rich-Edwards, J.W., Kaiser, U.B., Chen, G.L., Manson, J.E. and Goldstein, J.M., 'Sex and gender differences research design for basic, clinical, and population studies: Essentials for investigators', *Endocrine Reviews,* Vol. 39, No 4, 2018, pp. 424-439.

[75] Ibid.

population.[76] This is an important first step to eliminate the sex bias of health research. Some good practices pointing to the same direction include:

- **Charité** in Berlin that has integrated sex and gender analysis in its six-year long medical training.
- **Gendered Innovations** is a joint effort in 2009 of Stanford University, the European Commission and the US National Science Foundation to develop practical methods of sex and gender analysis for engineers and natural scientists.
- The WHO has developed a **gender responsive assessment tool**.

However, scholars consider gender analysis equally important. Focusing on differences between the sexes (that include intersex and transgender people and not just men and women) may result in obscuring similarities. Furthermore, the studied categories may be treated as homogeneous, which they are not. Analysing gender differences in terms of race, ethnicity, sexuality, socio-economic status and culture and their intersections with sex will contribute to a much richer and nuanced discussion that will enable policymakers to design effective policies.[77] Intersectional gender inequalities are crucial in determining health behaviour and the social determinants of health are not captured by collecting disaggregated data solely by sex. A gender analysis will highlight the significance of the social determinants of health and the power dynamics that determine the social disadvantage of certain genders and consequently, capture the different experiences.

Integrating gender analysis is much more complex and requires social science expertise. Therefore, an interdisciplinary approach is recommended, that will not be restricted to extracting information exclusively from administrative statistical data; those focus on some health outcomes (deaths, comorbidities etc.), guided by the desire to contain costs. Often when relying on administrative data, sex and gender are conflated, and the emphasis is on quantifiable data, such as 'quality of care', which is used to denote the number of visits to the doctor. Introducing gender-sensitive indicators will shed light on the circumstances which form patients' unhealthy habits, and cause or exacerbate their conditions. Such data can only be collected through gender analysis of the social determinants of health.[78]

Universities, funding bodies and peer-reviewed journals must collaborate and put pressure to this end. Policy can be a major force in the same direction.[79] Research into topics such as the treatment of women by the medical establishment and access to services or the reasons why there is underdiagnosis of certain conditions has shown pronounced sex and gender differences.[80]

Lack of adequate funds often leads to research design with less statistical power which often do not differentiate between men and women. Even when the sample is very small, it is still worth reporting

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[76] Hawkes, S., Pantazis, A., Purdie, A., Gautam, A., Kiwuwa-Muyingo, S., Buse, K., Tanaka, S., Borkotoky, K., Sharma, S. and Verma, R., 'Sex-disaggregated data matters: tracking the impact of COVID-19 on the health of women and men', *Economia Politica*, Vol. 39, No.1, 2022, pp.55-73.

[77] Nowatzki, N. and Grant, K.R., 'Sex is not enough: The need for gender-based analysis in health research', *Health Care for Women International*, Vol. 32, No 4, 2011, pp.263-277.

[78] Ibid.

[79] Tannenbaum, C., Ellis, R.P., Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp. 137-146.

[80] Nowatzki, N. and Grant, K.R., 'Sex is not enough: The need for gender-based analysis in health research', *Health Care for Women International*, Vol. 32, No 4, 2011, pp. 263-277.

gender differences. Nevertheless, the opposite can be equally problematic, as big data analysis can detect trivial differences but fails to lead to meaningful conclusions about vital differences.[81]

On the other hand, there are some risks associated with an obligation to **report gender differences in medical research**, as this may lead to a body of work of questionable quality. There is also the **bias of researchers** of the biological world to view sex differences in a non-binary way. Much more caution and scepticism, as well as alertness are required before attributing disease outcomes to sex differences i.e., associating the higher death rates of men with lung cancer to sex, rather than third factors such as smoking. Confounders must be measured and, when not available, simulation must be used. Finally, the interpretation of findings must always consider prior scientific knowledge to test for apparent sex effects.[82]

The use of AI in the health sector has led to major innovations in terms of diagnostics, monitoring devices and **wearables**. The latter enhance users' independence, as they can monitor and manage their health without the need for multiple doctor appointments, which leads to substantial savings in health care expenditure.

The role of the aesthetic aspect in adoption of a product should not be underestimated. The challenge for designers is to introduce technology that will engage the users. So far, such developments are driven from above without much involvement of the users. Lack of user-friendliness can lead to inaccurate readings and suboptimal monitoring. Therefore, research on gender performances and aesthetics in interactive technology is key to understanding user experience and designing human-centred and user-engaging products.[83]

Mobile health (mHealth) applications often lack a gender sensitive content design. For instance, they may be based on historical data that had not included women or at least not a representative sample. A study shows an absence of sex specific data for chronic medical conditions in mHealth randomised control trials. The scarcity of gender disaggregated data poses risks to women's health but also limits the effectiveness of mobile apps in monitoring chronic conditions.[84]

2.4.2. How design can influence health attitudes

The importance of design and marketing of products has been found to be very significant in influencing attitudes to health. Their interplay with gender norms can lead to increased risks for certain social groups.

An illustrative example is the case of skin cancer prevention, which requires use of protective clothing, sunscreen products and staying in the shade. Marketing advertising campaigns of sun protection products have highlighted the health risks associated with longer exposure to the sun. Yet, skin cancer has been on the rise, despite the campaigns and development of relevant wearables that measure UV exposure and alert the users to the health risks, via connection with their smartphones).[85]

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81 Rich-Edwards, J.W., Kaiser, U.B., Chen, G.L., Manson, J.E. and Goldstein, J.M., 'Sex and gender differences research design for basic, clinical, and population studies: Essentials for investigators', *Endocrine Reviews,* Vol. 39, No 4, 2018, pp. 424-439.

82 Ibid.

83 Esfahani, B.K. and Sareh, P., 'Insights into the role of gender in aesthetic design: a participatory study on the design of digital health wearables', *International Journal of Interactive Design and Manufacturing (JIDeM)*, Vol. 15, 2021, pp. 173-185.

84 Wang, J., Barth, J., Göttgens, I., Emchi, K., Pach, D. and Oertelt-Prigione, S., 'An opportunity for patient-centered care: Results from a secondary analysis of sex- and gender-based data in mobile health trials for chronic medical conditions', *Maturitas*, 138, 2020, pp.1-7.

85 Esfahani, B.K., 'Bridging gender and human-centered design: a design verification study', Procidia CIRP 91, 2020, pp. 824-831, available online at www.sciencedirect.com.

A recent study of attitudes of men and women to the use of sun protection has shown that the design of bottles and the presentation of products affect their use by different genders. Some men do not want to use creams that must be applied on the skin, as they associate this with the female gender and prefer sprays. Overall, men tend to use sun protection much less, which explains the higher incidence of skin cancer in male population.[86] Designers' gender perceptions are also reflected in their products. Conscious efforts must be made on their part to go beyond their own gender perceptions and respond to the variety of genders of their users.

2.4.3. Women and drug addiction

Although women who inject drugs (WWID) are about 3.5 million globally, they form just 20% of drug users, and consequently receive much less attention than men.[87] One could argue that disaggregation of data in the case of WWDI is not necessary and that treatment programmes are aimed at all users. Nevertheless, women are more vulnerable because of intersectional inequalities.

Addiction makes women more prone to intimate partner violence (IPV) and there is an association of IPV with infections with Human Immunodeficiency Virus (HIV), Human Papilloma virus (HPV) and hepatitis C virus (HCV), the most common comorbidities among women. Incidents of such infections are particularly high among sex workers. Violent behaviour against women does not just increase their exposure to infections and the impact on their mental health but also prevents them from effective adherence to treatment.[88] Mothers with drug addiction are reluctant to enrol in prevention treatment programmes out of fear of having their children removed from home by social services, which exacerbates the problem.

Disaggregation of data by gender would throw light on the intersectional vulnerabilities of WWID and would lead to an evaluation of availability and accessibility of treatment programmes for those women, as well as measures to enhance their participation. Current interventions are designed mainly for male drug users. There is a clear need for programmes designed for women to go beyond their health problems and meet their needs holistically and in collaboration with social services. For example, safe spaces must be provided to women and their families combined with treatment. Women must be part of the design of those services to increase their effectiveness.[89]

2.4.4. Women and the health and safety industry

The repercussions that a world designed for men has on the lives of women in certain work environments are significant. They range from the impact on their health to the temperature of the workplace.

With regard to manual occupations, work tools that are designed for men can lead to women's injuries and chronic conditions (e.g., musculoskeletal problems, accidents at work). Moreover, exposure to harmful elements (e.g., chemicals, dust) or, as the recent pandemic showed, to infections, as women were frontline workers.

This highlights the necessity for personal protection equipment (PPE) designed for female and transgender bodies. In addition to the discomfort that badly designed PPE causes, and the risk factors associated with ill-fitting equipment, there is also the affect it has on work performance. A clothing

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86 Ibid.

87 Iversen, J., Page, K., Madden, A. and Maher, L., 'HIV, HCV, and health-related harms among women who inject drugs: Implications for prevention and treatment', *J Acquir Immune Defic Syndr*, 69, Suppl 2(01), 2015, pp 176-81.

88 Ibid.

89 Ibid.

survey in 2010 by the Women's Engineering Society, found that 60 per cent of women wearing PPE designed for men, described it as very uncomfortable and restrictive in their movement.[90]

There is evidence of correlation of frequent night shifts with a 40 per cent increased risk of breast cancer, as they disrupt biological rhythms. The prolonged wearing of gloves has been proven to increase the wearer's risk of developing contact dermatitis, as women's skin is thinner and consequently more sensitive. Lifting heavy weights might also lead to infertility.[91]

Recognition of health problems related to menstrual disorders is necessary for the design of inclusive and gender sensitive employment policies. Funding research in these areas and collecting gender disaggregated data on ill health and the risks associated with work activities are long overdue.

