

*Contigo+ opening session*

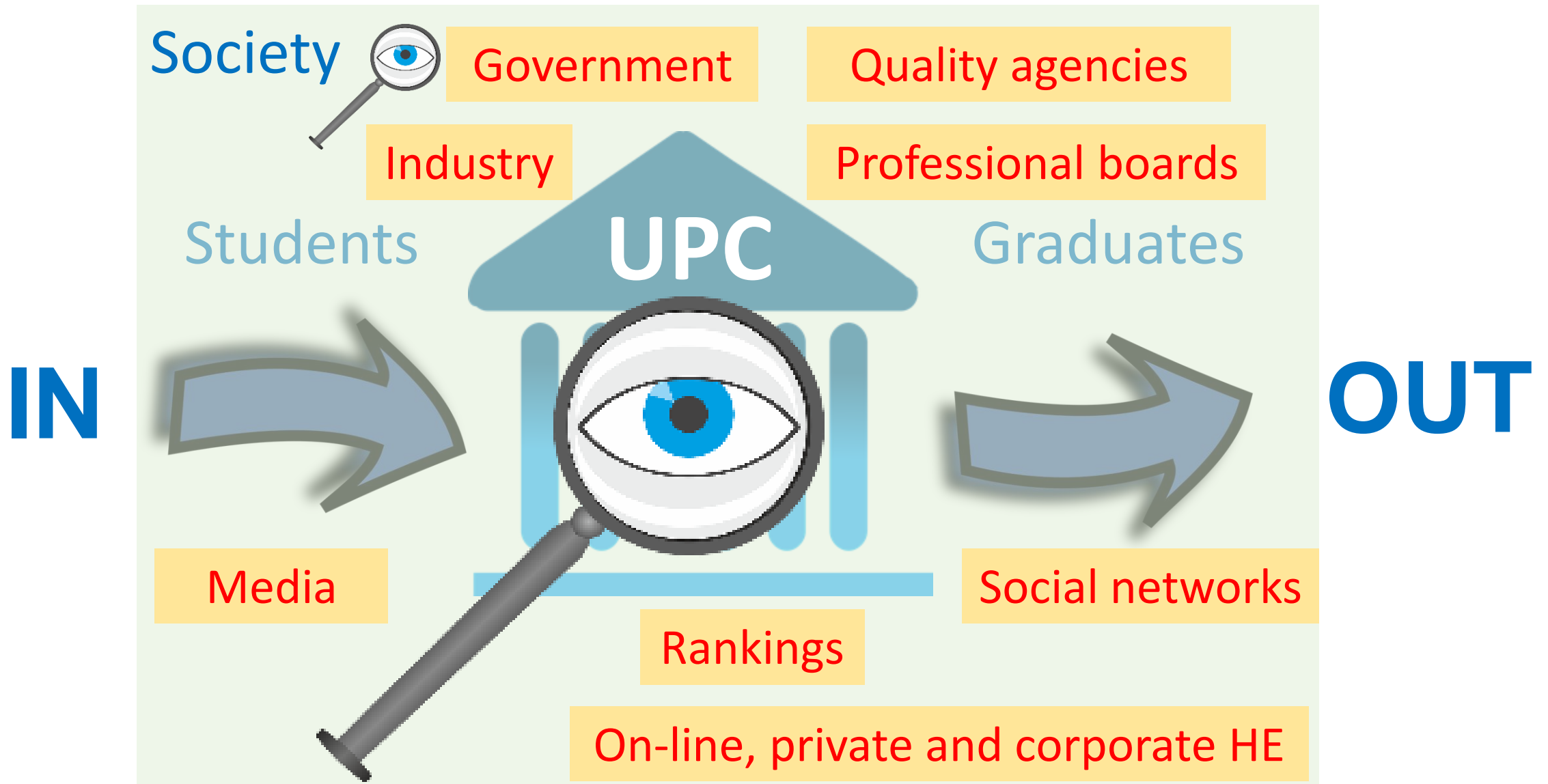
*Part I*

*Some reflections on STEM  
Higher Education*

**Francesc Torres (UPC)**

Instituto Superior Técnico. Lisbon, 17th November 2022







# *Universitat Politècnica de Catalunya (UPC)*

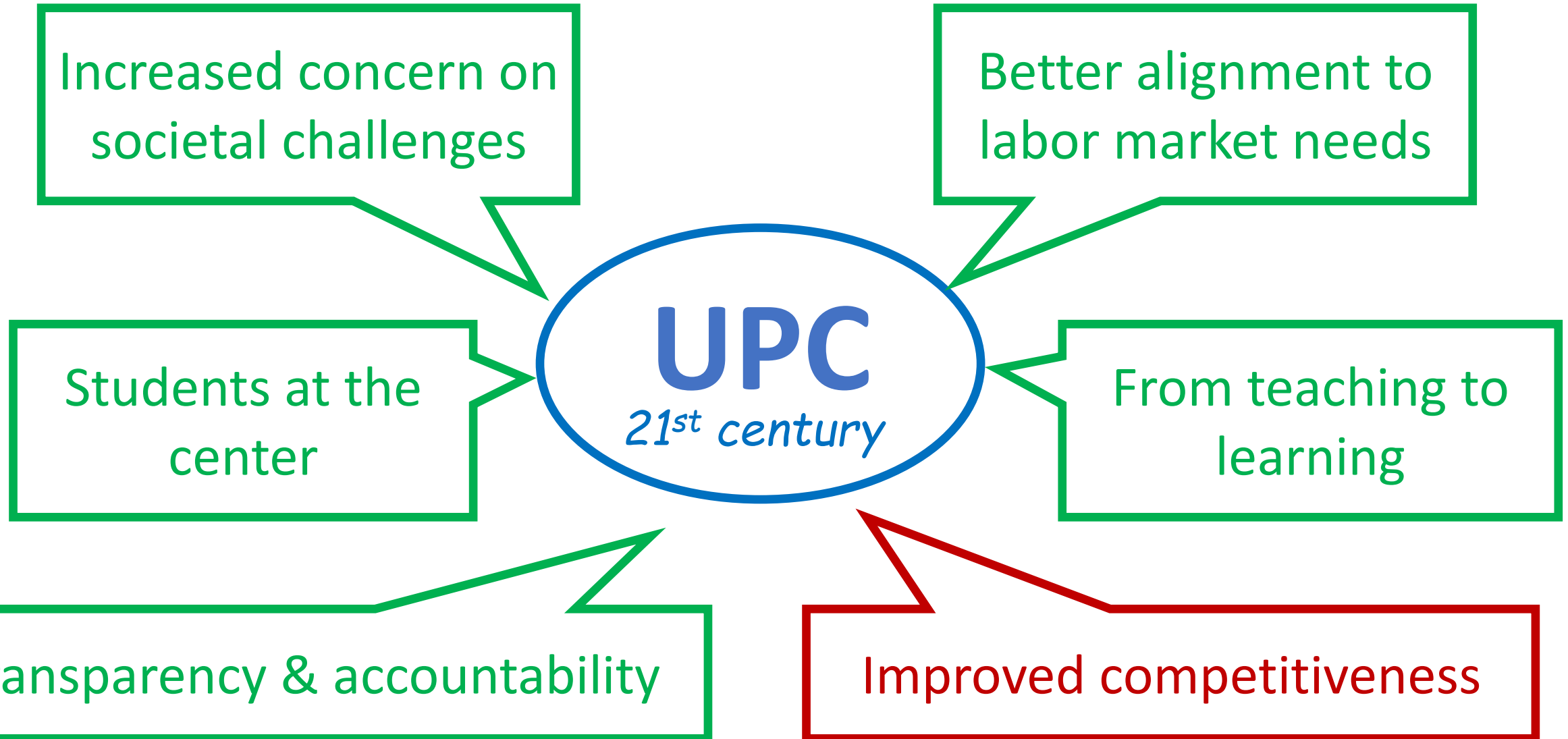
*HE in the fields of  
engineering, architecture, science and technology*



- *18 schools in 6 Campus*
- *300 M€ budget*
- *28.000 bachelor & master students*
- *1600 PhD students*
- *3400: academic staff*



