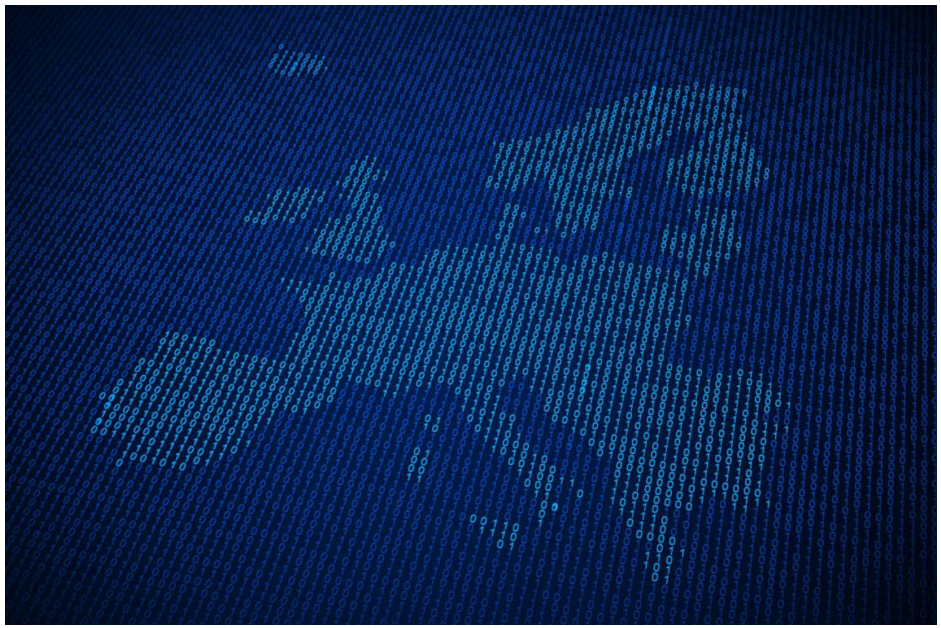
European landscape on Data Science



Maria (Marilena) Longobardi

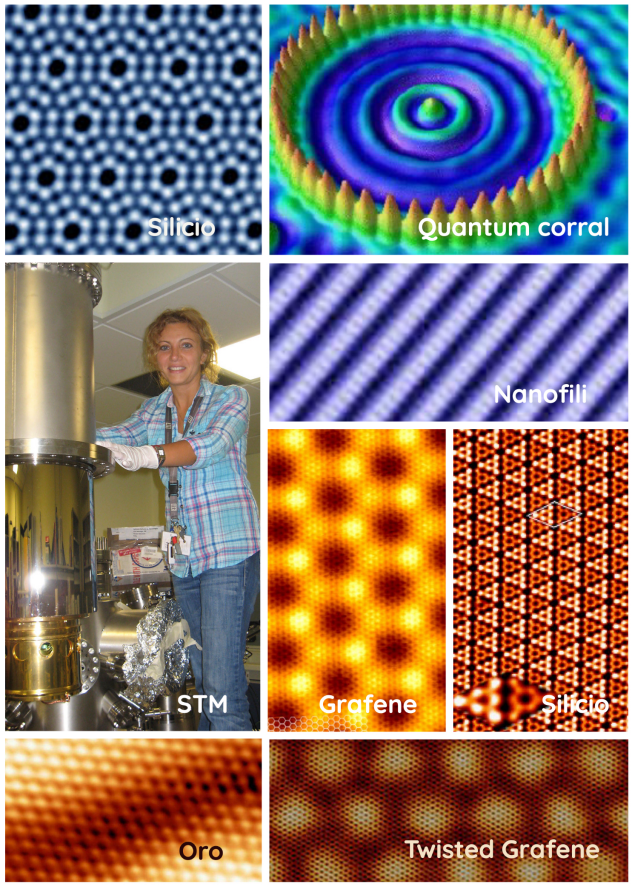
DSECOP Workshop 2022

APS physics

UNIVERSITY OF MARYLAND

INSTITUTE FOR PHYSICAL SCIENCE & TECHNOLOGY

Maria (Marilena) Longobardi



Experimental Condensed Matter Physicist
- Local electronic properties
- Scanning Tunneling Microscopy (STM/STS)
- Semiconductors (Silicon) Superconductors Nanocrystals
- Magnetism

NCCR SPIN - National Center for Quantum Computing (based on Silicon)
– University of Basel, Switzerland
(Consortium: University of Basel, ETH, EPFL and IBM)
- Scientific Coordinator

APS Topical Group of Data Science
- Current Chair 2022

DSECOP
- Co-PI

maria.longobardi@unibas.ch

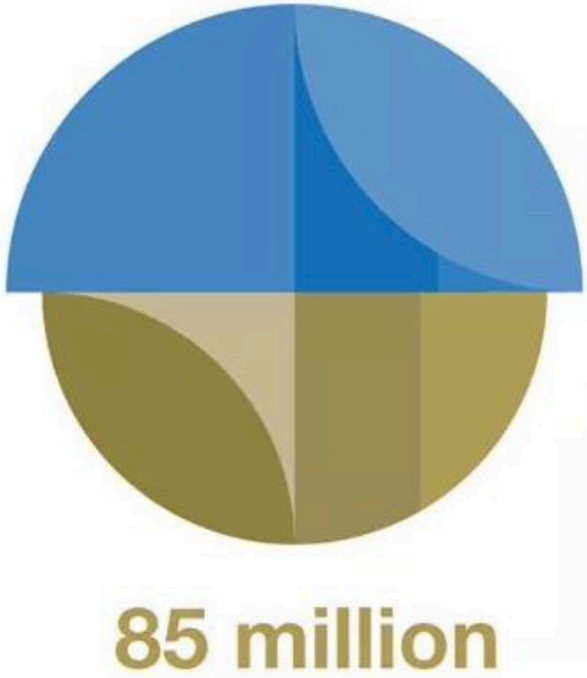
Outline

- **Global landscape**
- **Focus on European landscape**
- **Open questions for discussion**

Let’s start with some good news…
(on a global scale)

WORLD ECONOMIC FORUM

Projections 2025



Growing job demand:

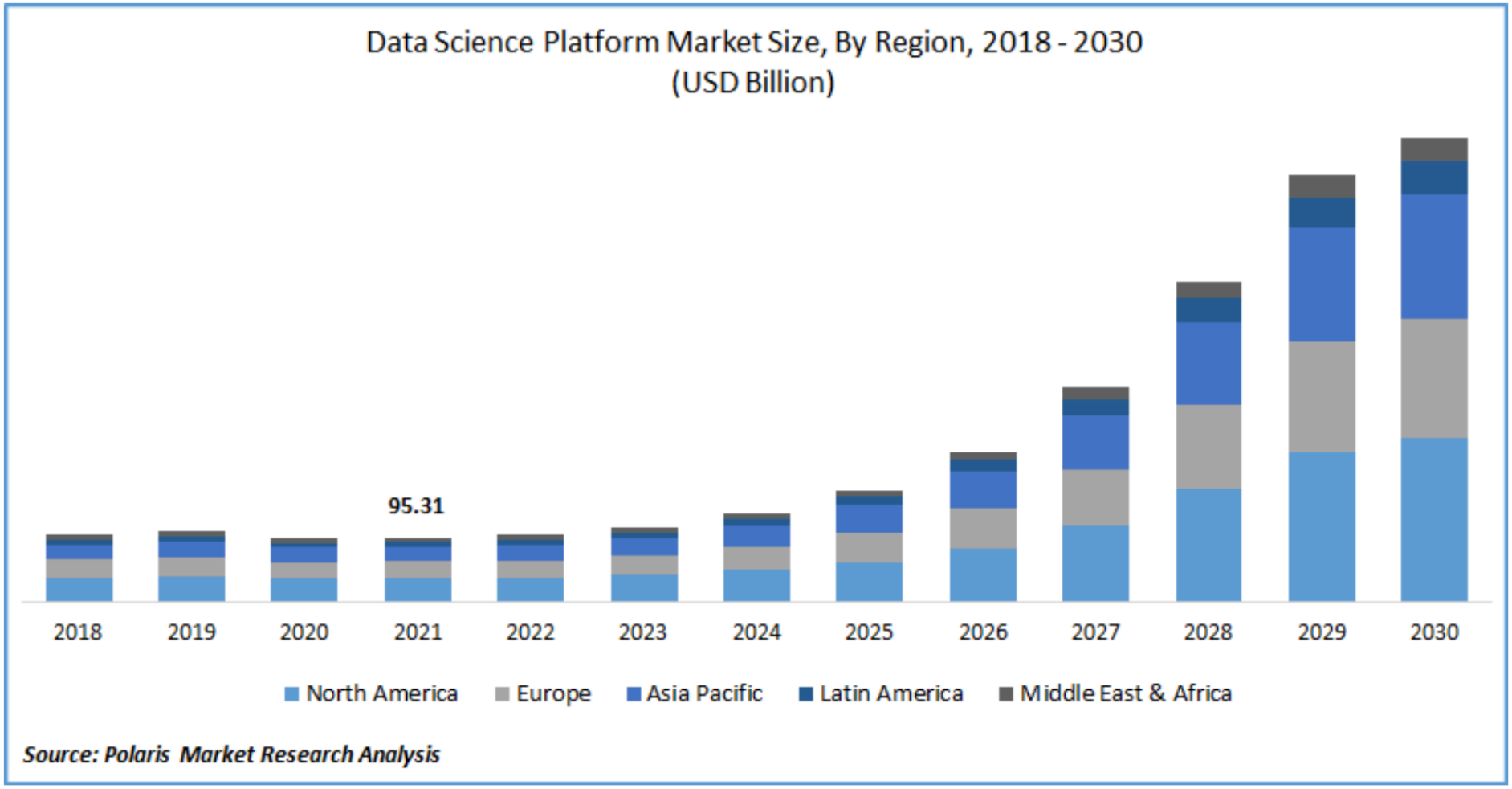
1. Data Analysts and Scientists
2. AI and Machine Learning Specialists
3. Big Data Specialists
4. Digital Marketing and Strategy Specialists
5. Process Automation Specialists
6. Business Development Professionals
7. Digital Transformation Specialists
8. Information Security Analysts
9. Software and Applications Developers
10. Internet of Things Specialists

Decreasing job demand:

1. Data Entry Clerks
2. Administrative and Executive Secretaries
3. Accounting, Bookkeeping and Payroll Clerks
4. Accountants and Auditors
5. Assembly and Factory Workers
6. Business Services and Administration Managers
7. Client Information and Customer Service Workers
8. General and Operations Managers
9. Mechanics and Machinery Repairers
10. Material-Recording and Stock-Keeping Clerks

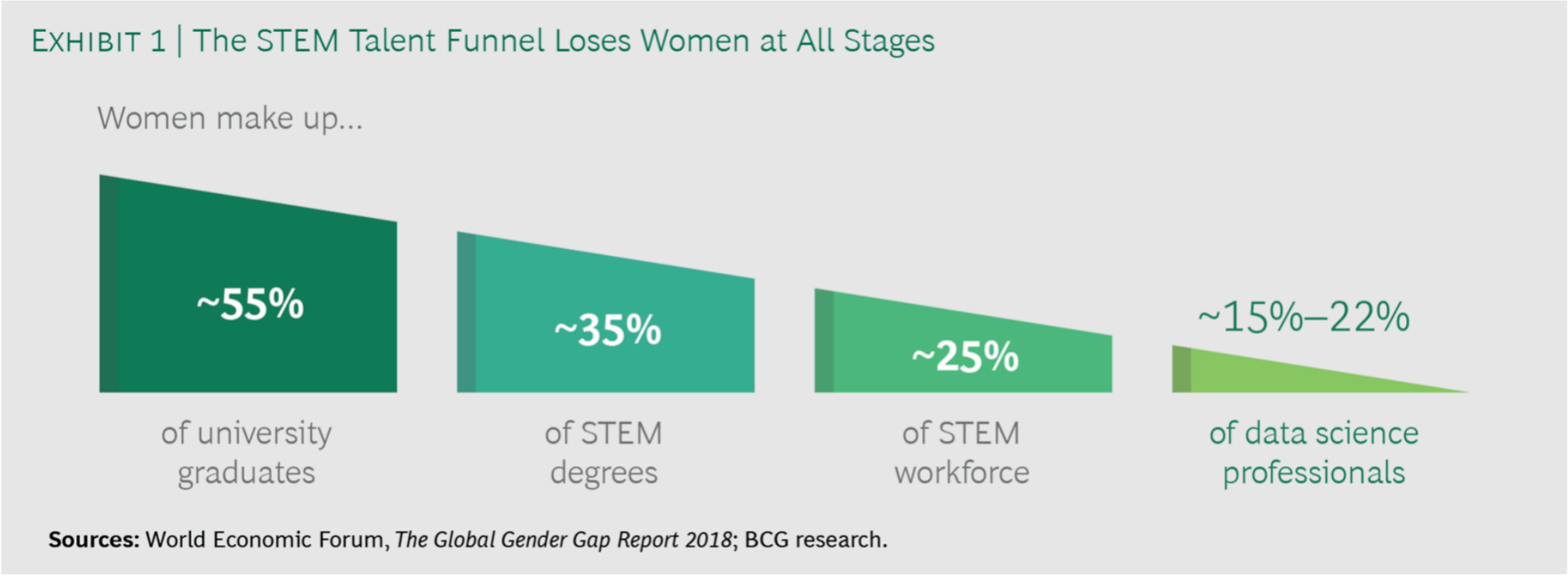
Future of Jobs Report 2020, World Economic Forum.