Representatives of all genders must be consulted and participate in the design process. Moreover, they must be involved in monitoring and reviewing health and safety processes and policies. There are very few women among environmental and safety professionals. In the United States only 27.3 per cent of such professionals are women.[92] According to research results, figures in Europe are similar: 27 per cent although they represent 48 per cent of the workforce.[93]A better gender balance would contribute to the improvement of working conditions and participation in the design of PPE and work conditions for the female and transgender bodies, as well as for people with disabilities who need adjustments to their PPE.

2.5. Finance and Taxation

Many studies have dealt with the intersection between gender and finance from different perspectives, including representation of women in financial institutions, accessibility of financial mechanisms, and financial inclusion.

There is ample evidence of the under-representation of women in leadership positions in financial institutions – less than 2 per cent chief executive officers and less than 20 per cent of executive board members.[94] At the same time, 56 per cent of the 1.7 billion adults without account ownership globally are women, while in developing economics women are more likely to be unbanked than men by an order of 9 per cent.[95] Increased female participation in financial executive boards may result in higher financial stability due to the diversity of views offered and the higher qualifications that women need to have because of discriminatory hiring practices.[96] A positive step toward this direction is Directive (EU) 2022/2381, approved in November 2022 by the European Parliament to boost gender equality on corporate boards and increase transparency in recruitment procedures. At least 40% of non-executive director posts, or 33% of all director posts must be occupied by the under-represented sex by the end of June 2026. Nevertheless, these measures refer to publicly listed companies (more than 250 employees) and exclude small and medium enterprises (the vast majority of smaller Member States). Hence its impact on the overall promotion of gender balance on boards is bound to be limited.

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90 UNISON, *Gender, safety and health*, UNISON, London, 2013.

91 Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

92 Roll, C., 'Why we need more women in Environmental, Health and Safety (EHS) industry', 2022, https://axaxl.com/fast-fast-forward/articles/inclusive-protection-women-in-ehs.

93 TUC *Union Health and Safety Reps Survey, 2020/2021*, London, Trade Union Congress, 2021.

94 Sahay, R. and Cihak, R., 'Women in finance: A case for closing gaps', *IMF Staff Discussion Notes*, Vol. 18, No 5, International Monetary Fund, 2018.

95 Sahay, R. and Cihak, R., 'Women in finance: A case for closing gaps', *IMF Staff Discussion Notes*, Vol. 18, No 5, International Monetary Fund, 2018.

96 Ibid.

Budgets are not neutral tools but rather reinforce inequalities, including gender ones. They do so by not taking into due consideration the unequal gender relations in society and by ignoring the impact that budgets have on women because of their different roles, responsibilities and capabilities.[97] Critical accounting perspectives have put under scrutiny the principles underpinning government budgets. They argue that accounting and budgeting are gendered, in that they reflect a set of values that are in tandem with gender stereotypes, such as rationality and logic.[98]

Gender budgeting is seen as a way to apply gender mainstreaming to budgeting processes and policies. Several countries have made efforts to incorporate gender budgeting into their economic policy. These involve the collection of sex-disaggregated data and the challenge of appreciating the relevance of gender in the respective policy sectors.[99]

Welfare state policies have often been seen as perpetuating gender inequalities in care work and in the labour market, including income gaps. Recent studies across different countries have demonstrated that welfare state taxes and transfers have a limited effect in reducing income gaps. Achieving equality in terms of income would necessitate the provision of public services to reduce female care work and increase female hours and wages in the labour market, while increasing male participation in care work, as suggested by the dual breadwinner model.[100]

Box 1: Good practices

- Belgium has introduced law to mandate methodologies to integrate gender equality in all budgetary processes, collection of gender-based data and application of gender budgeting to government procurement.
- Austria has also mandated gender equality as one of the budgetary principles.
- Sweden has since 1984 mandated that all official statistics should be sex-disaggregated and since 2016 has applied gender budgeting, including mechanisms for management and control, an improved methodology, and improvement in the use of sex-disaggregated data. Ireland has since 2015 introduced more robust gender-budgeting methodologies integrated with decision-making.

Source: Quinn, S., 'Gender budgeting in Europe: What can we learn from best practice?' *Administration*, Vol.65, No 3, 2017, pp.101-121

Tax policies also contribute to gender discrimination. Policymakers often do not consider gender aspects when designing tax laws and instruments – but tax systems and fiscal policies do affect women

[97] Khalifa, R. and Scarparo, S., 'Gender responsive budgeting: A tool for gender equality', *Critical Perspectives on Accounting*, Vol. 79, 2021, 102183.

[98] Ibid.

[99] Quinn, S., 'Gender budgeting in Europe: What can we learn from best practice?', *Administration*, Vol. 65, No 3, 2017, pp. 101-121.

[100] Avram, S. and Popova, D., (2020) 'Do taxes and transfers reduce gender income inequality? Evidence from eight European countries' *Social Science Research*, Vol. 102, 102644, 2022.

differently than men.[101] Focusing on individual rather than on household indicators as proxies is recommended in order to capture the non-monetary dimensions of poverty.[102]

Presumptive taxation, for instance, puts women at a disadvantage compared to men in low and middle income countries, as it does not take into account that women traders typically earn less than male ones.[103] Indirect taxation also affects those on poor households more, while inefficient taxation instruments and lack of resources to collect taxes has impact on the availability of social services, which women typically need more than men.[104]

The European Commission and the European Parliament have started paying attention to the importance of gender aspects in taxation. As taxation policies operate at the national level, a key demand posed to the Member States is to introduce individual taxation and the elimination of benefits based on joint income to reduce tax-related disincentives related to female employment (benefit trap).[105] Another recommendation has been to avoid consumption taxes that discriminate on gender grounds and generate inequalities.

Scholars have expressed criticism vis-à-vis IMF approaches to taxation in developing countries and have revealed embedded gender biases in their push for tax reforms as a policy priority. A fundamental principle of structural reforms by the IMF often replaces direct taxation with indirect ones, such as the VAT. Gender differences in paid employment, women's unpaid work, consumption expenditure, as well as property rights and asset ownership, all constitute a background against which the implementation of taxes that are borne by all consumers, such as the VAT, have gender effects, as women are over-represented in lower income groups.[106] Tax decisions such as which goods should bear excise taxes, be exempted or zero-rated, reflect gender assumptions and generate gender effects.[107]

2.6. Consumer goods

An increasing volume of literature focuses on the interplay of a range of factors influencing product design. More recently, there has been a growing interest in researching the reasons why the vast majority of consumer products are designed for men, and in trying to address the gap that the lack of gender disaggregated has caused. Most products are designed for the male body, fewer for the female body and almost none for intersex or transgender bodies. Approaches that challenge the dominant binary view of gender are yet to be incorporated into the design process[108].

There have been reactions by some designers to the debate that attempted to fill the gap by designing products solely for women such as *Femme Den*, a brand whose designs are based on thorough research of the female body, women's aesthetic and varying needs at different stages of their life. Nonetheless,

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[101] Gunnarsson, A. and Spangenberg, U., 'Gender equality and taxation policies in the EU', *Intereconomics*, No 54, 2019, pp.141-146.

[102] Bradshaw, S., Chant, S. and Linneker, B., 'Gender and poverty: what we know, don't know and need to know for Agenda 2030', *Gender Place and Culture*, Vol. 24, No 12, 2017, pp. 1667-1688.

[103] Hicks, J., Smith, B., Downs, A. and Musillo, B. 'Conversations on Gender and Tax', *K4D Resource Pack*, Brighton: Institute of Development Studies, 2022.

[104] Razavi, S., 'The 2030 Agenda: Challenges of implementation to attain gender equality and women's rights', *Gender and Development*, Vol. 24, No 1, 2016, pp. 25-41.

[105] Gunnarsson, A. and Spangenberg, U., 'Gender equality and taxation policies in the EU', *Intereconomics*, No 54, 2019, pp. 141-146.

[106] Buenaventura, M. and Miranda, C., 'The gender dimensions of the IMF's key fiscal policy advice on resource mobilisation in developing countries', *The IMF and Gender Equality*, Bretton Woods Project, London, 2017.

[107] Ibid.

[108] Prochner, I., 'Incorporating queer understanding of sex and gender in design research and practice', in Lim, Y., Niedderer, K., Redström, J., Stolterman, E. and Valtonen, A., (eds) *Design's big debates* – DRS International Conference 2014, 16-19 June, Umeå, Sweden. https://designresearchsociety.org/drs-conference-papers/drs2014/researchpapers/122.

they still categorise women and adopt, according to some gender scholars, a limited view of women's experience.[109]

EU legislation on product safety and liability includes: the General Product Safety Directive (2001/95/EC), as well as several more specific regulations for a variety of products such as machines, planes, cars, toys, medical devices and many more.

The growing popularity of e-commerce is a fact. There are gender differences in purchasing goods or services online. Although the gender gap narrows when it comes to e-commerce of goods, it is less so with digital services which are becoming more complex and may maintain the gender gap in terms of effort expectancy. More research into differences in e-commerce with gender disaggregated data on purchase of goods or digital services is needed.[110]

E-commerce can enhance women's opportunities to be economically active and connect them with other women beyond the boundaries of their region, foster collaboration, and unleash creativity in product design that will respond to women's needs. However, female entrepreneurship is often conditioned by women's care duties, especially in small rural communities and in less developed economies. For e-commerce to really enhance women's entrepreneurship, equal access to finance and training in ICT must be available.[111] Data from EIGE for 2021 show that 57 per cent of females (aged 16-74) have used Internet banking and 59 per cent have engaged in e-commerce.[112] Further qualitative research is required to identify the nature of their activities and draw meaningful conclusions.