# *Growing pressure on public HE institutions*

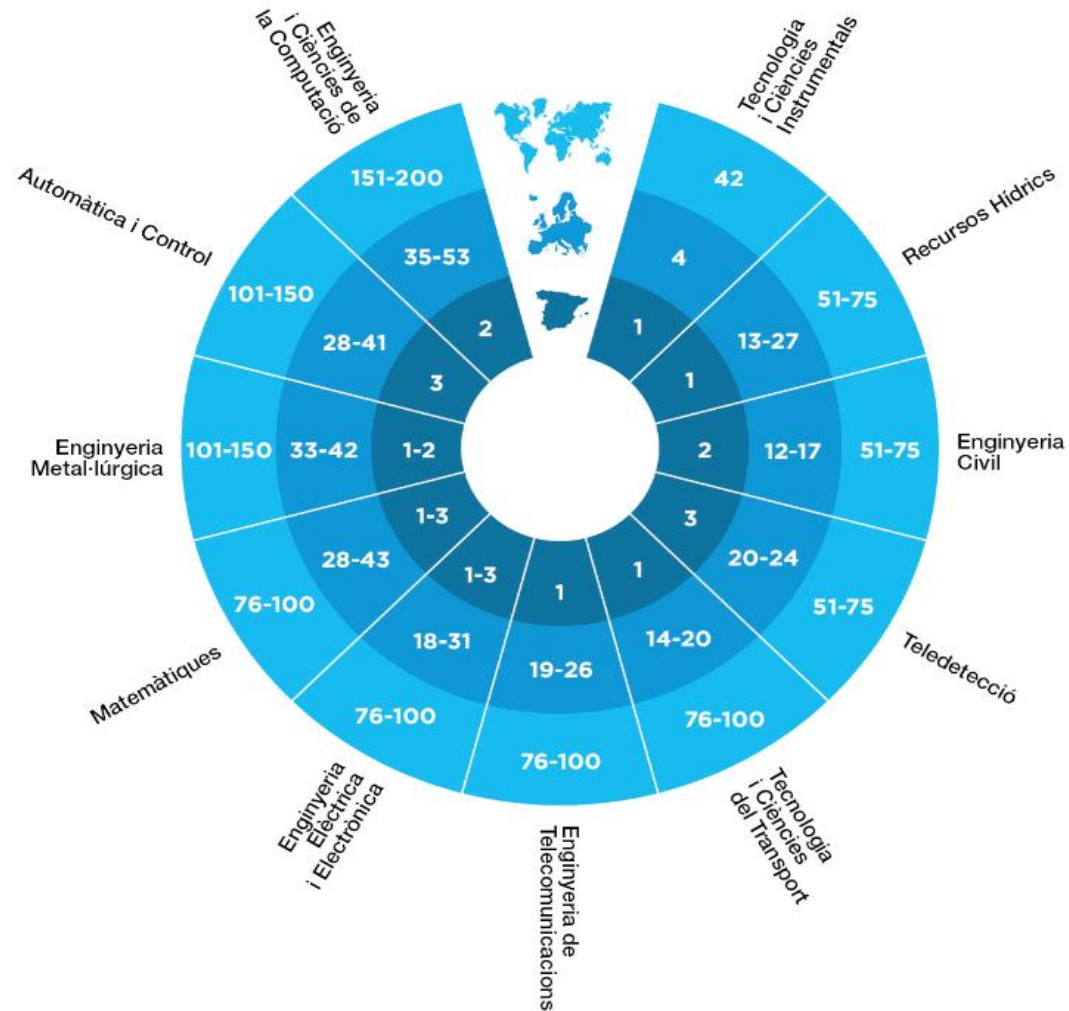




# Universitat Politècnica de Catalunya (UPC)



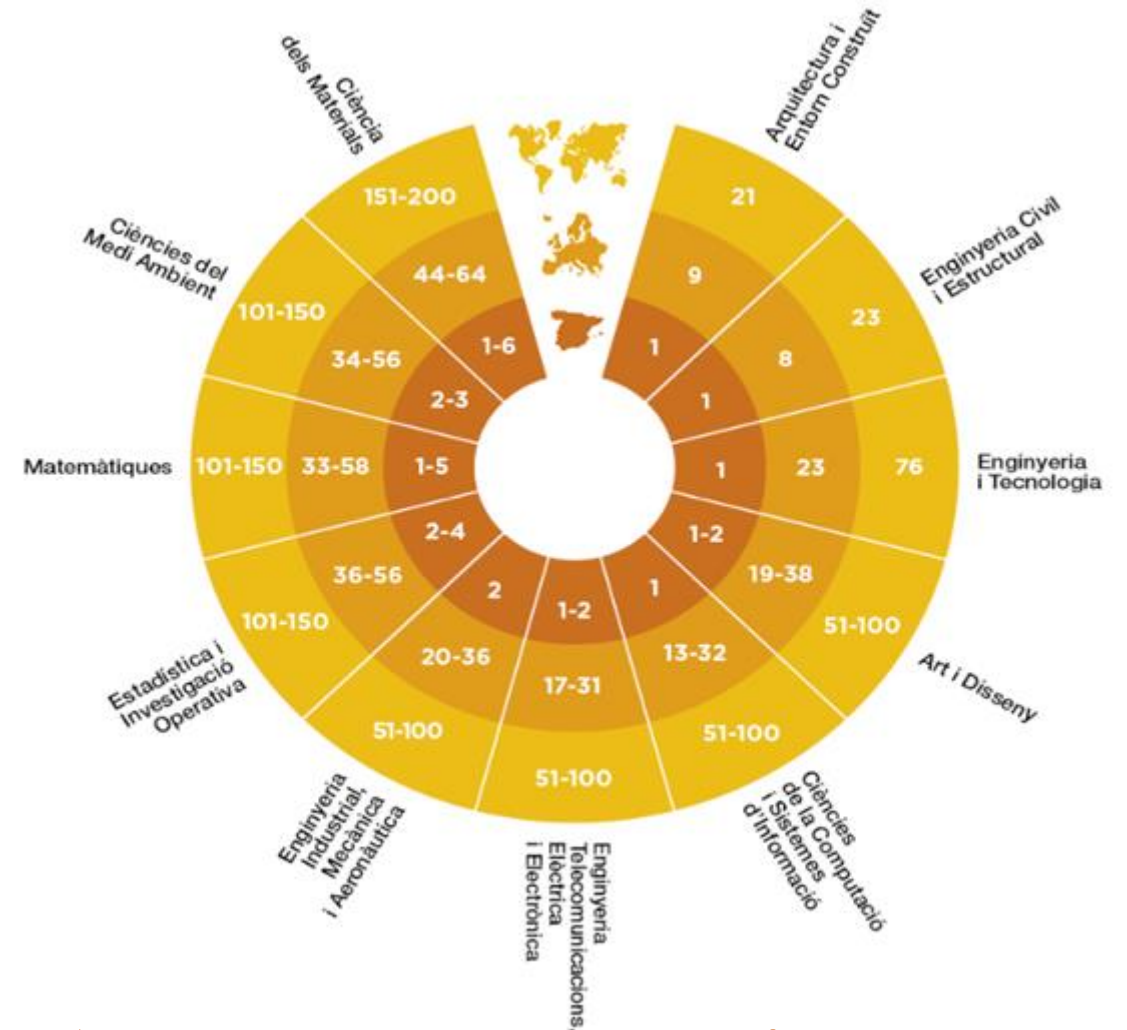
Shanghai Global Ranking  
of Academic Subjects, 2020