https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

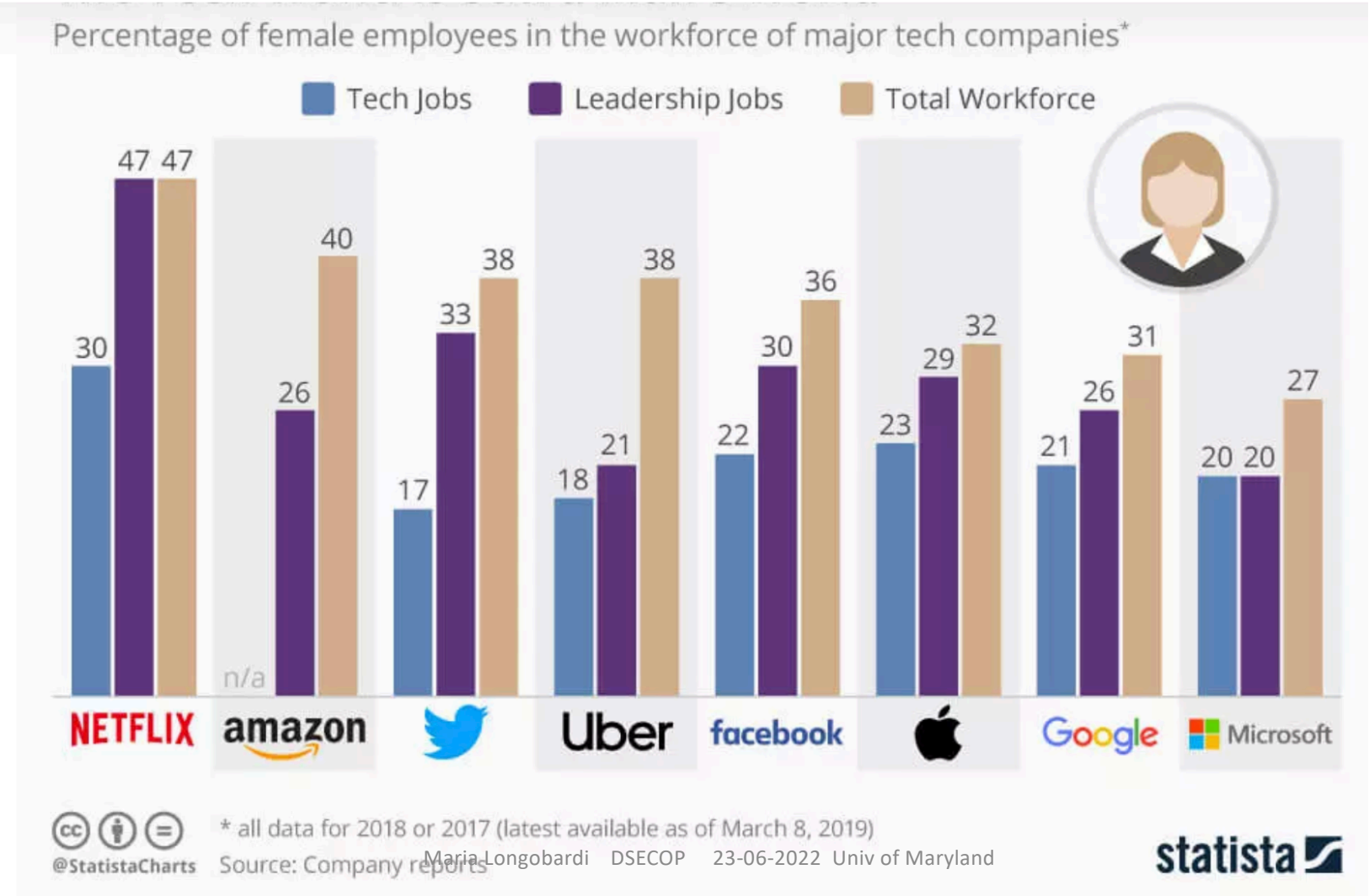

Data Science Platform Market Size, By Region, 2018 - 2030
(USD Billion)
95.31
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
North America
Europe
Asia Pacific
Latin America
Middle East & Africa
Source: Polaris Market Research Analysis

Some bad news…

Gender Gap - Students



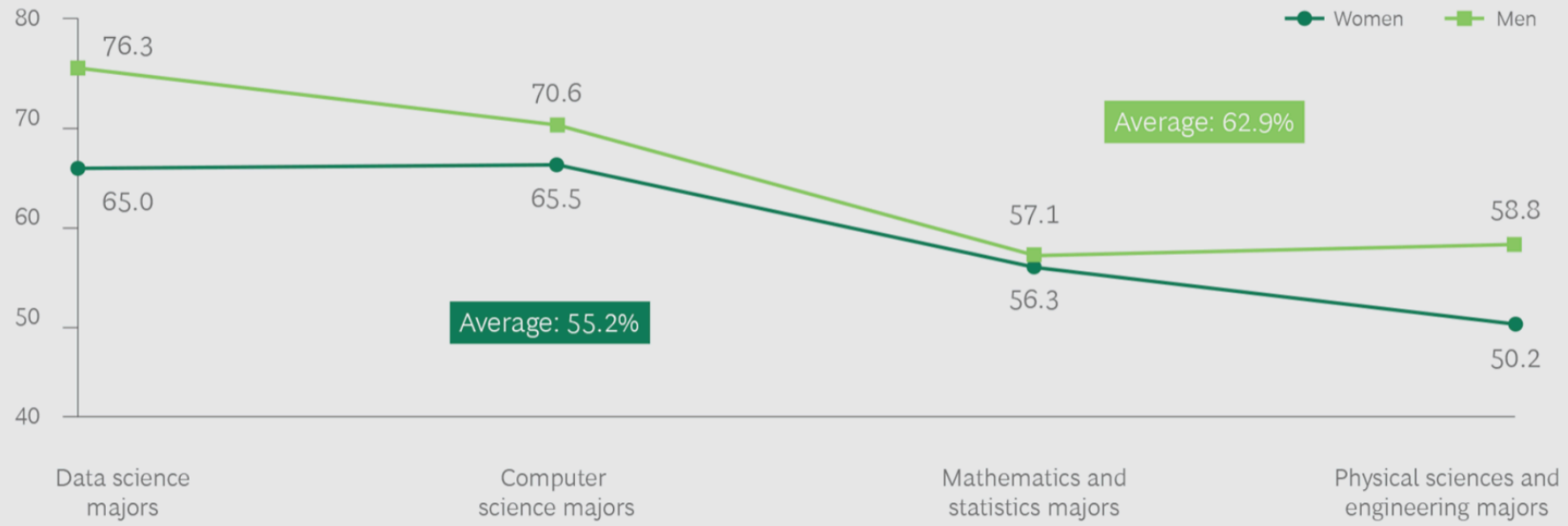
Gender Gap - Jobs



Students are poorly informed

EXHIBIT 5 | Many Students Do Not Understand the Day-to-Day Work of Data Scientists

Share of students with good understanding (%)