The European institutions have shown interest in this growing field of activities. The Electronic Commerce Directive (2000/31/EC) was a way to regulate the growing field of online services, remove obstacles within the Union and create a flexible and legally safe space for e-commerce activities and competition.[113] The Directive refers to services and not to providers. It also covers activities that are offered free of charge to consumers.

Moreover, the Digital Education Action Plan (2021-2027) is an EU policy initiative aiming to establish a shared vision of high-quality, inclusive and accessible digital education in Europe and to upgrade the education and training systems of the Member States in this direction. It contains several Actions focusing on improving digital literacy, data-related and AI skills, digital traineeships, and increasing women's participation in STEM.

Recent data show that women represent only 20% of Information and Communications Technology (ICT) graduates. They are also under-represented in entrepreneurship, specifically in technology-oriented fields: only 24% of self-employed professionals in science, engineering and ICT professions, including entrepreneurship and innovation, are women.[114] The European Commission's 2030 policy programme sets up a cooperation mechanism which includes a monitoring system to measure progress towards digital transformation by using the Digital Economy and Society Index (DESI). The Women in Digital Scoreboard (WiD) is a gender-disaggregated composite measure based on twelve indicators, including Internet use, Internet users' skills, specialist skills and employment.

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[109] Ibid..

[110] Pascual-Miguel, F.J., Agudo-Peregrina, A.F. and Chaparro-Peláez, J., 'Influences of gender and product type on online purchasing', *Journal of Business Research*, Vol. 68, 2015, pp. 1550-1556.

[111] European Parliament, *The underlying causes of the digital gender gap and possible solutions for enhanced digital inclusion of women and girls*, Brussels: European Parliament, 2018.

[112] https://eige.europa.eu/gender-statistics

[113] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32000L0031

[114] European Commission, Directorate-General for Research and Innovation, *She figures 2021 : gender in research and innovation : statistics and indicators*, Publications Office, 2021, https://data.europa.eu/doi/10.2777/06090

Interaction is a 'conversation', a cyclic process in which actors listen, think and speak. If we transpose this to design, the respective stages are inputting, processing and outputting.[115] Interaction design combines industrial design and user experience. The debate on gender and product design and the need to avoid enhancing gender inequalities has led to unisex products, when they do not target a particular gender, whereas those that do, appeal to perennial gender stereotypes, in terms of colour, shape etc. This is the outcome of people's upbringing in traditional societies, where heteronormativity and a dichotomous approach to gender prevail. Gender stereotypes are reinforced in early childhood and through the education systems.

Going beyond the traditional gender norms in the design of products will contribute to engaging users and changing consumers' behaviours.

2.6.1. Gender differences and product design

Data on ergonomics are essential for design of usable and safe products but are often lacking.[116] Biased design can be found in many products that are used in daily life. For instance, a smartphone is usually designed with the average male user in mind. Consequently, it is often too big for a female user to handle it with one hand or put in their pocket.

The dominance of the male anthropometric characteristics in product design have led to serious discrepancies when accidents occur. Using male dummies in the automobile industry has led to designing safety belts that are less suitable for women or smaller people. Body measurement techniques cannot adequately measure variations in body shape both between men and women and within each of these groups. Variations in torso shape, for instance, cannot be fully explained by traditional body measures.[117]

The outcome is an overrepresentation of women injured or killed in car crashes. Evidence from the US in the period 1998-2008 showed that female drivers who had their belt on had 47 per cent more chances to sustain serious injuries than male drivers.[118] The introduction of a female dummy in car crash testing in 2011 was a positive step.[119] In a similar vein, detailed sex disaggregated data of the different measurements of human body are key to the successful design of prosthetic limbs and protective equipment.

Studies of spaceflights have shown that women are affected differently and are more vulnerable to different risks than men both during and after space missions. Female body characteristics, for instance, respond differently to the conditions of space flights. Consequently, the default male model used in design and development result in risks for women when put into practice.[120] The design of spacesuits and life support systems in space research poses risks for women due to anthropometric differences between men and women. Risks of cardiovascular diseases, musculoskeletal impact, cancer resulting from space radiation, impact on the reproductive system, the neurosensory system and the immune

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[115] Esfahani, B.K. and Sareh, P. 'Insights into the role of gender in aesthetic design: a participatory study on the design of digital health wearables', *International Journal of Interactive Design and Manufacturing (JIDeM)*, Vol. 15, 2021, pp. 173-185.

[116] Peebles, L. and Norris, B., 'Filling "gaps" in strength data for design', *Applied Ergonomics*, Vol. 34, 2003, pp.73-88.

[117] Thelwell, M., Bullas, A., Kuhnapfel, A., Hart, J., Ahnert, P., Wheat, J., Loeffler, M., Scholz, M. and Choppin, S., 'Modelling of human torso shape variation inferred by geometric morphometrics', *PLoS ONE*, Vol. 17, No 3, 2022, e0265255.

[118] Tannenbaum, C., Ellis, R.P., Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp. 137-146.

[119] Ely, K., 'The world is designed for men: how bias is built in our daily lives', 8 Sep 2015 https://medium.com/hh-design/the-world-is-designed-for-men-d066640654491

[120] De Souza, S., Haghgoo, N., Mankame, K., Mummigatti, S. and Saadi, A., 'Safe space flight for women: Examining the data gap and improving design considerations', *Journal of Space Safety Engineering,* Vol. 9, 2022, pp. 154-159.

system are all under-researched, particularly in the case of women, who typically are absent from relevant impact studies. The same applies for behavioural and mental health effects. [121]

There is the widespread stereotype that women are less gifted in DIY work. As a result, tool manufacturers design tools for men, using respective body measurements. This excludes women but also other categories of people, such as people with disabilities, senior citizens and smaller people from the use of basic tools, such as drills. There is a growing demand for incorporating the needs of the broader audience into tool manufacturing. The **Makita drill** is an excellent example of gender-neutral design. It is smaller, lighter, and easy to use, yet a very powerful tool which can serve the needs of a much broader range of users.[122]

A sector which remains a predominantly male fiefdom is agriculture**.** Most machinery requires manual operation and a degree of physical strength that most women do not possess. Much more research and a large volume of data on force values by gender can contribute to developing tools suitable for female agricultural workers. In the meantime, other solutions must be sought to enable women's equal participation in agricultural activities. [123]

Gender bias is also encountered in the design of children's products, such as toys, costumes, and other items of popular culture. These have to do with the depiction of dominant characteristics associated with traditional men's and women's roles.[124]

Tobacco products also present certain types of gender bias, e.g., in the way they are marketed. Policies to discourage tobacco use appear to be gender-blind and based on information about men's consumption. Consequently, gender-sensitive information must be collected and women must be empowered to resist advertising and other promotion strategies of tobacco products.[125]

The tobacco and alcohol industries use women in their marketing activities in ways that reinforce gender stereotypes. Such ways include representing women in a sexualised way or appropriating images of female emancipation and self-fulfilment as means to promote their consumption message.[126]

Ehrnberger, Råsånen and Ilstedt argue that gendering products creates hierarchies associating masculine products with higher functions than feminine. Therefore, they reversed the language and produced a masculine mixer, *Mega Hurricane*, and *Dolphia*, a feminine drill to challenge the dominant binary approach to gender.[127] But is it sufficient to reverse the gendered language? Independently of the way a product is introduced to the market, meanings ascribed by users differ. Such an example is the Barbie doll that, although marketed as the epitome of stereotypical femininity, queer users could ascribe different meanings to it without necessarily using Barbie dolls in the way they were meant to be used. Studying queer identity can contribute to understanding the complexity of identity, the

[121] Ibid.

[122] Ely, K., 'The world is designed for men: how bias is built in our daily lives', 8 Sep 2015 https://medium.com/hh-design/the-world-is-designed-for-men-d066640654491

[123] Von Rymon-Lipinski, K., Serafin, P. and Kluβmann, A., 'Gender in agriculture: requirements for operating forces on (agricultural) machinery', KAN report, 2013, pp. 72-78.

[124] Murnen, S., Greenfield, C., Younger, A. and Boyd, H., Boys act and girls appear: A content analysis of gender stereotypes associated with characters in children's popular culture. *Sex Roles*, Vol. 74, No 1-2, 2016.

[125] Samet, J.M. and Yoon, S-Y., *Gender, Women, and the Tobacco Epidemic*, World Health Organisation, 2010.

[126] Hill, S.E. and Friel, S., 'As long as it comes off as a cigarette ad, not a civil rights message": Gender, inequality and the commercial determinants of health', *Int J Environ Res Public Health*, Vol. 17, No 21, 2020.

[127] Ehrnberger, K., Råsånen, M. and Ilstedt, S., 'Visualizing gender norms in design: Meet the Mega Hurricane Mixer and the drill Dolphia', *International Journal of Design*, Vol. 6, No 3, 2012, pp. 85-98.

creativity of users and that choice and use of products can help gender performance and, in this way, add to the enrichment and inclusivity of design.[128]

2.6.2. Unequal representation of genders among designers

Women are grossly underrepresented among designers. It is curious that few women designers have made it to the top echelons, and even more so that there is reluctance on the part of young girls to pursue such a career. As a result, design remains overwhelmingly male.[129] According to data from 27 design firms whose staff information was publicly available, only 24 per cent were female. More precisely there were just 34 women in physical product design; in the smaller firms not even one in a design or engineering role.[130]

One of the consequences of male dominance in the field is that it makes career progression harder for other genders. Other barriers are inability and unfamiliarity with some technical competencies are also deterring factors for women to study industrial design, especially when tools are designed for men. Another reason that explains the lower number of women is the growing association of design with computers and innovation and less with creativity. There is a better gender balance in interior design.[131]

The outcome is that women's experiences do not inform the design stage and end up in the production of products that do not meet the needs of certain population groups. Interestingly, women seem to thrive in service or social design, as they are new areas and, as a result, without male legacy.[132]

Little exposure of girls to design and technology from the first stages of education is another contributing factor to female designers' lower numbers. Irish researchers have found that some technical subjects are not offered to all-female schools, while, in mixed schools, female students are discouraged either by the lack of relevant subjects or the way they are taught, or the underlying masculinity of such topics.[133]

Concerted efforts must be undertaken to close the gender gap in design. Similarly, academic research into design is also dominated by men. Demystifying design as a field for 'creative genius', a typically male stereotype, female designer as mentors and role models would be indispensable in encouraging women to opt for this field.