➤ *World Top100 on 8/13 subjects*



QS World University Rankings  
by Subject, 2020



➤ *World Top100 in 7/11 subjects*



# Universitat Politècnica de Catalunya (UPC)



- *National Top5 institution on H2020 funds: 99,8 M€ (2014-20)*



**Surveys**

- *Satisfaction ( 85%), Employability (93%), job quality index (70%),*



Science, technology,  
engineering and maths

- *National Top3 in 8/11 HE areas*

**Budget: ~10.000€/student per year!!!!**



# *Starting with WHY*

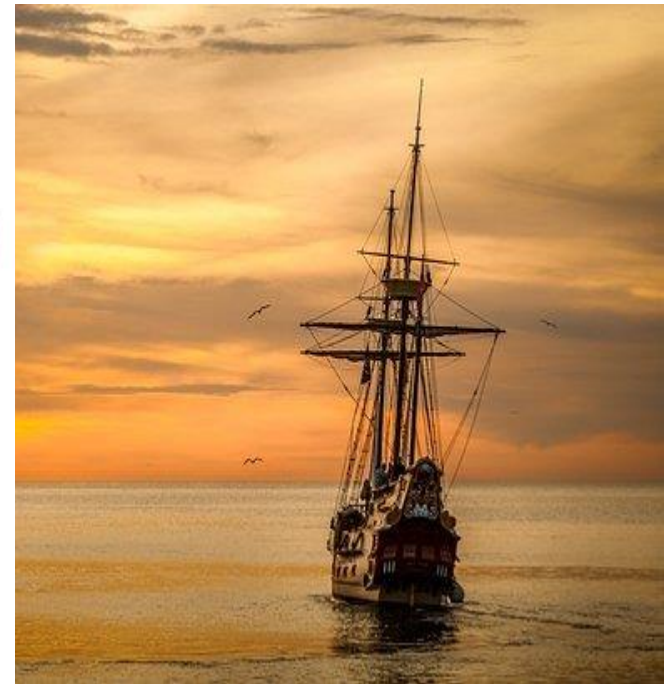
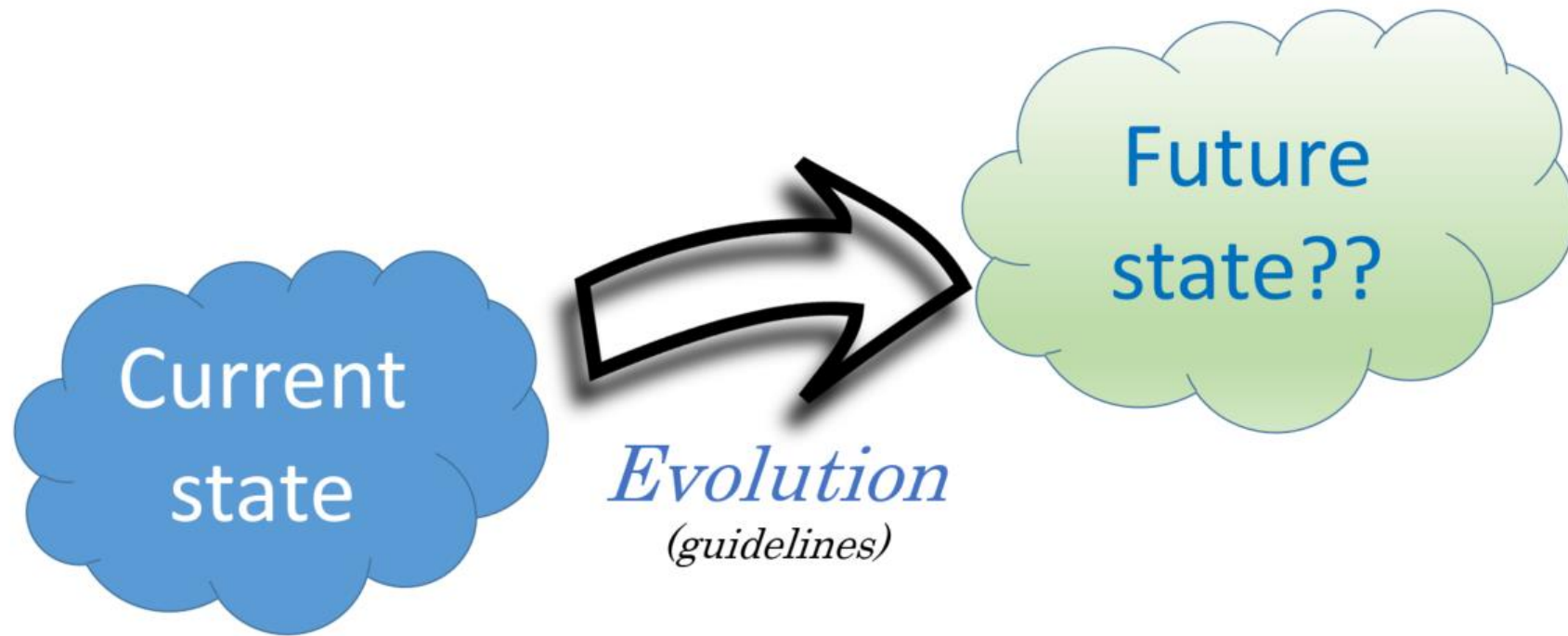
- 1. Why should we change?*
- 1. Why are we doing what we are doing?*
- 1. Why should society keep paying us?*





*The answer to 'Why?'*

*Evolve to better address societal challenges*





# *Adaptability: a key feature to survive*

*“The adjustment of organisms to their environment in order to improve their chances of survival in that environment”*





# *What is our institutional identity?*



*A public university of  
reference in the fields of  
**engineering, architecture,  
science and technology***



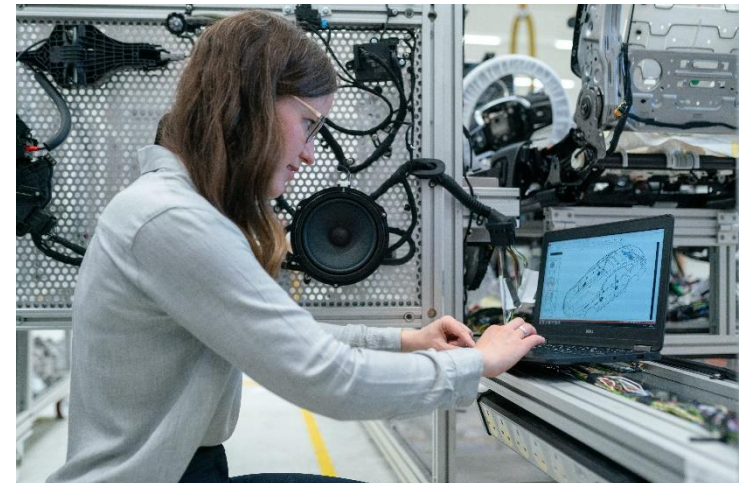
# *What is our purpose?*

*Provide higher education of the best quality as our central mission*

*Produce relevant research, innovation and technology transfer*

---

*Pursue excellence as a driving force to better serve our society*





# *A key feature to progress: flexibility*

*Be rigid with the principles and goals, flexible with implementation*

*The reed which bends in the  
wind is stronger than the oak  
which breaks in a storm*