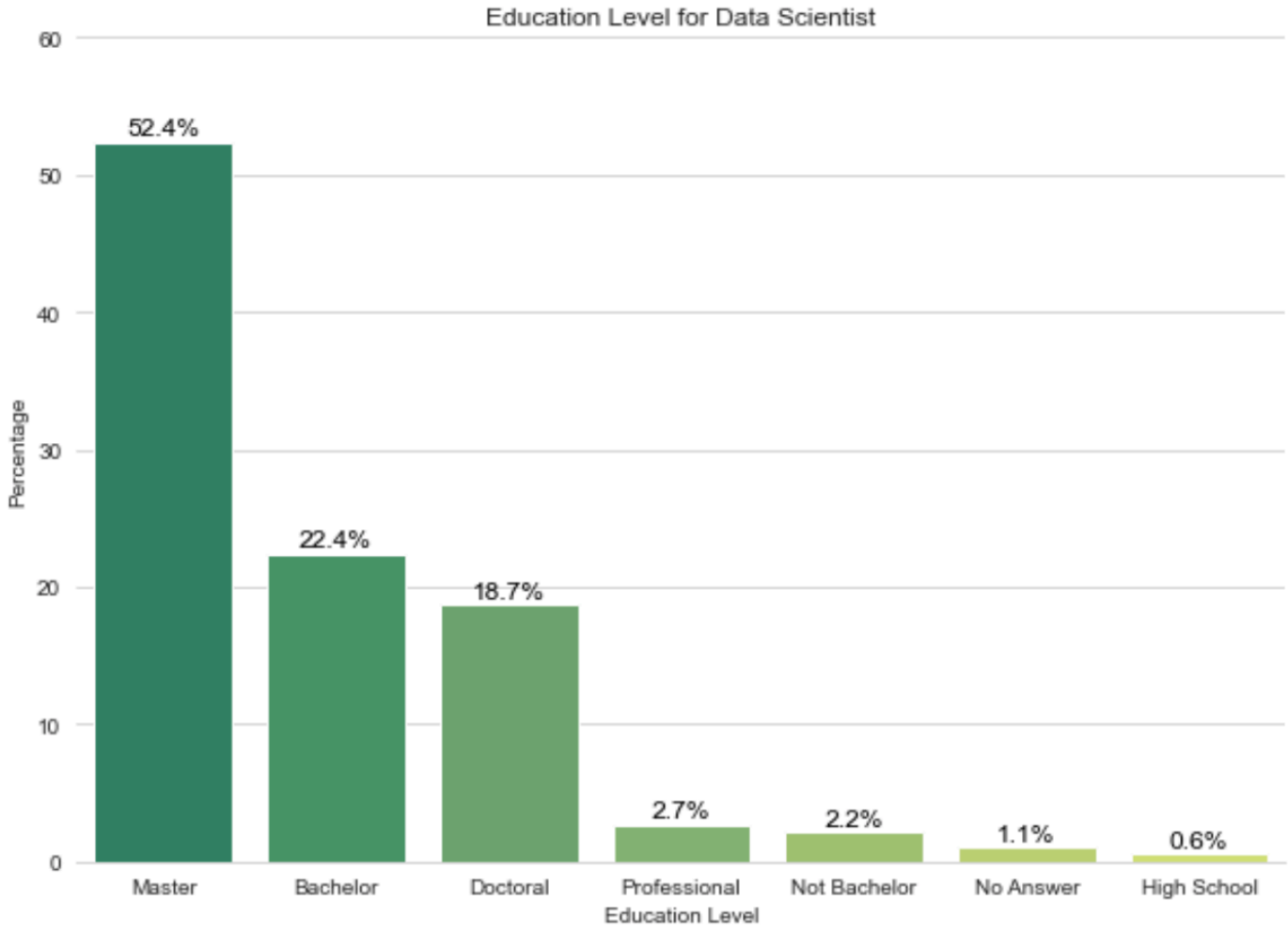
Source: BCG Women in Data survey 2020.

Open questions:

How to engage more female students?

How to better inform students about a career in data science?

Educational landscape (global scale)


Education Level for Data Scientist
60
50
40
30
20
10
0
Percentage
52.4%
22.4%
18.7%
2.7%
2.2%
1.1%
0.6%
Master
Bachelor
Doctoral
Professional
Not Bachelor
No Answer
High School
Education Level

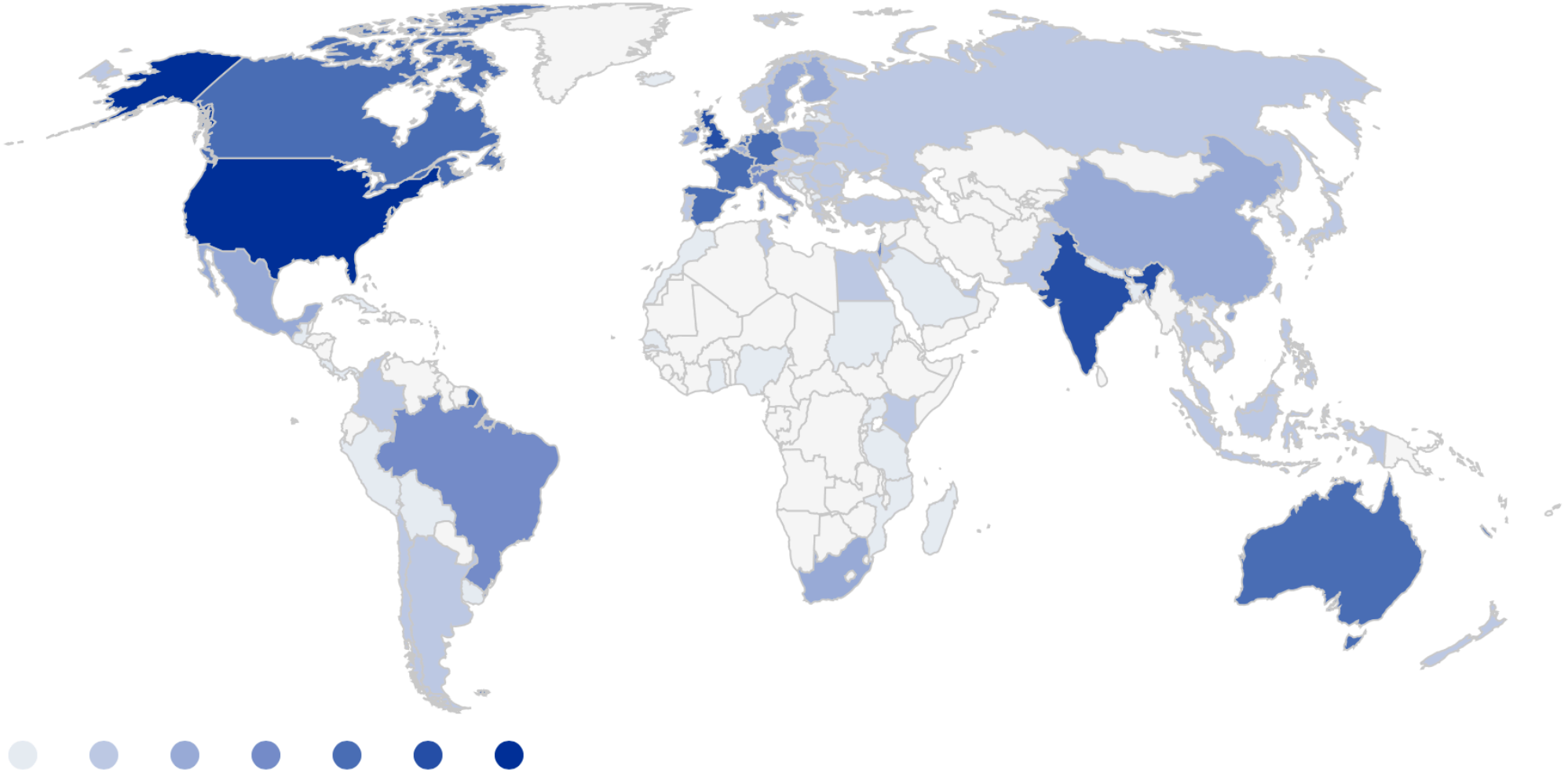
Top 10 Backgrounds for People with Master's and Doctoral Degrees