2.6.3. Toward a gender-neutral design?

Moving toward a gender-neutral design in fashion, objects, fragrance and cosmetics industries is on the rise. Aesop and The Ordinary are very popular, quality skincare brands with a gender-neutral design and packaging. *Byredo* is a gender-neutral fragrance.

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[128] Prochner, I., 'Incorporating queer understanding of sex and gender in design research and practice', in Lim, Y., Niedderer, K., Redström, J., Stolterman, E. and Valtonen, A., (eds) *Design's big debates* – DRS International Conference 2014, 16-19 June, Umeå, Sweden. https://designresearchsociety.org/drs-conference-papers/drs2014/researchpapers/122.

[129] Clegg, S. and Mayfield, W., 'Gendered by design: How women's place in design is still defined by gender', *Design Issues*, Vol. 15, No 3, 1999, pp. 3-16.

[130] Ely, K., 'The world is designed for men: how bias is built in our daily lives', 8 Sep 2015 https://medium.com/hh-design/the-world-is-designed-for-men-d066640654491

[131] Clegg, S. and Mayfield, W., 'Gendered by design: How women's place in design is still defined by gender', *Design Issues*, Vol. 15, No 3, 1999, pp. 3-16.

[132] McMahon, M. and Kiernan, L., 'Sisters are doing it for themselves: Exploring gender in Irish product design education', International Conference on Engineering and Product Design Education, 7&8 September 2017, Oslo and Akersus University of Applied Sciences, Norway.

[133] Ibid.

Major companies such as Apple and Google try to produce gender neutral products. Nevertheless, critical gender studies scholars detect invisible meanings and values even in unisex products. The critical gender perspective must be part of the design process. Men tend to prefer durable, dark-coloured and robust products, as they reflect their stereotypical self-perception of masculinity of which strength is a major characteristic. Women tend to like softer, curved lines and more colour suitable to their stereotypically soft and gentle feminine nature.

Initiatives toward the same direction by Unilever that formed the Unstereotype Alliance with the collaboration of UN Women and major companies, such as Google and Facebook following suit with the aim to change the way they communicate with consumers and their work culture.[134]

2.6.4. Gender differences in behaviour related to consumer products

People's behaviour varies greatly across genders, cultures, ethnic or age groups, especially when it comes to decisions related to risks. Although individual behaviour is not always rational or predictable, some correlations with gender and age are there. Men pay more attention to packaging, women to price. Family and culture are also crucial in shaping attitudes to consumer products, as research into coffee consumption shows.[135] Moreover, regarding values, men seem to be driven more by power and stimulation, while women by benevolence and universalism.[136]

Research has shown that women overall make safer choices than men, but the importance of individual characteristics is crucial. Some individual characteristics influencing choices are opportunity cost which varies greatly; white men have the highest opportunity cost, due to their overrepresentation in the highest-paid occupations. High opportunity cost is negatively correlated with time-consuming choices. Another one is time at home where gender differences are pronounced.[137] Education and wealth are positively related to safety and healthy choices, such as exercise, as well as with the use of seat belts and monitoring blood pressure. Gender matters when it comes to healthy choices, made predominantly by women who tend to be more risk averse.[138]

[134] Thompson, G., 'Gender-less or gender-more? Addressing gender in product branding', 13 September 2017, http://www.itsnicethat.com/news/gender-in-design-130917.

[135] Aguirre, J., 'Culture, health, gender and coffee-drinking: a Costa Rican perspective', *BFJ,* Vol. 118, No 1, 2015, pp. 150-163.

[136] Bryla, P., 'The impact of consumer Schwarz values and regulatory focus on the willingness to pay a price premium for domestic food products: Gender differences', *Energies*, vol. 16, 6198, 2021.

[137] Hersch, J., 'Smoking, seat belts and other risky consumer decisions: Differences by gender and race', *Managerial and Decision Economics*, Vol. 17, 1996, pp. 471-481.

[138] Ibid.

3. REGULATION IN THE EU CONTEXT

It has become evident that, unless gender disaggregated data are collected systematically, women, transgender people, as well other vulnerable groups will be left out of technological and social developments and at a disadvantage, as they will lack access to the right services and skills to cope with changes.

All in all, its forms will prevail in all aspects of everyday life. This radical transformation of all sectors of human activity requires a robust regulatory framework. Technologies can liberate some and enslave others.

3.1. The AI Act and the relevant debate

The discussion about AI in Europe stress the need to foster innovation by creating an 'ecosystem of excellence' as well as an 'ecosystem of trust'.[139]

The Commission, working together with the Member States, presented a coordinated plan in December 2018 for the development of AI in Europe. The plan involves the creation of excellence centres where experimentation and testing will support the development of AI applications. It places emphasis on the training of the workforce to accommodate AI developments, as well as the inclusion of more women trained and employed in AI-related areas. It calls for the urgent development of products and services for areas such as public administration, hospitals, transport, finance and education.[140] In early 2018, the EP resolution 2017/3016 (RSP) highlighted the urge to include women and girls in ICT education and training from early years. It encouraged the Commission and the Member States to promote e-services and digital forms of work, collect gender-disaggregated data, identify the risks involved (such as cyber-crime or acts of violence against women) and raise public awareness. All these raise matters of design and practice and the need to avoid risks, such as personal harm, violation of fundamental rights, such as privacy, and non-discriminatory treatment of individuals. The gender aspects of such risks are worth the attention of all the parties involved in designing AI products and services.[141]

Such risks call for the necessity to create trust in citizens that AI will be beneficial rather than detrimental to them. For these reasons, the Commission produced a report on 'Trustworthy AI' which sets out requirements for the development and implementation of AI in accordance with the following principles: human agency and oversight, technical robustness and safety, privacy and data governance, transparency, diversity, non-discrimination and fairness, societal and environmental wellbeing, and accountability.[142]

The nature of AI tools, which are based on software, makes the applicability of EU product safety legislation difficult. When software is part of a product (e.g. a component or device) then it is often covered by general products safety rules; when it comes to services, though, there are sectoral differentiations: e.g., software that is intended for medical purposes is considered a medical device

[139] European Commission, *On Artificial Intelligence: A European approach to excellence and trust*, White Paper, COM(2020) 65 final, Brussels, 2020.

[140] Ibid.

[141] Ibid.

[142] European Commission, *Ethical guidelines for trustworthy AI*, High Level Expert Group on Artificial Intelligence, Brussels, 2019.

under the Medical Device Regulation (EU 2017/745); however, the EU safety legislation does not apply to AI-based services.[143]

3.2. AI, Robotics and gender effects

Many have expressed concerns about the use and misuse of AI and its potential to reproduce and even exacerbate inequalities through impact bias based on sex, race, ethnicity, sexual orientation, etc.[144] The gender aspects are relevant here – as Caroline Criado Perez illustrates with numerous examples, AI algorithms often use data where women as a general category and more specific women categories (such as women of colour, disabled, low-income etc.) are underrepresented. This fact creates outputs that have gender effects.[145]

When it comes to AI-based recommender systems, an important question is to what extent individuals would challenge AI outputs when their understanding is that this result might be biased in racial or ethnic terms. In particular, the role of culture and cultural values must be addressed in this context, as well as gender differences in attitudes to equality and welfare often conditioned by overrepresentation in a particular labour market sector and political views.[146]

As AI, robots and information tools more generally bring dramatic transformations in the world of work so there is a pressing need for assessment of current and anticipation of future outcomes and effects. This necessitates the availability of sound evidence to avoid possible negative consequences in terms of unemployment and conditions in the workplace.[147]

While indicators are showing that the digital gender gap may be closing in terms of Internet use skills, it does remain significant regarding more specialist digital skills. More importantly, these indicators do not capture how digital technologies and AI may affect women's working lives.[148]

Studies have shown that workplace digitalisation and the use of robots and AI tools affect middle-skilled workers who often engage in more routine jobs and codifiable tasks. As women are often over-represented in these types of jobs, they are likely to be more affected by AI-induced changes. Examples can be cashiers or customer services workers. Organisational studies related to digital technologies have emphasised the need to involve workers in the processes of adoption of digital technologies. AI algorithmic management of work and the workplace involves aspects of surveillance, performance, work routines, etc. As these have had so far (largely) unidentified effects, it is imperative that such management be negotiated, and women be involved in the design and implementation of relevant AI tools.[149]

AI tools and analytics have vast application possibilities and redefine the provision of services for citizens. Public employment services such as linking citizens to available jobs, are a case in a point, as the use of AI tools makes such services more efficient. Nonetheless, poor quality of data (e.g., lack of

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[143] European Commission, *Ethical guidelines for trustworthy AI*, High Level Expert Group on Artificial Intelligence, Brussels, 2019.

[144] Gupta, M., Parra, C.M. and Dennehy, D., 'Questioning racial and gender bias in AI-based recommendations: Do espoused national cultural values matter?', *Information Systems Frontiers*, published online 20 June 2021.