# *Minimum change enforcement*

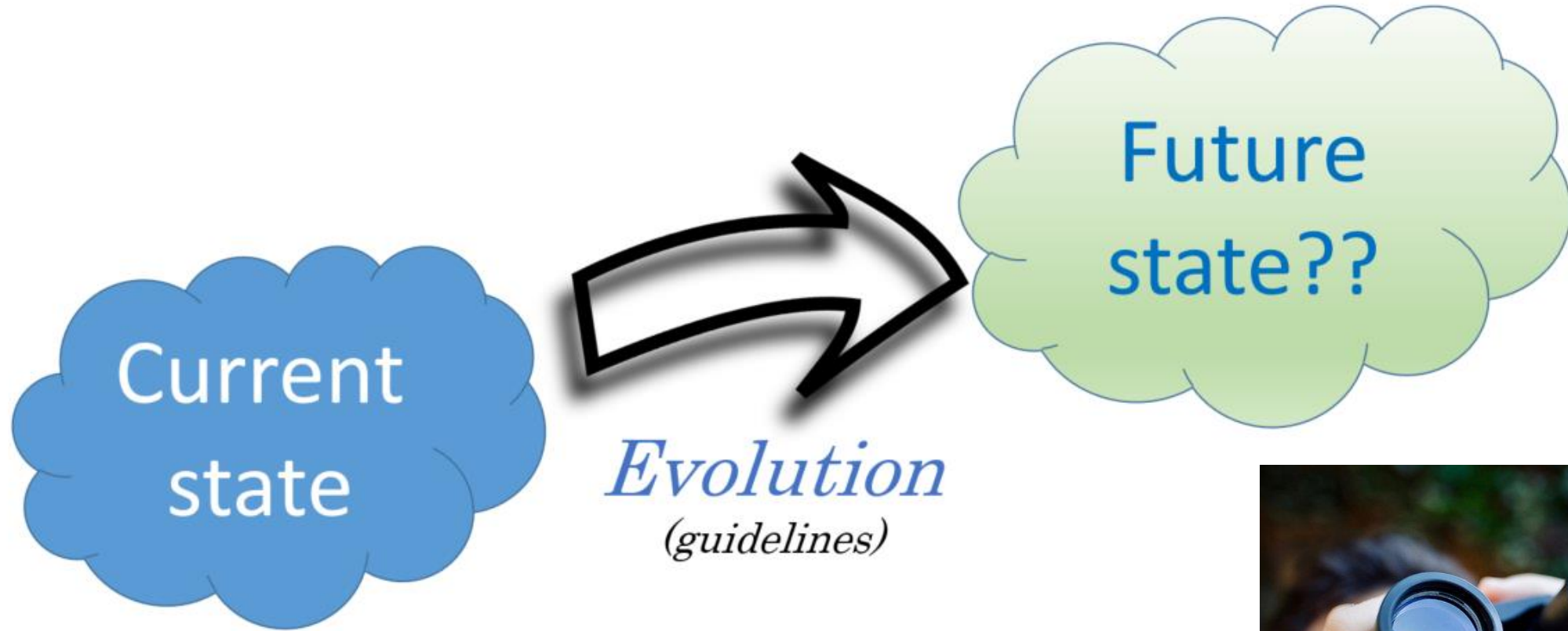
Limited power and  
budget framework

Change is a flow:  
***swim downstream!***





*Where should we go?*

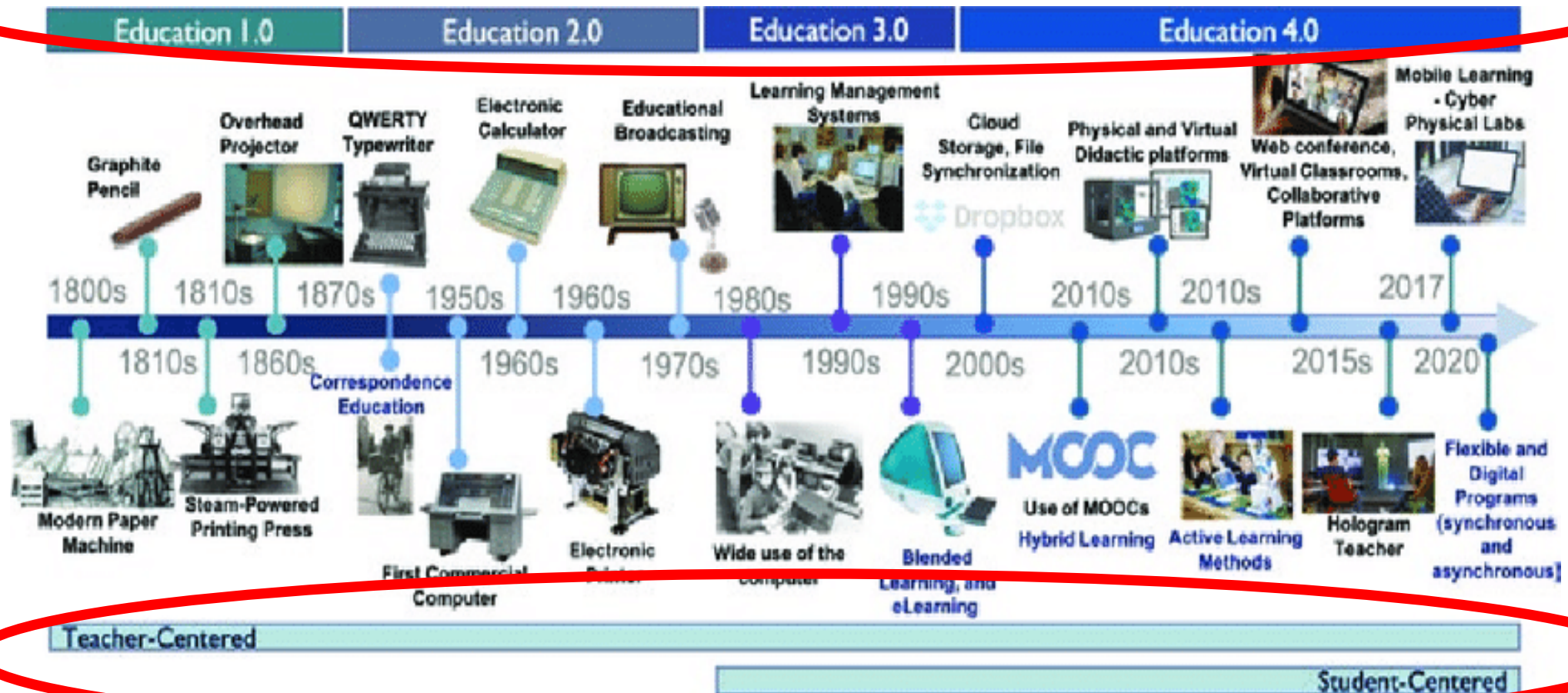


***Envision the future***





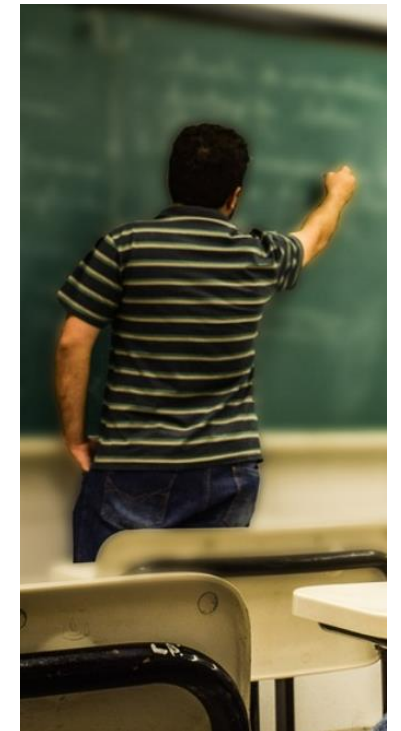
# *Evolution of educational methodologies: time axis*





# *Trends in Higher Education*

Element	Traditional education	Future-ready learning landscape
<b>Pillars of learning</b>		
Students	Passive and interim information recipients	Active and lifelong learners
Teachers	Lecturer and subject expert	Various roles: coach, mentor, facilitator, curator, practitioner, learning designer; continuous upskilling
Subject matter	Discipline-centered	Multidisciplinary, problem-based and challenge-driven
Spaces	Classrooms and lecture halls with fixed sitting	Flexible spaces and the real world



“Envisioning the future of learning” K. Papageorgiou and O. Kokshagina (2022)



# *Innovation on HE: master class vs collaborative spaces*



- Not everything can/should be done simultaneously
- Not everyone can/should do everything



# *Innovation on HE: Transition to new methodologies*



## ➤ Additional resources are required

- New spaces
- Smaller student/tutor ratios
- Technological infrastructure
- Workshop expendables
- Extra support (e.g. video-recording studios)



# Hard and soft skills trade-off on education

## HARD SKILLS

## SOFT SKILLS

$$q = \int_0^s E\theta'''(x)\omega(s)tds = E\theta'''(x)\int_0^s \omega(s)tds = E\theta'''(x)S_{\omega} \quad (14)$$



The key importance of professor face-to-face communication and feedback

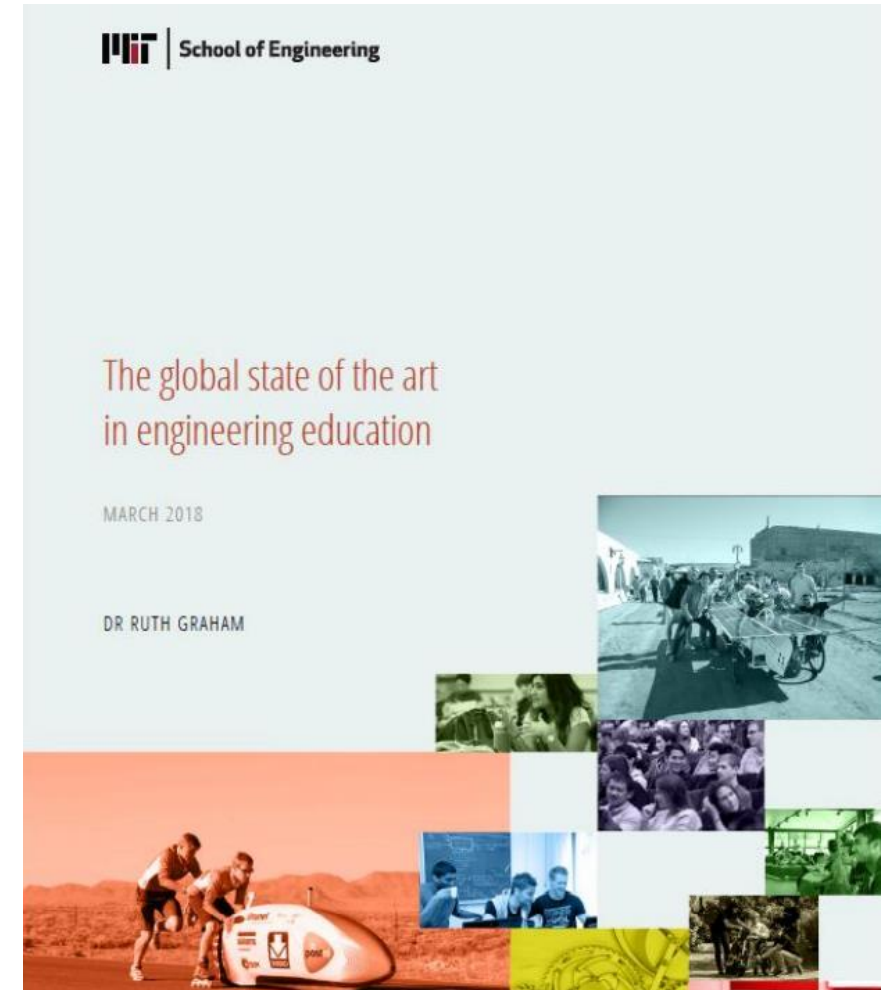
**Do not transfer to the student full responsibility for acquiring the fundamental knowledge**