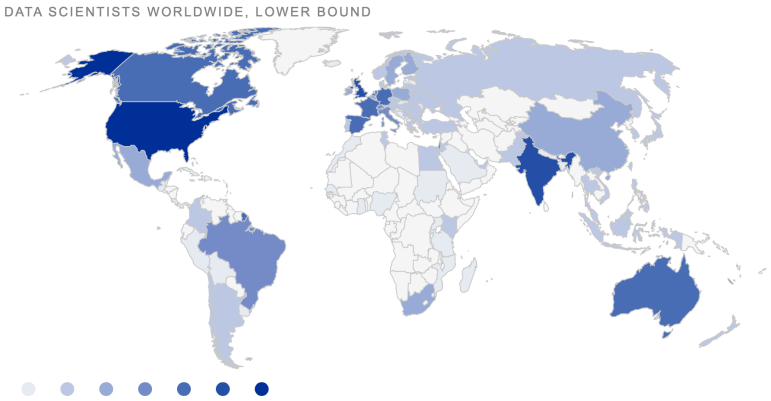
Master's		
Rank	**% of people**	**Field**
1	12.86%	Computer Science
2	12.49%	Business Administration/ Management
3	10.98%	Statistics
4	10.20%	Mathematics
5	8.54%	Physics
6	5.25%	Machine Learning/ Data Science
7	4.50%	Electrical Engineering
8	4.21%	Economics & Finance
9	2.85%	Computer Engineering
10	2.48%	Biology
	16.54%	All other fields
	9.10%	Not provided

PhD		
Rank	**% of people**	**Field**
1	14.74%	Physics
2	14.46%	Computer Science
3	10.83	Mathematics
4	8.24%	Statistics
5	4.77%	Electrical Engineering
6	4.08%	Biology
7	4.06%	Machine Learning/Data Science
8	3.25%	Computer Engineering
9	3.09%	Neuroscience
10	2.74%	Economics & Finance
	20.32%	All other fields
	9.41%	Not provided

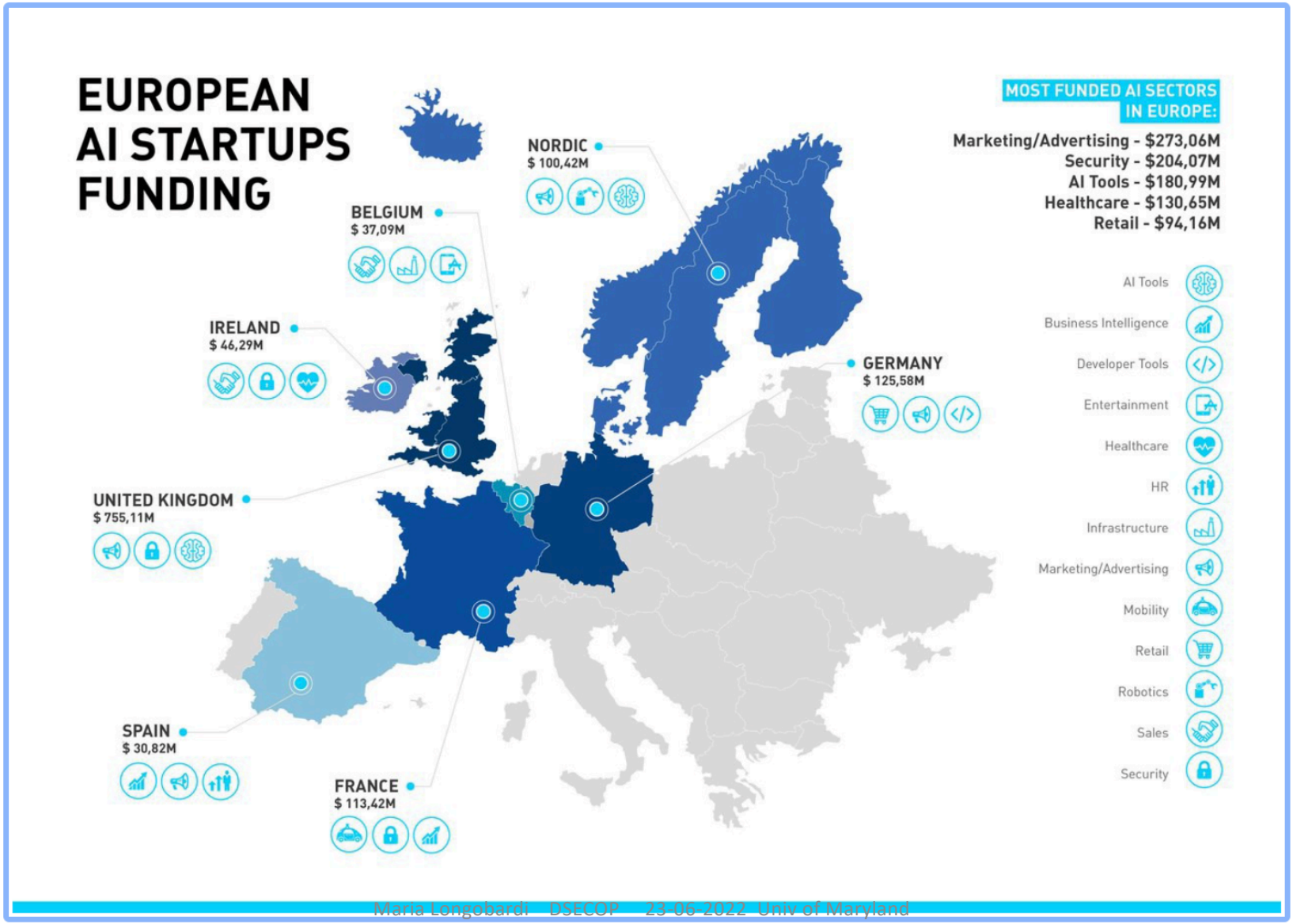
Geographical landscape (global scale)