[145] Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

[146] Women are overrepresented in redistributive occupations and have more egalitarian views. In Howell, E. and Day, L., 'Complexities of the gender gap', *The Journal of Politics*, Vol. 62, No 3, 2000, pp. 858-874.

[147] Konle-Seidl, R. and Danesi, S., ***Digitalisation and changes in the world of work: Literature review***, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2022.

[148] Ibid.

[149] Konle-Seidl, R. and Danesi, S., ***Digitalisation and changes in the world of work: Literature review***, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, 2022.

gender-disaggregated data) and the inability of tools to capture intangible aspects (e.g., aspects of employment that are not quantitative, such as work-life balance issues) are likely to generate gendered effects.[150]

3.3. Approval of products

3.3.1. The importance of sex and gender in pharmaceutical regulation

Sex and gender are of major significance in epidemiology, diagnosis, injury, response to drugs and health outcomes. When it comes to pharmaceutical regulation, they are crucial at all stages from **clinical trials** to post-marketing surveillance. The leading role of the US Food and Drug Administration (FDA) in the pharmaceutical industry develops the guidelines that govern research, development and marketing.[151] It must report analyses of women's data on effectiveness and safety and the information must be offered to the public in the labelling and packaging when a drug is introduced to the market. A recent example of the importance of researching sex differences is the FDA notification to the manufacturer of the drug *Zolpidem*, to lower the dose for women, as they tend to retain it in their blood for longer.[152]

Historically, women, especially those of childbearing age, were not involved in randomised control trials for cardiovascular diseases. For three decades, oestrogen replacement therapy was adopted for women to prevent cardiovascular diseases. Thirty years later, in the 1990s, it was found that oestrogen treatment not only did not prevent cardiovascular disease but constituted an actual risk.[153]

One of the main hurdles in this type of research is that primary scientific research into sex differences is far too expensive and is left to universities. The pharmaceutical industry finances research only if there is evidence of potential for improved outcomes and income generation. Therefore, clinical trials aim at improving safety and effectiveness. Nevertheless, not all demographic groups, genders and ethnic groups are represented in the clinical trials. Moreover, not all data differentiate between sexes which often results in sex differences being revealed after the marketing of a pharmaceutical product. Some products are prescribed for use by only one sex (i.e., *Lotronex* for some women with irritable bowel syndrome). Sex differences have been reported in association with the use of diagnostic tests which may differ by sex, the risk-factor profiling of patients by physicians, and control parameters.[154]

The exorbitant costs of clinical trials on a massive scale to test for safety acts as a disincentive for the pharmaceutical industry, especially when it comes to controlling for gender differences in efficacy of a particular drug. Some attempts to have more diverse samples in terms of gender and ethnicity have been made recently. Also, adaptive design is a way toward an earlier introduction to the market of an effective product and preventing, thus, the withdrawal from the market because of negative effects on women much later.[155]

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[150] Ibid.

[151] McGregor, A.J., Barr, H., Greenberg, M., Safdar, B., Wildgoose, P., Wright, D.W. and Hollander, J.E., 'Gender-specific regulatory challenges to product approval: A panel discussion', *Academic Emergency Medicine*, Vol. 21, No 12, 2014, pp. 1334-1338.

[152] Ibid.

[153] Dougherty, A.H., 'Gender balance in cardiovascular research: importance to women's health', *Tex Heart Inst J*, Vol. 38, No 2, 2011, pp.148-50.

[154] McGregor, A.J., Barr, H., Greenberg, M., Safdar, B., Wildgoose, P., Wright, D.W. and Hollander, J.E., 'Gender-specific regulatory challenges to product approval: A panel discussion', *Academic Emergency Medicine*, Vol. 21, No 12, 2014, pp. 1334-1338.

[155] Ibid.

Post-marketing monitoring is essential to ensure patients' safety and to further refine products. Important information on side-effects or gender-specific dosage must be available to the public and disseminated via family doctor practices and hospitals using email or text messages, the media, and scientific journals. According to 2005 data from the US, 8 out of 10 prescription drugs that had been withdrawn were found to cause statistically greater health risks to women.[156]

From a feminist point of view, excluding women of a child-bearing age from clinical trials just because of the potential risk to the foetus, may be seen as a paternalistic attitude. The best example of this was the prescription of Thalidomide to pregnant women in the late 1950s and early 1960s suffering from nausea, without prior testing on women. The result was a high number of babies born with severe disabilities, missing one or both arms.

3.4. The COVID-19 pandemic through a gender lens: its intersectional dimensions

COVID-19 was often presented as an 'equaliser' in the sense that it posed a threat to the lives of all citizens, independently of socio-economic or gender status. Yet, looking at it from a gender perspective this does not hold.

Feminist economic analysis has been used to understand the interrelated gender dynamics of work, care and well-being so that policies can be designed to produce more equitable outcome. It is estimated that on a global scale over 70 per cent in healthcare and social services are women.[157]Female **healthcare professionals** were under enormous pressure to manage the dual role of work and care at home during the lockdowns.

The pandemic has had a **disproportionate impact** on women because of the disruption of care services which resulted in increasing demands on women for care labour.[158] The shutting down of schools added to women's workload substantially, as well as to the increase of domestic violence.

Women workers have been affected disproportionately by disruptions in the labour market due to job losses in feminised labour market sectors which had been hit by the lockdown and overrepresentation in frontline jobs, deemed as essential, and hence rendering them particularly exposed to the virus, a risk exacerbated by the shortage of personal protective equipment (PPE).[159] Moreover, they are concentrated in the informal economy.

The gender-blind design of lockdown policies has led to enhancement of gender inequalities, as the care responsibilities of women and their overrepresentation in the informal sector impacted on their health and wellbeing disproportionately. Had gender disaggregated data been available, more consideration may have been given to the estimation of the costs associated with the pandemic in different welfare sectors. In addition, physiological differences between sexes would have been taken

[156] Ely, K., 'The world is designed for men: how bias is built in our daily lives', 8 Sep 2015 https://medium.com/hh-design/the-world-is-designed-for-men-d066640654491

[157] ILO, *ILO Social protection monitor: Social protection responses to the COVID-19 crisis around the world,* 2020, ILO Geneva.

[158] Kabeer, N., Razavi, S. and van der Meulen Rodgers,Y., 'Feminist perspectives on the COVID-19 pandemic', *Feminist Economics*, Vol. 27, Nos 1-2, 2021, pp.1-29.

[159] Ibid.

into account in the development of treatments and vaccines.[160] Sex disaggregated data are scarce but data that capture gender-related differences are even scarcer.[161]

Despite the availability of a high volume of data on COVID-19, most of them are not disaggregated by gender. There are three sources of data on COVID-19 and mortality (from UN Women's Women Count Data Hub, Global Health 50/50 and the Harvard GenderSci Lab). Some research gaps that have been identified are as follows: lack of data on intimate partner violence, the intersectional dimensions of the pandemic, and the absence of enough research on the costs and benefits of alternative policies.

There is evidence that women presented more signs of depression, anxiety, post-traumatic stress during the pandemic. Despite numerous studies, no disaggregated data have been presented because of the urgency to publish.[162] It is a general characteristic of data collected during epidemics that they are not disaggregated. COVID-19 was no exception.[163] A survey has shown that less than 5 per cent of about 2500 studies had taken into consideration sex disaggregated data in their analysis.[164] Further research into the effects of the pandemic can lead to valuable conclusions and gender-sensitive design and provision of services.

The way the COVID vaccines were developed was hasty and there is not enough information about the extent to which gender differences had been factored in. In vaccine studies, cisgender females tend to develop higher antibody response, higher efficacy, and more side-effects. Therefore, disaggregation by biological sex is essential.[165] This reflects the extraordinary pressure on the health system under which testing and treatment decisions were made based on prevailing gender assumptions.[166]

Moreover, gender disaggregated data help us understand the female experience of COVID-19 and gender differences that are related to topics, such as exposure to the virus, opportunities for avoiding exposure, incentives of compliance with interventions, patterns of accepting testing and vaccination, access to health services, among others. Availability of quality disaggregated data would enable researchers to go into an in-depth analysis of all the aspects of the pandemic and the way it impacted on women.[167]

A good practice is the **COVID-19 sex disaggregated data tracker,** an innovative tool based on data collected regularly from government and national agencies official reports and media from over two

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[160] Hawkes, S., Pantazis, A., Purdie, A., Gautam, A., Kiwuwa-Muyingo, S., Buse, K., Tanaka, S., Borkotoky, K., Sharma, S. and Verma, R., 'Sex-disaggregated data matters: tracking the impact of COVID-19 on the health of women and men', *Economia Politica*, Vol. 39, No 1, 2022, pp. 55-73.

[161] Heidari S., Ahumada, C. and Kurbanova, Z., 'Towards the real-time inclusion of sex- and age-disaggregated data in pandemic responses', *BMJ Global Health*, Vol. 5, No 10, 2020; Hersch, J., 'Smoking, seat belts and other risky consumer decisions: Differences by gender and race', *Managerial and Decision Economics*, Vol. 17, 1996, pp. 471-481.

[162] Maleki Dana, P., Sadoughi, F., Hallajzadeh J., Asemi, Z., Mansournia, M.A., Yousefi, B. and Momen-Heravi, M., 'An insight into the sex differences in COVID-19 patients: What are the possible causes?' *Prehospital and Disaster Medicine*, Vol. 35, No 4, 2020, pp. 438-441.

[163] Heidari S., Ahumada, C. and Kurbanova, Z., 'Towards the real-time inclusion of sex- and age-disaggregated data in pandemic responses', *BMJ Global Health*, Vol. 5, No 10, 2020; Hersch, J., 'Smoking, seat belts and other risky consumer decisions: Differences by gender and race', *Managerial and Decision Economics*, Vol. 17, 1996, pp. 471-481.