# *Features of successful STEM HE Institutions*

- Focus on rigor in the engineering 'fundamentals'
- User-centered design
- Technology-driven entrepreneurship
- Active Project-based learning (PBL)

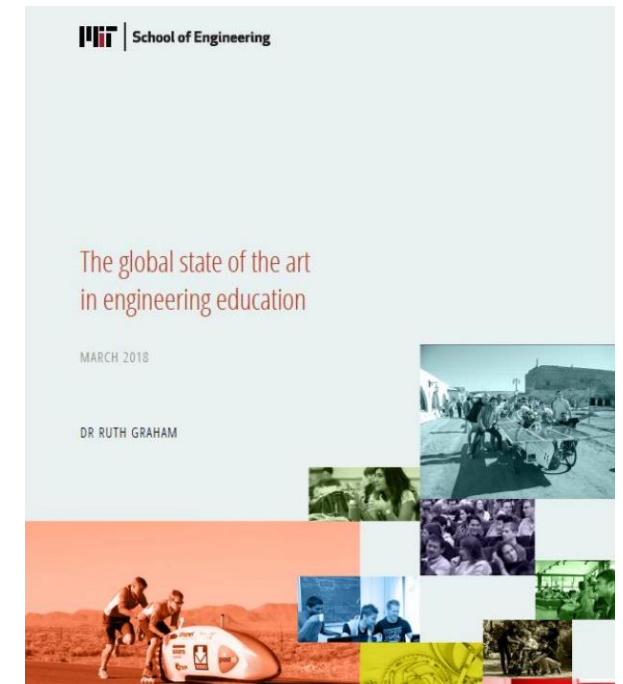


MIT report, March 2018



# *Key challenges to successful STEM HE Institutions*

- Alignment between government and HE goals
- Siloed monodisciplinary structure of many engineering schools
- Promotion systems that are not perceived as rewarding teaching achievement
- Deliver student-centered active learning to large cohorts



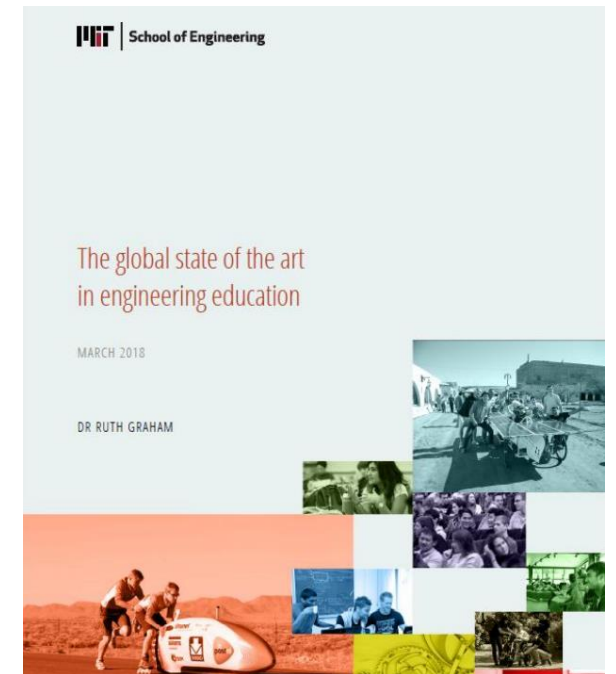
MIT report, March 2018



# *The path to successful STEM HE Institutions*

- Each university is unique
- TU Delft: “Change happens slowly, by consensus, in small steps, spreading like an oil stain”

MIT report, March 2018





*Contigo+ opening session*

*Part II*

*Innovation on HE at UPC*

*Putting students at the centre*

**Francesc Torres (UPC)**

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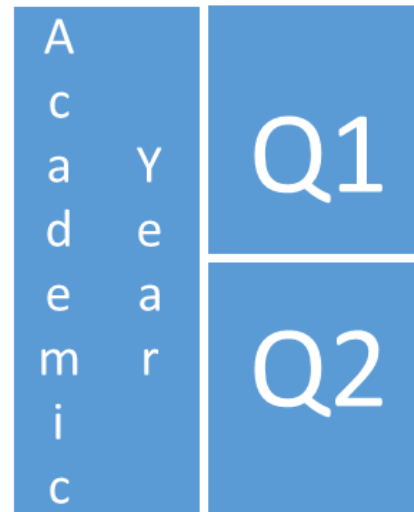


# *Innovation waves on education at UPC*

- 90's-2000:
- Content update
  - Enhance hands-on learning
  - Improve yield and drop-off rates



Labs for education



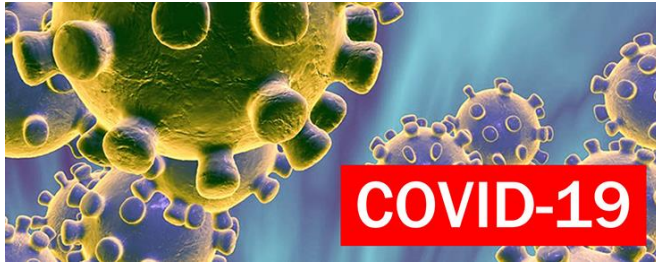
Semestral courses



Academic commissions



# *Innovation waves on education at UPC*



2010-2022: Innovation fuelled by the Bologna process and COVID-19

Pre-Bologna engineering degrees (5 Year-300 ECTS)

Bachelor (4 Year-240 ECTS)



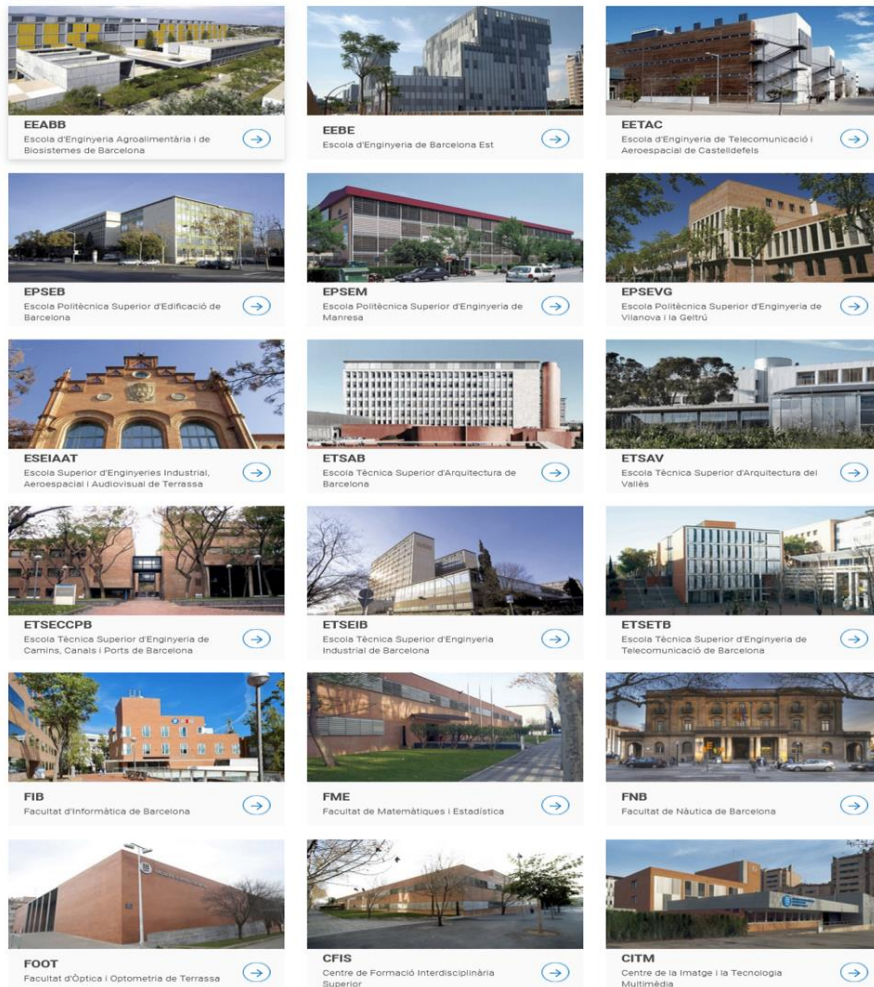
Master  
(90-120 ECTS)