DATA SCIENTISTS WORLDWIDE, LOWER BOUND





Main Players: **UK**, France, Spain, Germany, Italy, Switzerland, Netherland…


EUROPEAN
AI STARTUPS
FUNDING
NORDIC
$ 100,42M
BELGIUM
$ 37,09M
IRELAND
$ 46,29M
GERMANY
$ 125,58M
UNITED KINGDOM
$ 755,11M
SPAIN
$ 30,82M
FRANCE
$ 113,42M
MOST FUNDED AI SECTORS IN EUROPE:
Marketing/Advertising - $273,06M
Security - $204,07M
AI Tools - $180,99M
Healthcare - $130,65M
Retail - $94,16M
AI Tools
Business Intelligence
Developer Tools
Entertainment
Healthcare
HR
Infrastructure
Marketing/Advertising
Mobility
Retail
Robotics
Sales
Security

Focus on Europe

In Europe (generally speaking),
AI and Data Science are considered as two different fields

EU has a special focus on AI: AI Flagship

Definition of AI

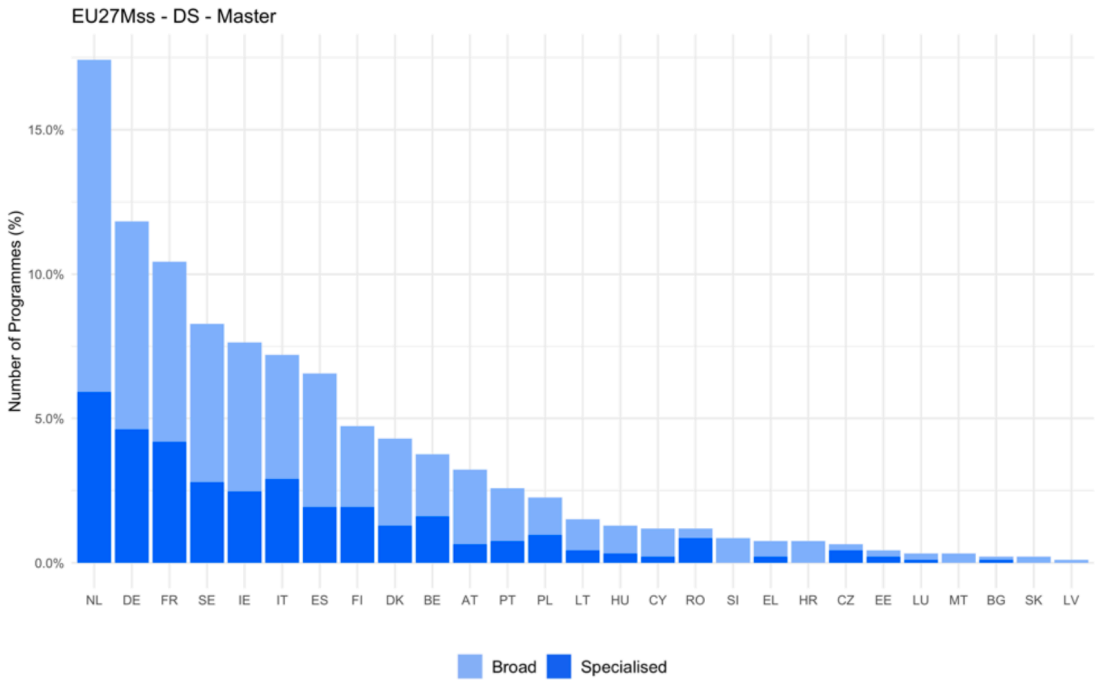
AI refers to any machine or algorithm that is capable of observing its environment, learning, and based on the knowledge and experience gained take intelligent actions or propose decisions. (Cit: AI Flagship Report)

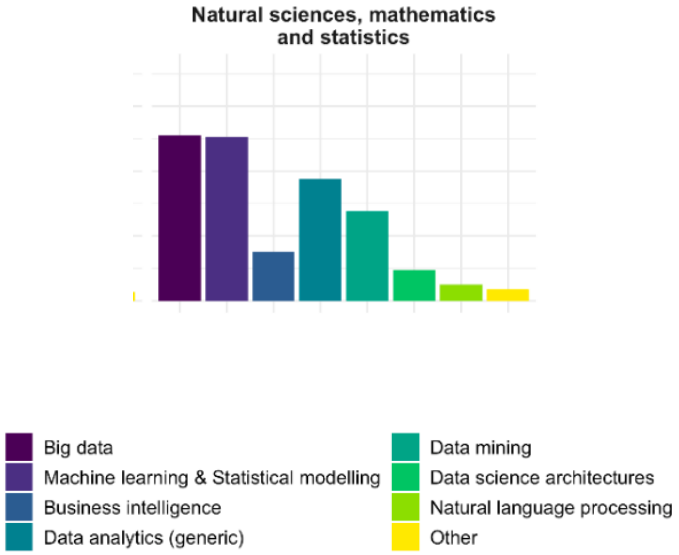
Open question:

Should Artificial Intelligence be included in Data Science or not?

Academic Offer Data Science* in EU in 2019-20

Figure 29. DS master's programmes by Member State and scope (%). 2019-20





Note: The percentages are based on the number of programmes in each field of education in the EU27.

https://publications.jrc.ec.europa.eu/repository/handle/JRC121680

*** AI is not included**

Academic Offer Data Science* in 2019-20.
EU vs Global

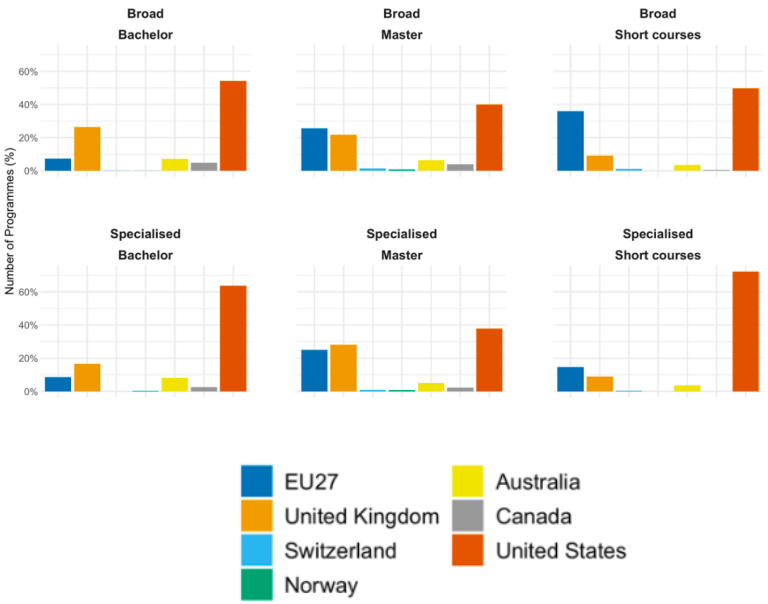
https://publications.jrc.ec.europa.eu/repository/handle/JRC121680