[164] Vijayasingham, L., Bischof, E. and Wolfe, J., 'Sex-disaggregated data in COVID-19 vaccine trials', *The Lancet*, Vol. 397, No 10278, 2021, pp.966-967.

[165] Vijayasingham, L., Bischof, E. and Wolfe, J., 'Sex-disaggregated data in COVID-19 vaccine trials', *The Lancet*, Vol. 397, No 10278, 2021, pp.966-967.

[166] Heidari S., Ahumada, C. and Kurbanova, Z., 'Towards the real-time inclusion of sex- and age-disaggregated data in pandemic responses', *BMJ Global Health*, Vol.5, No.10, 2020; Hersch, J., 'Smoking, seat belts and other risky consumer decisions: Differences by gender and race', *Managerial and Decision Economics*, Vol. 17, 1996, pp. 471-481.

[167] Hawkes, S., Pantazis, A., Purdie, A., Gautam, A., Kiwuwa-Muyingo, S., Buse, K., Tanaka, S., Borkotoky, K., Sharma, S. and Verma, R., 'Sex-disaggregated data matters: tracking the impact of COVID-19 on the health of women and men', *Economia Politica*, Vol. 39, No 1, 2022, pp.55-73.

hundred countries. Although data beyond the binary approach to gender is even scarcer, there is a non-binary category for vaccine uptake in Austria and some data on transgendered people in some states in India.[168]

The COVID-19 crisis has brought to the fore, there is a clear need for **a gender sensitive response to pandemics** which is based on sound evidence and is informed by human rights principles.[169] The pandemic also highlighted the need for state regulation of health-related products and services (i.e., development of vaccines and vaccination programmes).

[168] Ibid.

[169] Heidari S., Ahumada, C. and Kurbanova, Z., 'Towards the real-time inclusion of sex- and age-disaggregated data in pandemic responses', *BMJ Global Health*, Vol.5, No.10, 2020; Hersch, J., 'Smoking, seat belts and other risky consumer decisions: Differences by gender and race', *Managerial and Decision Economics*, Vol. 17, 1996, pp. 471-481.

4. POLICY RECOMMENDATIONS

Research that does not **include disaggregation of data by sex and gender** has been proven to put certain population categories at risk. Policies are often gender-blind in that they do not take into consideration the social circumstances in which men and women operate and how these might differ. As a result, policy might have differential impacts on men and women. This relates to institutional factors, namely the fact that policy makers and civil society representatives tend to be men, while women are under-represented in decision-making processes. [170]

It is imperative to disaggregate data by sex and gender in all research projects to capture the experiences of different genders and inform product and policy design. Unless disaggregated data are combined with gender-based analysis, the unique health experiences of different genders and socio-economic or cultural status will not be captured.[171] The analysis must also consider the context in which policy making takes place.

Gender sensitive indicators must be used to complement gender equality targets and ensure accountability. They must be contextualised and incorporated into the data collection methods.[172] Use of gender disaggregated indicators will allow tracking progress on the gender equality front.

UN Women reports stress the need to **bring together qualitative and quantitative data** to measure the implementation of SDGs and identify appropriate policies and enabling conditions for SDGs achievement for women and girls.[173] The 2016 the Flagship Programme Initiative (FPI} 'Making Every Woman and Girl count' is a public-private collaboration aiming to provide technical and financial support for the improvement of the production and use of gender statistics at a national level.[174] In a different context, a collaboration between the National Institute of Statistics and Geography in Mexico and UN Women has set to **collect gender-sensitive environment and climate change data**, while also providing training to other national statistical agencies, particularly in Central America.[175]

National **statistics** organisations must be more transparent, inclusive, gender-sensitive and capable of mainstreaming gender accountability by producing gender disaggregated data.[176]

4.1. Disaggregation of data in the field of Artificial Intelligence

Algorithmic bias can be managed through careful monitoring and adjustments to ensure that certain social groups do not suffer discrimination.[177]The gender perspective must be included in explicit and implicit references in all debates and AI strategies. Datasets that are representative of all relevant dimensions of gender and its intersections with ethnicity, disability, income etc. are necessary for discrimination to be avoided. Procedures for testing and inspection of the algorithms should be in

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[170] Clancy, J., Ummar, F., Shakya, I. and Kelkar, G., 'Appropriate gender-analysis tools for unpacking the gender-energy-poverty nexus', *Gender & Development*, Vol. 25, No 2, 2007, pp. 241-257.

[171] Nowatzki, N. and Grant, K.R., 'Sex is not enough: The need for gender-based analysis in health research', *Health Care for Women International*, Vol. 32, No 4, 2011, pp. 263-277.

[172] Odera, A. J. and Mulusa, J., 'SDGs: Gender equality and women's empowerment: What prospects for delivery?' in M. Kaltenborn et al., (eds) *Sustainable Development Goals and Human Rights*, Interdisciplinary Studies in Human Rights, 2020.

[173] http://www.unwomen.org/en/digital-library/sdg-report .

[174] Bradshaw, S., Chant, S. and Linneker, B., 'Gender and poverty: what we know, don't know and need to know for Agenda 2030', *Gender Place and Culture*, Vol. 24, No 12, 2017, pp. 1667-1688.

[175] http://www.unwomen.org/en/digital-library/sdg-report .

[176] Odera, A. J. and Mulusa, J., 'SDGs: Gender equality and women's empowerment: What prospects for delivery?' in M. Kaltenborn et al., (eds) *Sustainable Development Goals and Human Rights*, Interdisciplinary Studies in Human Rights, 2020.

[177] Gupta, M., Parra, C.M. and Dennehy, D. 'Likelihood of questioning AI-based recommendations due to perceived racial/gender bias', *JEEE Transactions on Technology and Society,* Vol. 3, No 1, 2022, pp. 41-45.

place and, if the data used to train the algorithms are not adequate or representative, then the system should be retrained. [178]

The existing **EU product safety and liability legislation**, which includes both general and more specific rules, **must be applied to AI applications** to address the gender-specific risks emerging from poor or inadequate data at the design stage.[179]

Governments must introduce **regulations to apply the gender perspective** in their AI initiatives.[180] They should carry out assessments to ensure that AI applications conform with the principles of safety, fundamental rights such as privacy and non-discrimination, and trustworthiness set out at the EU level.[181] Based on the acknowledgement of bias, policymakers on the Member-State and the EU levels can work towards introducing a framework informed by fairness, the feminist perspective and the EU values. Explicit references to gender in all AI discussions and an openly feminist approach to gender equality are required to raise awareness about gender and other forms of bias Such an approach can inform the design of AI-based systems, including natural language processing ones.

The designers of the hardware of social robots must ensure that the **design does not reinforce gender stereotypes**. Chatbots designed to assist people, such as carebots, can possibly be more effective if they comply with the stereotypically female care jobs, as users are familiar with those. However, this tendency must be resisted, and regulations be put in place. Gendering technologies reinforces social stereotypes and the binary approach to sex and gender. A good practice to counteract gender bias is the genderless voice developed in Denmark.[182]

More research into the **ethical and social implications** of disruptive technologies is an essential step toward protection and safety of consumers. Given the connectivity, opacity, and autonomy of AI technologies, it is imperative to update and adjust the Product Liability Directive to the needs of the digital world, so that consumers are protected and can claim compensation if they suffer direct or indirect damage or harm.[183]

The European Commission has acknowledged the need to involve social partners in the development of the AI ecosystem so that a human-centred approach is followed.[184]

4.2. Gender awareness in designing goods and services

Gender awareness must inform design. Designers should focus on the users' perception of gender identities and respond with designs that will appeal to their target audience and engage it. They must make conscious efforts to ignore their past experiences and focus on the needs of the users, also taking

[178] European Commission, *On Artificial Intelligence: A European approach to excellence and trust*, White Paper, COM(2020) 65 final, Brussels, 2020.

[179] Ibid.

[180] Guevara-Gomez, A., Criado, I.G. and de Zarate-Alcarazo, L.O., 'Feminist perspectives to artificial intelligence: Comparing the policy frames of the European Union and Spain', *Information Policy*, Vol. 26, 2021, pp. 173-192.

[181] European Commission, *On Artificial Intelligence: A European approach to excellence and trust*, White Paper, COM(2020) 65 final, Brussels, 2020.

[182] Tannenbaum, C., Ellis, R.P., Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp, 137-146.

[183] European Parliament, *Civil liability regime for Artificial Intelligence*, 2021/C 404/05, Brussels , 2021.

[184] European Commission, *On Artificial Intelligence: A European approach to excellence and trust*, White Paper, COM(2020) 65 final, Brussels, 2020.

into consideration intersectional inequalities. Users must be consulted for design to be participatory. It is in this way that the gap between gender and human-centred design can be bridged.[185]

Integration of a sex and gender perspective in science is of fundamental importance to avoid gender-blind policies. Collaboration of scientists and social scientists is essential to deal with issues related to gender in specific social contexts and intersectional discrimination . While there is extensive research arguing for the availability of gender-disaggregated data, it is worth keeping in mind that the **category of "women" is not homogeneous** but contains women of different identities.[186]

Researchers have developed multilevel tools for assessing the design of a product or service before its adoption which allow insights into parallel processes of change and can support professionals at the designing phase to assess the impact of a particular measure on society.[187] Such prior research must become mandatory to ensure consideration and prevention of possible gendered effects.