# Large diversity on higher education innovation at UPC

18 centres: 64 bachelor's & 84 master's degrees

Centres docents

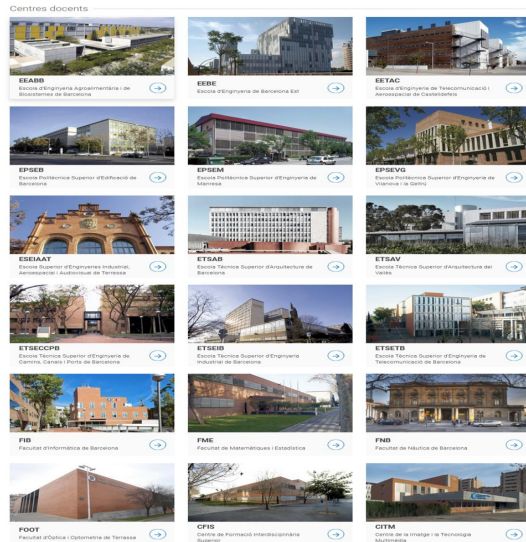


- Engineering, science or architecture
- Large vs small centres
- Bachelor, master and PhD
- Mandatory vs. elective subjects
- Core vs. specialized subjects
- Fundamentals vs. applications



On the way to share:

- Internal workshops
- Group discussion for best practices





# *Putting students at the center?*

Reviewing student roles:



- Learners
- Future professionals
- Future postgraduates

- Evaluators
- Prescribers
- Representatives

- Social beings
- Citizens

- Raw material
- Product
- Clients

Education

Stakeholders

Human

Factory



# *The human dimension*

## **The benefits of a physical campus**

- Corporate culture (profession)
- Sense of belonging and commitment
- Live experiences, informal learning



## **The need for purpose**

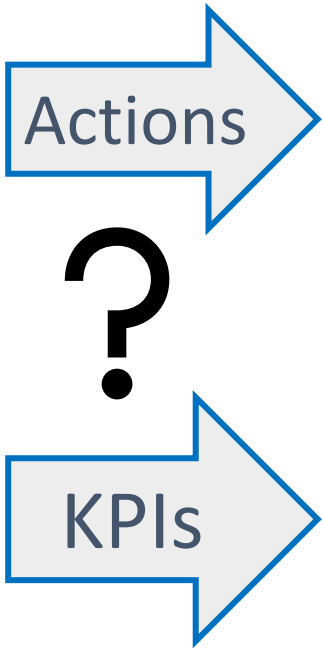
- Well-being, sustainability
- Cooperation, equity
- Contribution to society (self-fulfillment)





# *Putting students at the center?*

## Addressing student role challenges



- Improved focus
- Fill the gaps
- Specific actions
- Better engagement

## **Impact on students?**

Better researchers?  
improved employability?  
Higher engagement?  
Improved enrolment?  
More committed citizens?  
(...)



# *Putting the students in the center?*

Bachelor (4 year-240 ECTS)

Master  
(90-120 ECTS)

Selective  
phase

Intermediate  
phase

Final  
phase

Student needs and  
challenges evolve

**ACTIONS**

**ACTIONS**

**ACTIONS**

**Impact on  
students?**



# UPC approach

Selective  
phase



- Promotion
- Enrolment
- Basics
- Mentoring
- Leveling
- (...)

KPIs

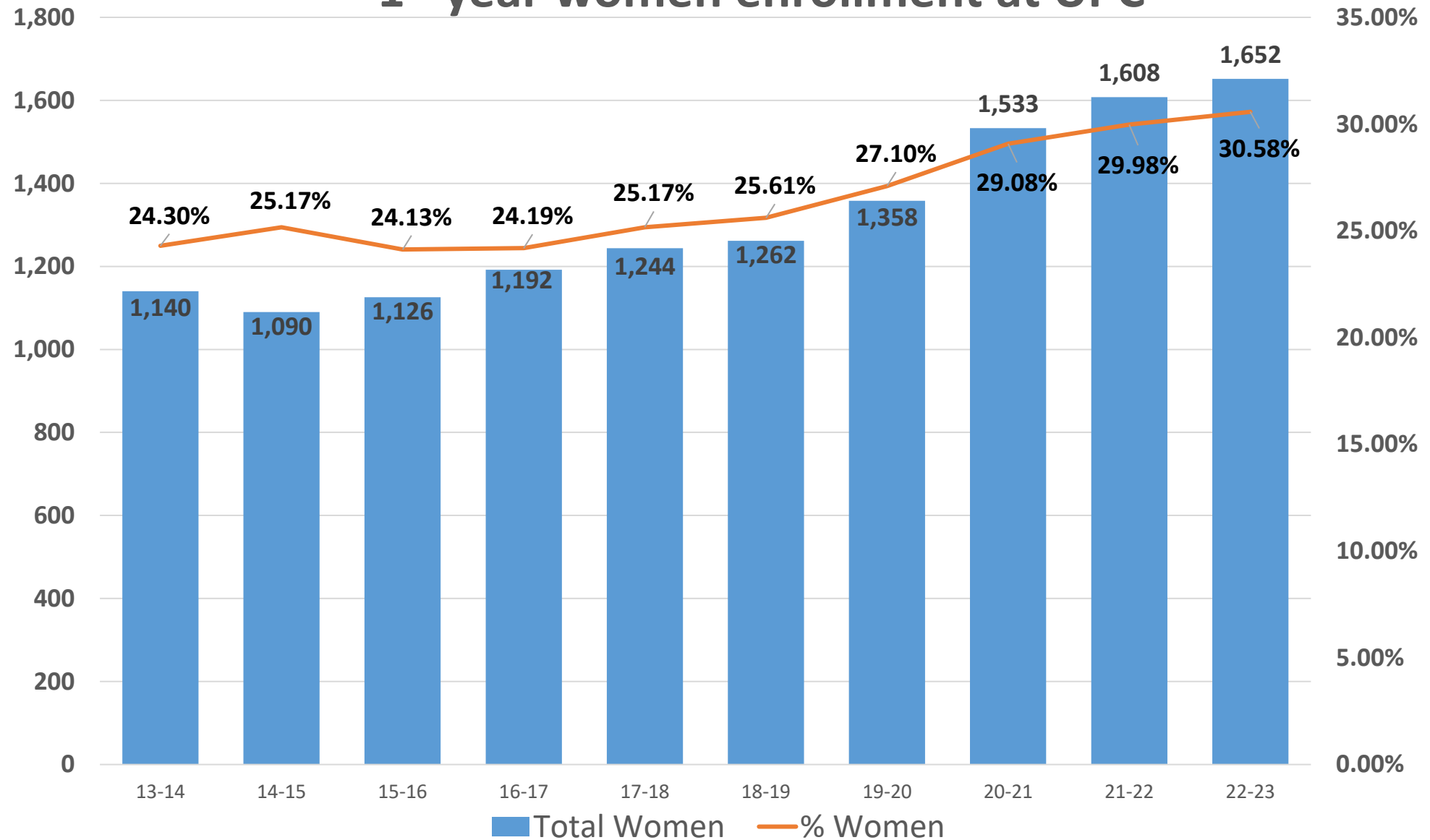


- ☐ Applications
  - Women in STEM
- ☐ Drop-off
- ☐ Yield
- ☐ (...)