*** AI is not included**

Academic Offer Data Science* in 2019-20.
EU vs Global

Table 5. DS programmes by geographic area, level and scope, 2019-20

		Bachelor		Master		Short courses		Total
		Broad	Specialised	Broad	Specialised	Broad	Specialised	
	EU27	106	34	605	325	63	39	1,172
UK	United Kingdom	377	66	515	365	16	24	1,363
NO	Norway	1	1	20	10			32
CH	Switzerland	2		36	12	2	1	53
CA	Canada	69	10	94	29	1		203
US	United States	776	252	946	492	87	193	2,746
AU	Australia	102	32	153	66	6	10	369
	TOTAL	1,433	395	2,369	1,299	175	267	5,938



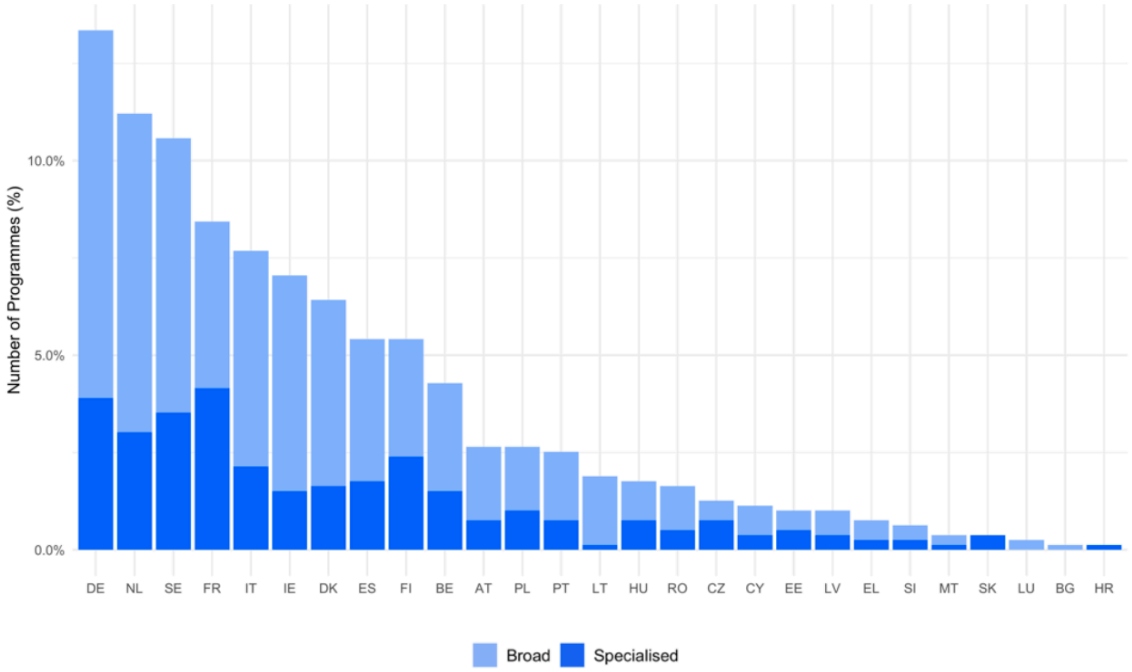
US dominates the landscape!

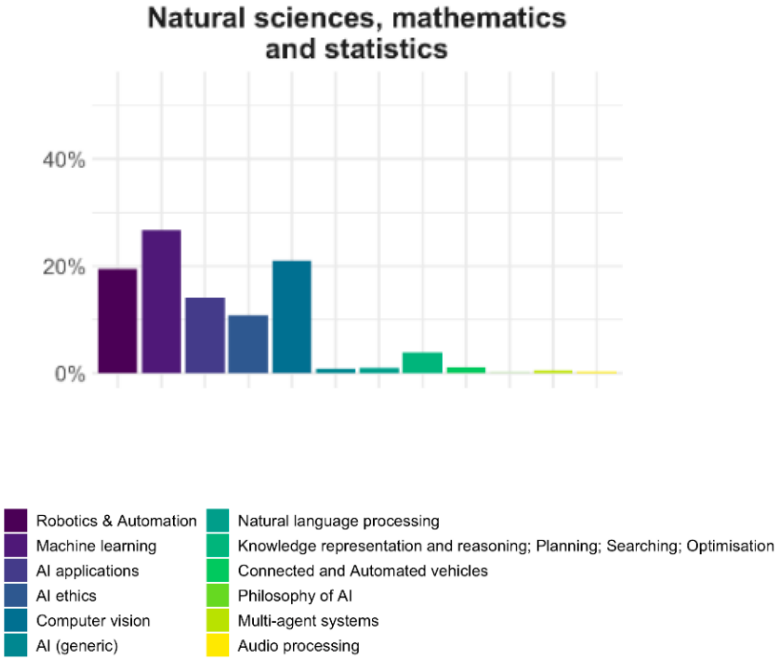
https://publications.jrc.ec.europa.eu/repository/handle/JRC121680

*** AI is not included**

Academic Offer Artificial Intelligence in EU in 2019-20

Figure 8. AI master's programmes by Member State and scope (%). 2019-20





Note: The percentages are based on the number of programmes in each field of education in the EU27.

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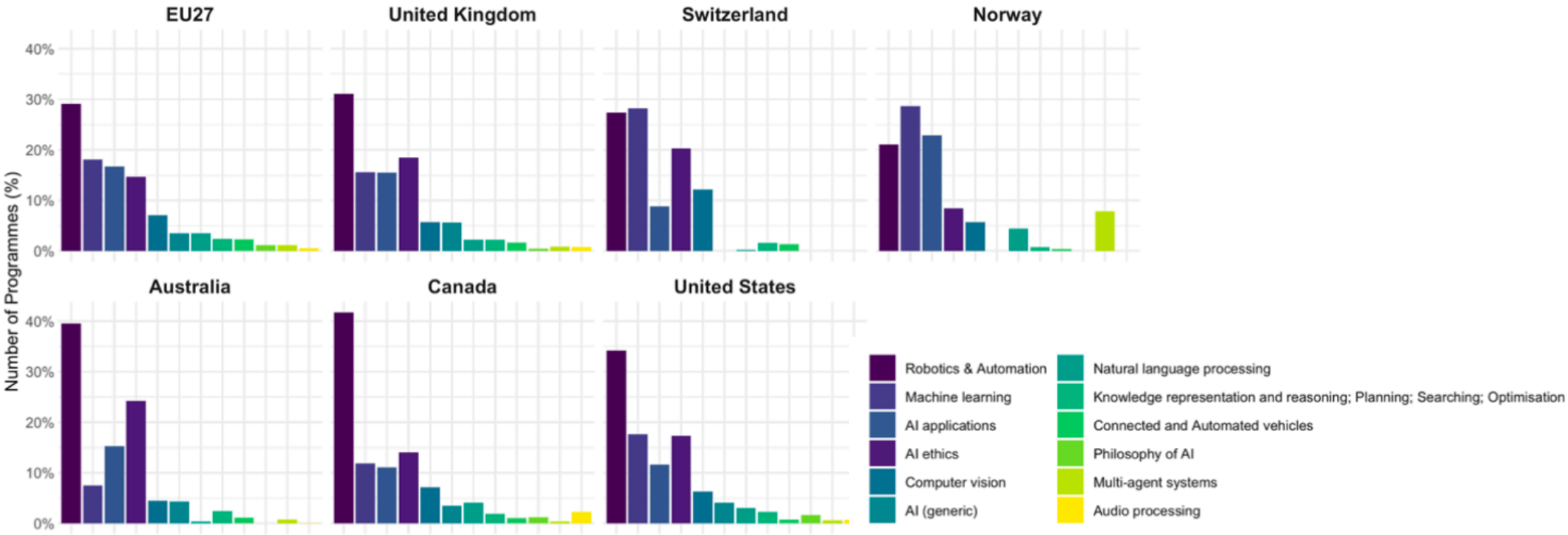
Academic Offer Artificial Intelligence in 2019-20.
EU vs Global