There is a growing interest in developing **gender neutral products**. Some good examples are Karim Rashid's 'Bobble', a water bottle that filters tap water, the Apple watch or the Alessi kettle designed by Michael Groves in 1985.[188]

Gender mainstreaming is used at the policy level as a general approach to address gender inequalities of plans, programmes, and practice. It consists in identifying and addressing gaps in gender equality that will impact sector policies as well as the design, planning, and provision of its infrastructure and service.[189] European institutions have produced practical tools which help policymakers assess the gender impact of a measure at the design stage. Moreover, some easy-to-use handbooks must be distributed to all service providers in all the Member States.[190]

4.3. Urban mobility and public space

Studies of **gender gaps in urban mobility** have informed policies for more inclusive design of transport systems and services.[191]

Transport gender audits have been developed to provide templates for measuring the extent to which policies, plans and practices meet women's needs. They have been used to identify priorities for campaigning, as well as for assessing the progress of transport operators and local authorities vis-à-vis transportation targets from a gender perspective.[192]

Different experiences of women in transport in terms of vulnerability to crime, for instance, call for **multi-faceted policy approaches that include both technological solutions and protection**

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185 Esfahani, B.K., 'Bridging gender and human-centered design: a design verification study', Procidia CIRP 91, 2020, pp. 824-831, available online at www.sciencedirect.com.

186 Crenshaw, K. W., *On Intersectionality: Essential Writings*, The New Press, New York, NY, 2017.

187 Joore, P. and Brezet, H., 'A multilevel design model: the mutual relationship between product-service system development and societal change processes', *Journal of Cleaner Production*, Vol. 97, 2015, pp. 92-105.

188 Esfahani, B.K., 'Bridging gender and human-centered design: a design verification study', Procidia CIRP 91, 2020, pp. 824-831, available online at www.sciencedirect.com.

189 Babinard, J., Hine, J., Ellis, S., and Ishihara, S., 'Mainstreaming gender in road transport: Operational guidance for World Bank staff', *Transport paper series*, No. 28, World Bank, Washington, DC.

190 Council of Europe, *Handbook for Gender Equality Rapporteurs-Gender equality and gender mainstreaming in practice*, 2022, Council of Europe., Strasbourg.

191 Gauvin, L., Tizzoni, M., Piaggesi, S., Young, A., Adler, N., Verhulst, S., Ferres, L. and Cattuto, C., 'Gender gaps in urban mobility', *Humanities and Social Sciences Communications*, Vol. 7, No 11, 2020.

192 Hamilton, K. and Jenkins, L., 'A gender audit for public transport: A new policy tool in the tackling of social exclusion', *Urban Studies*, Vol. 37, No 10, 2000, pp. 1793-1800.

through human elements. Failure of travel providers to understand these gender differences result also in economic loss.[193]

For policies and programmes in transport to be effective, mechanisms need to be in place for the **involvement of women at all stages,** including the design one. Online public policy databases are an effective way of disseminating information and increase participation.[194] It is necessary to provide gender-disaggregated data by **including female participants in sample groups** to increase female safety, protection and well-being from space missions but also transport systems more generally.[195]

Evidence suggests that there should be a **gendered perspective in the planning of public spaces,** which would take into consideration the different vulnerabilities and address women's safety concerns.[196]

Despite the improved understanding of the importance of women's perceptions of safety in public spaces, there is a lack of effective practical evaluation tools. One attempt in this direction has used photo simulations and has found that women are generally more responsive to design interventions in public spaces for the purpose of increasing perceptions of safety.[197] The need for further research is suggested, however, to examine whether different categories of women (e.g., different ethnic groups, age, professions, disabilities) would respond differently.[198]

Accident prevention strategies are important to design, develop, and implement (e.g., to prevent elderly individuals from accidentally falling) but they need to take into consideration gender differences in the circumstances that lead to such accidents.[199]

Studies have identified the need for more thorough research using **qualitative and quantitative** methods to understand the relationships between gender, mobility, and transport. This will produce gender-disaggregated data to inform better designed policies and practices providing safe spaces for the transportation needs of women to be met.[200]

4.4. Gender data gap in finance

There is a **need for better data to measure gender gaps in finance** and to understand the reasons behind them, as well as the extent to which such gaps are related to the design of financial institutions. Availability of gender disaggregated data has increased since 2017, which shows awareness of gender gaps and the need to increase female financial inclusion, but data are still not sufficient.[201]

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193 Yavuz, N. and Welch, E.W., 'Addressing fear of crime in public space: Gender differences in reaction to safety measures in train transit', *Urban Studies*, Vol. 47, No 12, 2010, pp. 2491-2515.

194 Hamilton, K. and Jenkins, L., 'A gender audit for public transport: A new policy tool in the tackling of social exclusion', *Urban Studies*, Vol. 37, No 10, 2000, pp. 1793-1800.

195 De Souza, S., Haghgoo, N., Mankame, K., Mummigatti, S. and Saadi, A., 'Safe space flight for women: Examining the data gap and improving design considerations', *Journal of Space Safety Engineering,* Vol. 9, 2022, pp. 154-159.

196 Navarette-Hernandez, P., Vetro, A. and Concha, P., 'Building safer public spaces: Exploring gender difference in the perception of safety in public space through urban design interventions', *Landscape and Urban Planning*, No 214, pp. 1-13.

197 Ibid.

198 Navarette-Hernandez, P., Vetro, A. and Concha, P., 'Building safer public spaces: Exploring gender difference in the perception of safety in public space through urban design interventions', *Landscape and Urban Planning*, No 214, pp. 1-13.

199 Stevens, J.A. and Sogolow, E.D., 'Gender differences for non-fatal unintentional fall related injuries among older adults', *Injury Prevention*, Vol. 11, 2005, pp. 115-119.

200 Muhoza, C., Wikman, A. and Diza-Chavez, R., *Mainstreaming gender in urban public transport: Lessons from Nairobi, Kampala and Dar es Salaam*, Stockholm, Stockholm Environment Institute, 2021.

201 Sahay, R. and Cihak, R., 'Women in finance: A case for closing gaps', *IMF Staff Discussion Notes*, Vol. 18, No 5, International Monetary Fund, 2018.

Gender responsive budgeting is seen as a potential way to challenge the dominant values and logic underpinning the design of accounting and budgeting processes. Starting from an appraisal of policies form a gender perspective, disaggregating the data to establish the effects of taxation and distribution policies and public expenditure on different population categories, inclusive policies must be designed to ensure a fair distribution of state expenditure:[202]

- Gender-disaggregated analysis must be included in policy analysis.
- Gender-aware medium-term economics policy framework: incorporating gender into medium-term economic frameworks.
- Gender-aware budget statement: coordination between the public-sector parts, with high-accountability processes when utilizing any of the tools above.

On the **taxation** front, civil society organisations have often called more gender-disaggregated tax data, and increased awareness of the care economy.[203] As most tax data are collected at the household level, it is hard to assess the gender aspects of property taxes, inheritance taxes, value-added taxes, excise taxes, capital incomes, business income, consumption expenditure, as well as tax fraud issues.[204]

Gender-aware instruments and methods in tax policies can reduce gender discrimination and contribute to women's economic empowerment. Many civil society organisations work towards achieving greater gender equality in taxation. The Global Alliance for Tax Justice, which includes Oxfam and ActionAid, for instance, has set a Gender and Tax Working Group, which has produced a feminist tax toolkit.[205]

Women's participation in tax policy design through their involvement in ministries of finance, tax revenue authorities and similar organisations and bodies is vital. Women's rights groups and advocates should also be involved in debates on taxation.[206] Efforts to reform the structure of taxes, such as the Value Added Tax, must involve those affected, notably women from lower income groups. Designing taxes with gender equality in mind should be a priority.[207] Revenue authorities and finance ministries should work together and be supported in the design of policies based on empirical research (e.g. public opinion surveys) so as to address the challenges faced by women taxpayers.[208] Information provision on tax obligations, as well as easier methods of paying tax using online payment would create a better and safer environment for female taxpayers.[209]

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[202] Khalifa, R. and Scarparo, S., 'Gender responsive budgeting: A tool for gender equality', *Critical Perspectives on Accounting*, Vol. 79, 2021, 102183, p.5.

[203] Hicks, J., Smith, B., Downs, A. and Musillo, B., 'Conversations on Gender and Tax', *K4D Resource Pack*, Brighton: Institute of Development Studies, 2022.

[204] Gunnarsson, A. and Spangenberg, U., 'Gender equality and taxation policies in the EU', *Intereconomics*, No 54, 2019, pp.141-146.

[205] Hicks, J., Smith, B., Downs, A. and Musillo, B. 'Conversations on Gender and Tax', *K4D Resource Pack*, Brighton: Institute of Development Studies, 2022.

[206] Ibid.

[207] Buenaventura, M. and Miranda, C., 'The gender dimensions of the IMF's key fiscal policy advice on resource mobilisation in developing countries', *The IMF and Gender Equality*, Bretton Woods Project, London, 2017.

[208] Hicks, J., Smith, B., Downs, A. and Musillo, B. 'Conversations on Gender and Tax', *K4D Resource Pack*, Brighton: Institute of Development Studies, 2022.

[209] Ibid.

4.5. Gender data and consumption of goods and services

A gender perspective must be adopted across the board, from the design of pharmaceutical products and their regulation to the provision of healthcare services to the effects of employment policies on the work-life balance of citizens.

Design must be **human-centred** and **participatory.**

When catering for the needs of the less able, the design of products becomes easier to use for everyone. For instance, kitchen utensils that are designed to help people suffering from arthritis in their everyday needs. Consequently, they are easier for everyone to use.[210]

When it comes to the **consumption of products that are harmful to health**, gender indicators need to be used and inform policies to reduce consumption to be effective in improving women's health. A **holistic approach** is fundamental to support women in reducing or eliminating tobacco use, e.g., by providing adequate incentives and economic means to do so.[211] Gender responsive budgeting can be part of such a holistic approach.[212] More research is needed to examine the links between corporate activities in the tobacco and alcohol industries and gender inequalities in health, in order to inform policies targeted at reducing the impact of corporate practices on gender inequalities.[213] Sex-disaggregated data will be needed to inform provision of services when it comes to support the reduction of tobacco use. [214]

Women and transgender people must be empowered to enter the design sector not just as users but also as designers. Efforts to familiarise students with design must start in early years, through exposure at school and inclusion of design in the curriculum and through role models who can act as mentors.