# 1<sup>st</sup> year women enrollment at UPC





*Communicate, Communicate, Communicate, Communicate, ...*



We are not evaluated for what we are or what we do,  
but for how we are perceived to be or to do



# Surveys



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Gabinet de Planificació, Avaluació i Qualitat



Agència  
per a la Qualitat  
del Sistema Universitari  
de Catalunya



[www.aqu.cat](http://www.aqu.cat)

## Internal student satisfaction surveys

On-line. Population ~28.000. Participation ~ 35% Yearly

## Satisfaction survey for graduates in the 2020-2021 academic year (by gender)

By phone. Population 3418. Participation 29,3% Yearly

[t.ly/amSK](https://t.ly/amSK)

## Job Placement Survey for Graduates. 2020 edition

Graduates of the promotion corresponding to the 2015-2016 academic year

By phone. Population 4930. Participation 42,2%. Triennial

[t.ly/5ndt](https://t.ly/5ndt)

*Putting students  
at the center*

Meaning

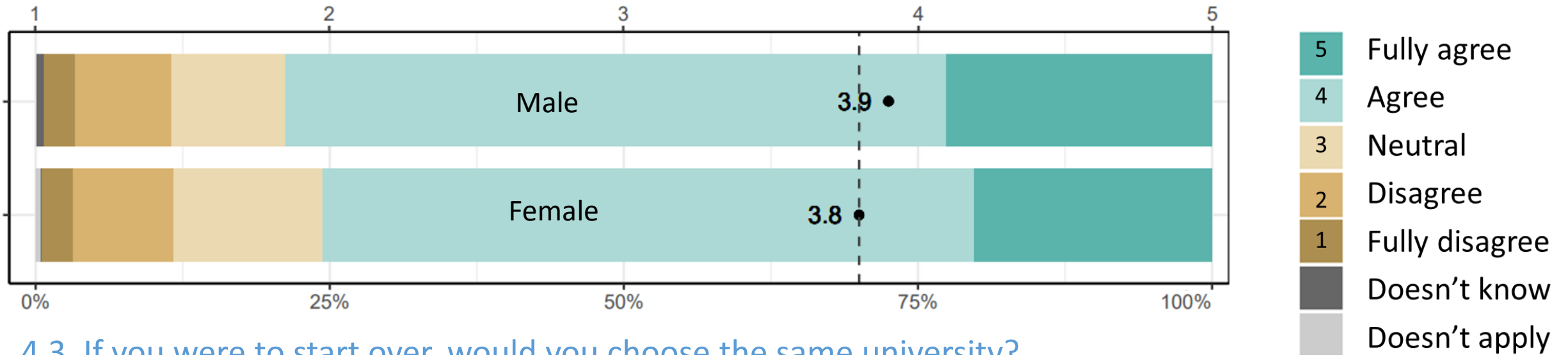
“When I enrolled at UPC I really made a very good personal and professional choice”



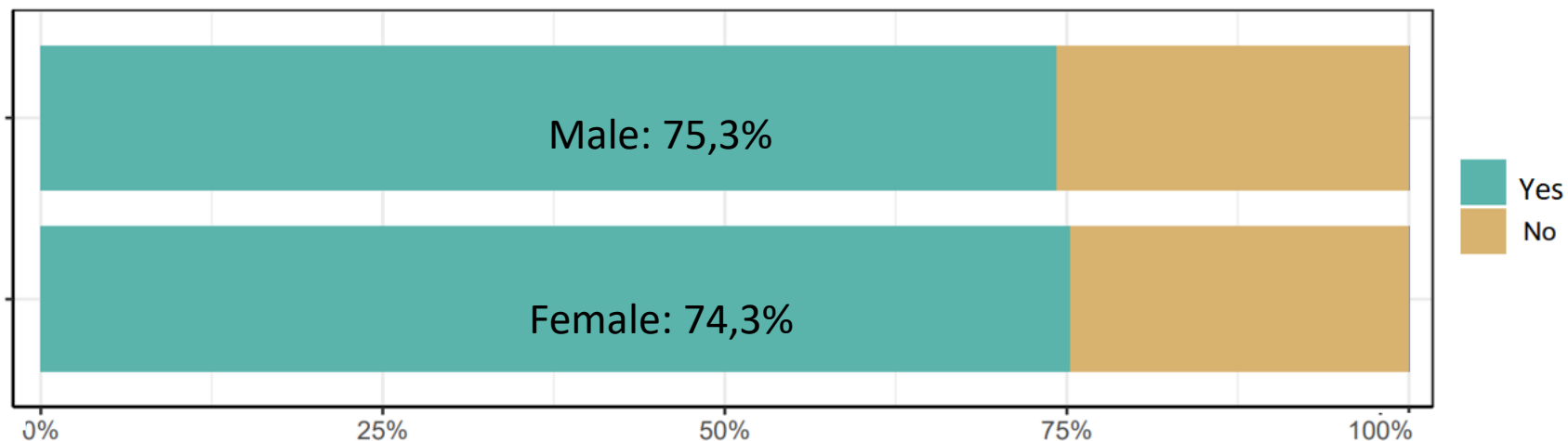
# Satisfaction survey for graduates in the 2020-2021 academic year

By phone. Population 3418. Participation 29,3% Yearly

## 4.1. I am satisfied with the degree



## 4.3. If you were to start over, would you choose the same university?





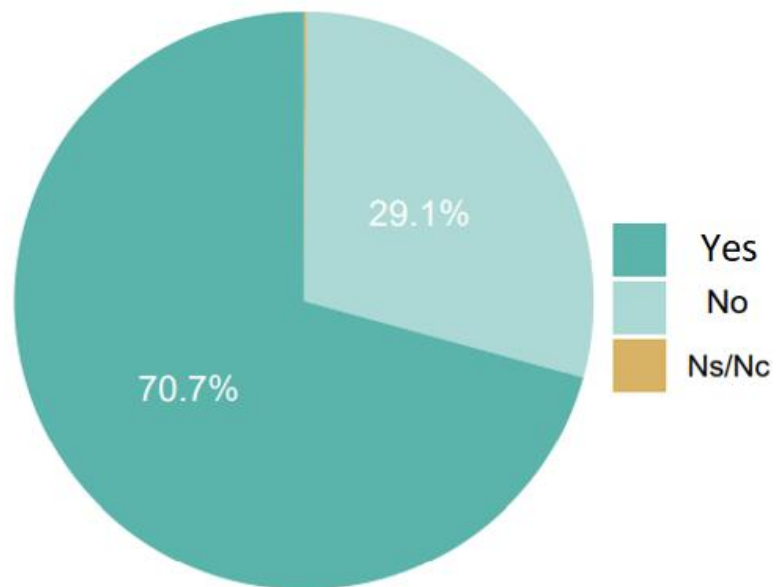
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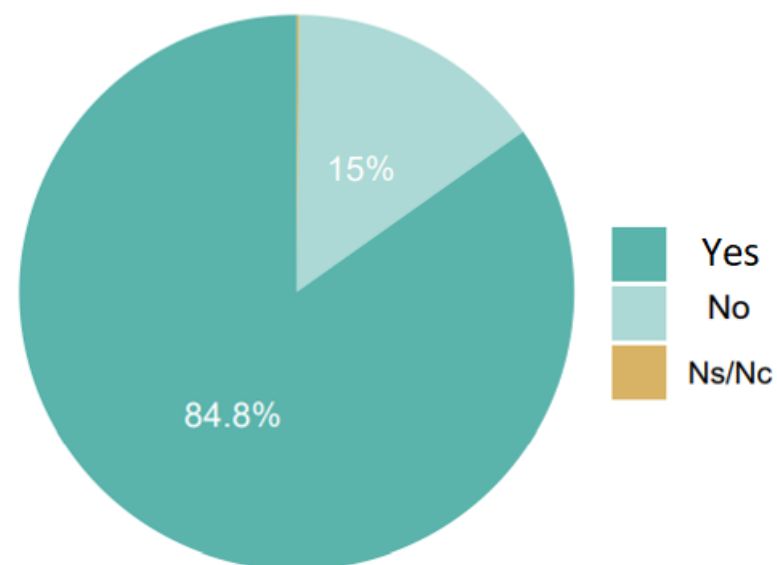
D3. If you had to start over, would you choose the same degree?