https://publications.jrc.ec.europa.eu/repository/handle/JRC121680

Keyword: Fragmentation

Europe needs a multi-national, pan-European, perspective and approach towards **AI.**

There is a strong need to pull together existing strategies in a cooperative way that will help grow the ecosystem across Europe without duplicating efforts.

If Europe does not combat fragmentation, there is a real risk of weakening the whole European ecosystem.

European Commission 2018

In EU there is a lack of coordinated efforts (Fragmentation)
Some examples of random efforts at personal level…

Norway, Oslo Morten Hjorth-Jensen

Center for Computing
Computational Physics and Science
hjensen@msu.edu

Italy, Giovanni Organtini
Sapienza Univeristy, Rome
Course

Jupiter notebook with python
giovanni.organtini@uniroma1.it

Switzerland, Alessandro Scarfato
University of Geneva

Lab course
Neural networks curve fitting to large datasets in STM
Alessandro.Scarfato@unige.ch

Germany, Wolfram Smith
Univerity of Hamburg
Book
Astronomy integrated with python
wolfram.schmidt@uni-hamburg.de

Thanks to Eugenio Tufino, University of Trento

Portugal, César Teixeira
University of Coimbra
cteixei@dei.uc.pt

Paper

Using the Jupyter Notebook as a Tool to Support the Teaching

Interesting case study (European Medical Physicists (MPs))

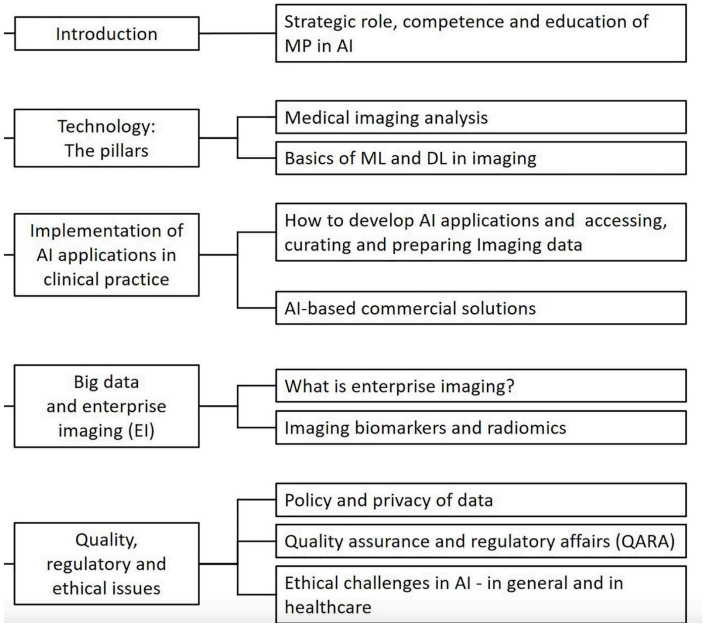
Expanding the medical physicist curricular and professional programme to include Artificial Intelligence
(2021)

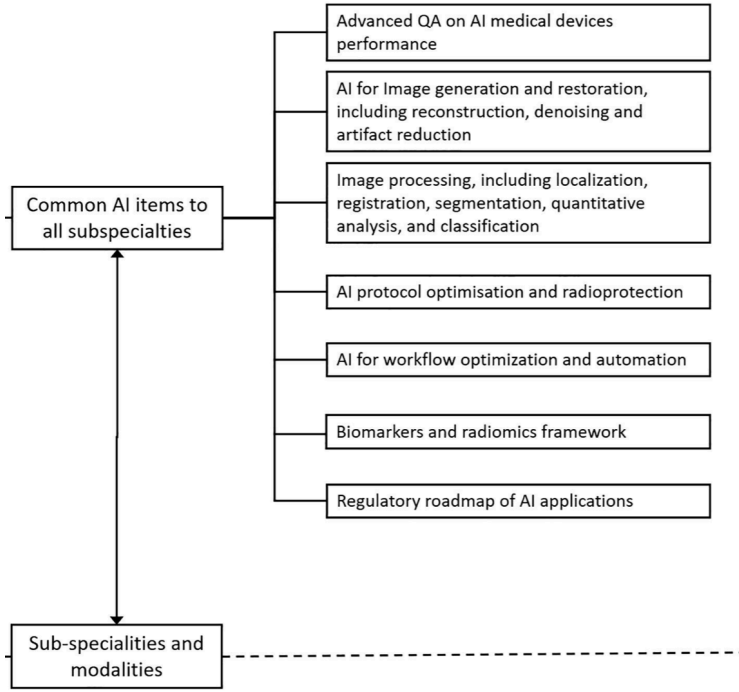
The European Medical Physicists (MPs) provides a a guideline to incorporate Artificial Intelligence to the education and training in Europe and associated countries

Basic Level and Advanced Level
Examples: Medical imaging analysis and AI introduction, Implementation of AI applications, medical devices, radioprotection

https://www.sciencedirect.com/science/article/pii/S1120179721000727

Proposed AI Training





Basic level

Advanced level

Interesting case study (European Medical Physicists (MPs)

Following MPs, in 2022,
the **Australasian College of Physical Scientists and Engineers in Medicine**

encourage medical physics educators to develop a strategy to incorporate AI module in the curriculum.

They propose that
(1) postgraduate medical physics programme should include a more comprehensive and well-structured AI module,
(2) extending the medical physics education and training time and
(3) inclusion of appropriate computer/data science experts in the curriculum delivery.

https://link.springer.com/article/10.1007/s13246-022-01099-2#ref-CR8

Thank you!

Any questions?

Send me an email at

maria.longobardi@unibas.ch

Our open questions:

How to engage more women?

How to better inform students about career in Data science?

Should Artificial Intelligence be included in Data Science or not?