[210] Ely, K. 'The world is designed for men: how bias is built in our daily lives', 8 Sep 2015 https://medium.com/hh-design/the-world-is-designed-for-men-d066640654491

[211] Samet, J.M. and Yoon, S-Y., *Gender, Women, and the Tobacco Epidemic*, World Health Organisation, 2010.

[212] Ibid.

[213] Hill, S.E., and Friel, S., '"As long as it comes off as a cigarette ad, not a civil rights message": Gender, inequality and the commercial determinants of health', *Int J Environ Res Public Health*, Vol. 17, No 21, 2020.

[214] Samet, J.M. and Yoon, S-Y., *Gender, Women, and the Tobacco Epidemic*, World Health Organisation, 2010.

5. CONCLUDING REMARKS

The above overview has highlighted the problem of gender-blind design in systems, products and policies in different areas of human activity. It has raised questions related to the fairness and equitability of outputs of algorithmic decision-making under non-transparent conditions in the context of AI-based systems and services.

It has examined the ways in which the organisation of transportation systems and the policies informing the planning of urban spaces generate services and public areas that are not functional, do not meet the needs of categories of users and pose threats to safety. It has investigated medical practices, clinical trials and products to argue that women have been historically excluded from or under-represented in the relevant design and administration processes. As a result, this exclusion puts their health at risk and leads to prescription of unsafe drugs.

It has considered financial systems and services and government budgetary and taxation policies to identify hidden gender discrimination, as they do not take into consideration the needs of different genders and categories of service recipients. It has also focused on several consumer products in different sectors to show that these are also gender-blind, as they fail to adequately consider women's body, mental and psychological differences, as well as different needs.

The potential of AI systems to improve people's lives by transforming all aspects of human activity is widely acknowledged.[215]Less is known about the future interactions of AI and Robotics and human activities, especially when sophisticated robots make autonomous decisions. Special emphasis should be put on algorithmic bias.

The common denominator in the absence of some genders from the design of products and services is the lack of adequate gender-disaggregated data. When disaggregated data are unavailable, differences among different social groups are masked.[216]

Gender-disaggregated data and gender-based analysis are indispensable for research into product and services design, but also for testing the validity, reproducibility and generalisability of scientific research findings.[217] They can reveal how products and services are adopted, appropriated, or resisted. For example, differences in physiology and hormonal profile of women, necessitates women's inclusion in clinical trials. Moreover, for similar reasons, the inclusion of transgender people should also be considered, due to the hormone treatments they receive during transition. Ensuring representation of all genders in clinical trials constitutes a priority at state level to safeguard the health of more than half of the population.

More generally, the design of safe and usable consumer products requires consideration of the physical capabilities of different consumer groups, including all genders and taking account of factors such as race, ethnicity, sexuality, disabilities, etc.[218] It should also incorporate heterogeneous experiences of real people in different stages of their lives, family situations and socio-economic circumstances.[219]

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[215] European Commission, *On Artificial Intelligence: A European approach to excellence and trust*, White Paper, COM(2020) 65 final, Brussels, 2020.

[216] Odera, A. J. and Mulusa, J., 'SDGs: Gender equality and women's empowerment: What prospects for delivery?' in M. Kaltenborn et al., (eds) *Sustainable Development Goals and Human Rights*, Interdisciplinary Studies in Human Rights, 2020.

[217] Tannenbaum, C., Ellis, R.P,. Eyssel, F., Zou, J. and Schiebinger, L., 'Sex and gender analysis improves science and engineering', *Nature*, Vol. 575, 2019, pp, 137-146.

[218] Peebles, L. and Norris, B., 'Filling "gaps" in strength data for design', *Applied Ergonomics*, Vol. 34, 2003, pp.73-88.

[219] Buchmüller, S., Joost, G., Bessing, N. and Stein, S., 'Bridging the gender and generation gap by ICT applying a participatory design process', *Pers. Ubiquit. Comput*., Vol. 15, 2011, pp. 743-758.

Involvement of representatives of all genders and socio-economic categories is instrumental to make their needs known to policy and product designers.

Current methods for data collection, often focus, for example, on women within households, without attention to intra-household resource allocation. Moreover, some households are rendered invisible, for instance same-sex households, because of heteronormative definitions 'household' and confusion as to the diversity of 'female-headed households.[220] Methodological improvements to address the above limitations are urgently needed.

The 2030 Agenda calls for reliable disaggregated data (by gender, race, ethnicity, income, location, and other criteria) to measure the effectiveness of the stated goals.[221] The need for high-quality data that capture intersections between gender and disability is pressing. These are essential to understand the multiple forms of discrimination faced by these groups of women as citizens, employees, consumers and patients.[222] Disaggregation must be done by gender and not by sex, in the sense of a biological binary, to capture intersecting inequalities. Gender differences are of vital significance and in addition, women are more diverse a group than men.[223]

Research into different genders is necessary as it can lead to nuanced representations of gender and discussions about gender-inclusive design. However, lack of funding is a significant impediment to academic research, especially sociological research.[224]

Integrating those findings into product and service design can lead to more equitable outcomes for all members of society. It also makes sense in economic terms: gender bias creates disincentives for women to participate in work and social activities as employees, clients and consumers while also having physical and mental health implications - all of which are detrimental to the economy.[225]

Inclusion of all genders in design necessitates changes in official approaches to gender stereotypes and their perpetuation in education, advertising campaigns and design. Regulation should aim at guaranteeing respect of all gender identities and promote diversity. Design can become a vehicle for change of societal attitudes towards different gender identities and acceptance.[226]

Regulatory frameworks and measures that will be based on disaggregated data are the way to safeguard the human and social rights of all citizens. Algorithms, AI systems and robotic processes in the provision of services, for example, need to be properly regulated. Otherwise, they are likely to enhance social inequalities at the expense of women and vulnerable social groups. It is significant to include the perspective of those who are discriminated against, including women, during the phases of design and the evaluation of outputs of AI systems.[227] The inclusion of relevant datasets representing

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[220] Bradshaw, S., Chant, S. and Linneker, B., 'Gender and poverty: what we know, don't know and need to know for Agenda 2030', *Gender Place and Culture*, Vol. 24, No 12, 2017, pp. 1667-1688.

[221] Razavi, S., 'The 2030 Agenda: Challenges of implementation to attain gender equality and women's rights', *Gender and Development*, Vol. 24, No 1, 2016, pp. 25-41.

[222] Abualghaib, O., Groce, N., Simeu, N., Carew, M.T. and Mont, D., 'Making visible the invisible: Why disability-disaggregated data is vital to "leave no-one behind', *Sustainability*, Vol. 11, 2019.

[223] Dougherty, A.H., 'Gender balance in cardiovascular research: importance to women's health', *Tex Heart Inst J*, Vol. 38, No 2, pp. 148-50, 2011.

[224] Dray, S.M., Busse, D.K., Brock, A.M. et al., 'Perspectives on gender and product design', 2014, conference paper, DOI:10.1145/2559206.2599218.

[225] Criado Perez, C., *Invisible women: Exposing data bias in a world designed for men*, Vintage, London, 2020.

[226] Thompson, G., 'Gender-less or gender-more? Addressing gender in product branding', 13 September 2017, http://www.itsnicethat.com/news/gender-in-design-130917

[227] Gupta, M., Parra, C.M. and Dennehy, D., 'Questioning racial and gender bias in AI-based recommendations: Do espoused national cultural values matter?', *Information Systems Frontiers*, published online 20 June 2021.

adequately women and other vulnerable social groups to reveal the intersections between gender and other factors such as ethnicity, disability, or socio-economic status. The gender perspective must be part of the planning of all services and the design of commercial products to meet the needs of all, taking into consideration their physical, mental and psychological differences.

Neither techno-enthusiasm nor technophobia constitute recommended attitudes toward the fast developments and radical changes of our world. Technology can indeed help in collection of gender-disaggregated data; for instance, global positioning systems (GPS) and remoting sensing can be deployed to generate sex-disaggregated data related to transportation, energy, use of other resources, or climate change.[228] **Big data** presents a potential for improving the availability of gender-disaggregated data, provided that the algorithms used are not gender biased.[229]

State funding and political will are key to the design of gender equitable policies. Concerted efforts must be put into ensuring that gender disaggregation will be part of all major data collection initiatives. Raising gender awareness of all parties involved in policy design, participation and consultation of all stakeholders are indispensable to a successful implementation of all measures and a fair and a just society.

Finally, a solid legal and regulatory framework is a *sine qua non* to ensure a harmonious symbiosis based on the collaboration and concerted actions of all the relevant stakeholders.[230]

[228] http://www.unwomen.org/en/digital-library/sdg-report .

[229] UN Women, Gender equality and big data: *Making gender data visible*, UN Women Innovation Facility, 2018.

[230] Karnouskos, S., 'Symbiosis with artificial intelligence via the prism of law, robots and society', *Artificial Intelligence and Law*, Vol. 30, 2021, pp. 93-115.

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This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the FEMM Committee, considers the impact the lack of gender-disaggregated data has on women and vulnerable social groups, as consumers of products and services. It examines the areas of AI-applications, health, transport, finance and consumer goods, highlighting health and safety risks. Drawing on good practices it makes recommendations for the design of products and services, gender equality and inclusion.

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