	Answers	%
Yes	1472	70.7
No	606	29.1
Ns/Nc	3	0.1
TOTAL	2081	100.0



D4. If you had to start over, would you choose the same center?

	Answers	%
Yes	1765	84.8
No	313	15.0
Ns/Nc	3	0.1
TOTAL	2081	100.0

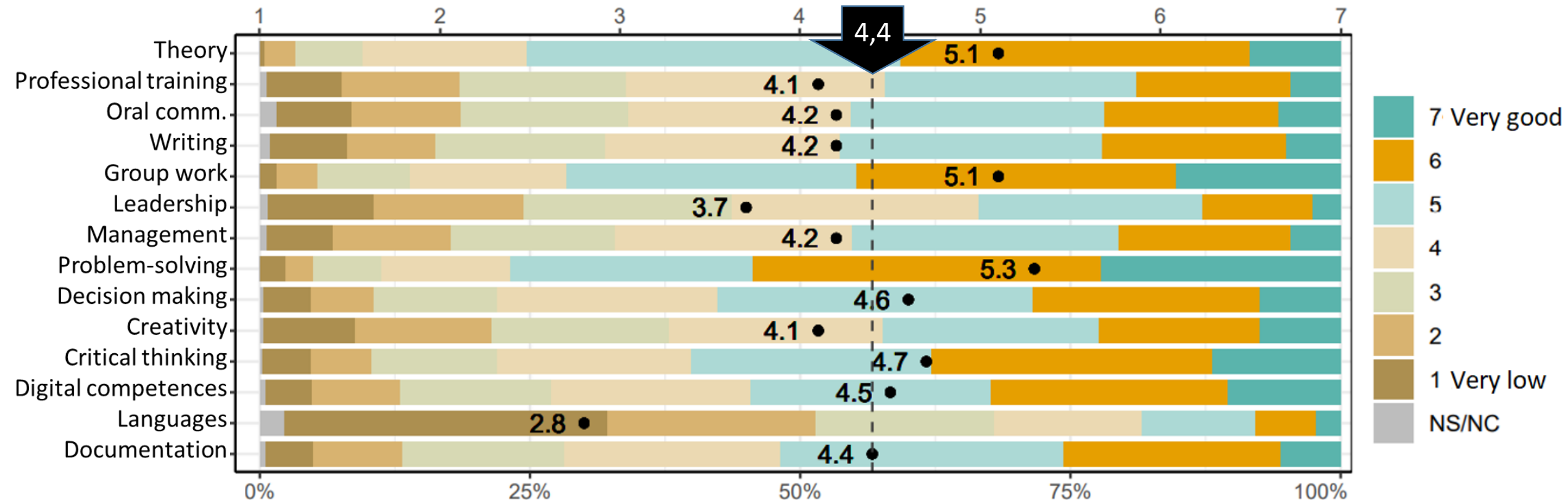




# Job Placement Survey for Graduates. 2020 edition

Graduates of the promotion corresponding to the 2015-2016 academic year

## D1. What do you think of the education you received at university?

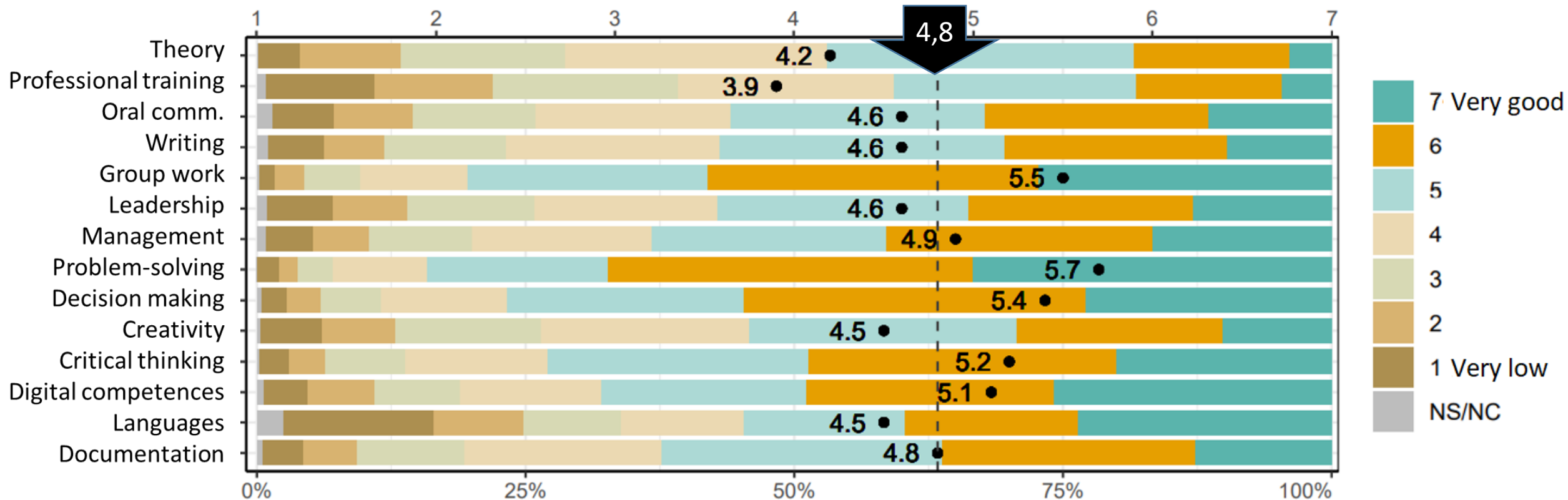




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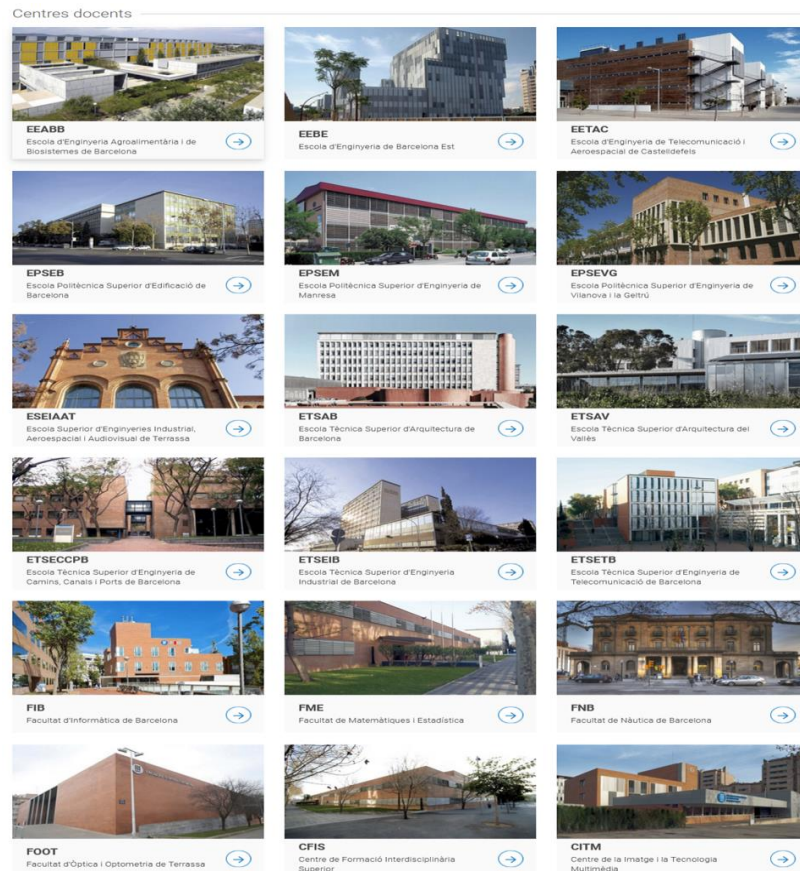
D2. What do you think about the usefulness of the education you received at university for your job?





# UPC organizational model

*Evolution from centralized direction ...*





# *UPC federal model*

*...to a distributed leadership and management model*

**Jazz band**



- Agreement on high-level principles and goals
  - High degree of freedom and trust
- Co-responsibility:
    - Transparency
    - Accountability



# Conclusion

*The energy is out there*

*“Take the energy  
from your opponent”*

