Benchmarking Design Research Groups

Chavi Mangla
1005803

Table of Contents

01 **Introduction**

Glance through benchmarking

02 **Methodology**

Benchmarking framework

03 **Data analysis**

Using benchmarking metrics

04 **Findings & Conclusion**

Final words

01

Introduction

Mission Statement

Performing a benchmark study on Design Research groups around the world

02

Objectives

Objectives of Study

1. Understand existing Design Research groups
2. Analyze and evaluate performance
3. Understand and evaluate the current position of our research group
4. Compare our research group with its competitors

Benchmarking Process

Data Collection

Websites, Emails, Videos, Brochures

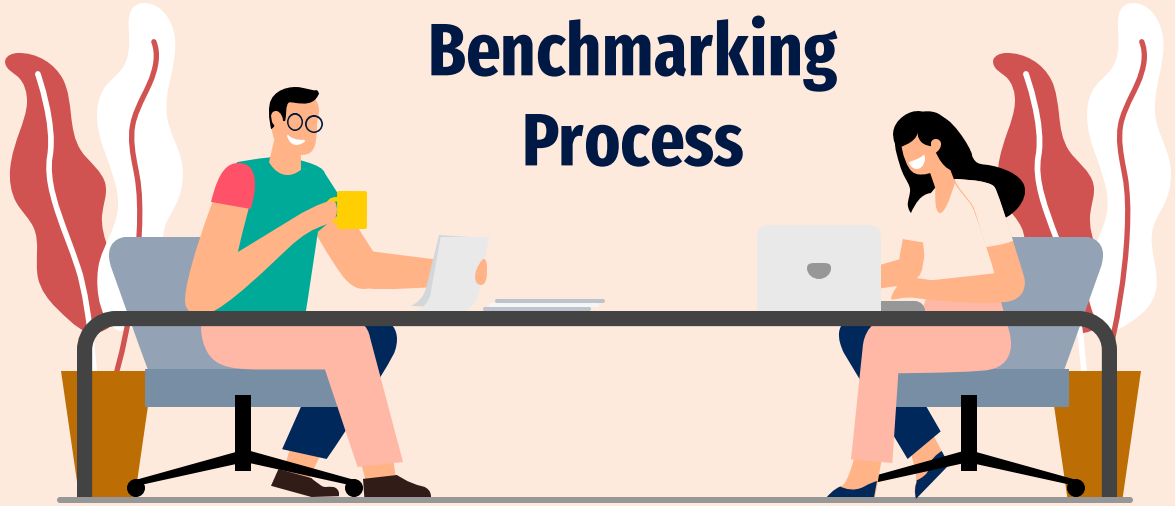
Data Analysis

Using spreadsheets to synthesize data

Key Findings

Insights & Perspectives

Benchmarking Process

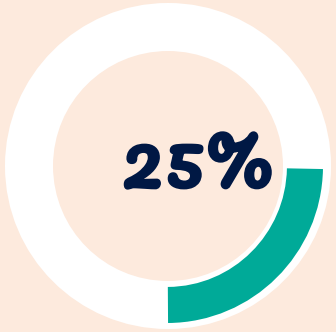


*Literature review was out of scope for the UROP

Data Collection

Research groups data updated & contacted

- Created a **spreadsheet** compiling the data received from the **website**
- Direct **correspondence** with the research group's director/dean or communications staff through **emails**
- Sent them **compiled** information retrieved from their **website**



Response Rate

- Around 15 groups **reverted**
- Seeking **clarifications** on the project/**verifying** the information sent
- **Spreadsheet** divided into 3 parts – Data **verified by email**, Data updated from **website only**, Data updated in **2014**

Verified Data on research group

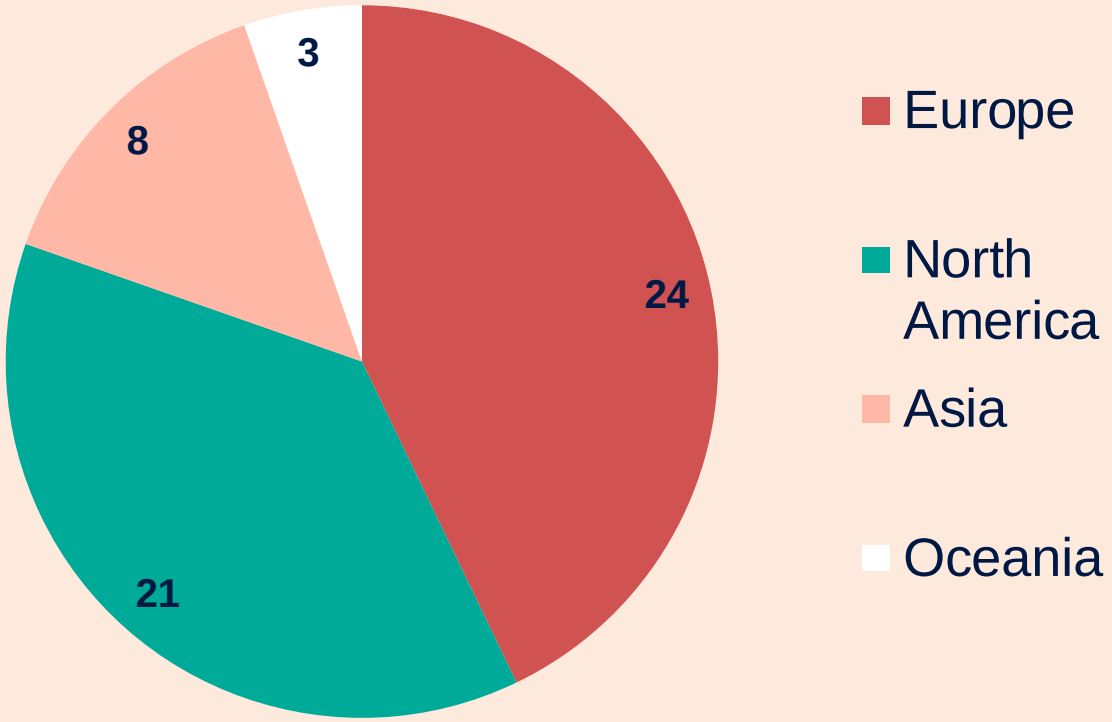
- **Updating** the website information with verified data from emails
- Compiled data **verified** from website and missing information **provided**

Research groups that provided verified data

Product Development Group Zurich ETH Zurich, Switzerland	**Product Development and Lightweight Design** Technical University of Munich, Germany	**think[box] Institute for Collaboration and Innovation** Case Western Reserve University, USA
International Design Institute Zheijhang University, China	**Industrial Engineering Laboratory** CentraleSupélec, France	**Institute for Product Development and Machine Elements** Darmstadt University of Technology, Germany
KTmfk Institute of Engineering Design University of Erlangen, Germany	**Innovation, Design Study and Sustainability Laboratory (IDeaS Lab)** Indian Institute of Science, India	**Chair of Design and Product Development Laboratory for Engineering Design CADLab** University of Zagreb, Croatia
Integrated Design Innovation Group Camegie Melon University, USA	**Centre for Design Innovation** Swinburne University of Technology, Australia	

***More information can be added gradually to this data & the current data may some discrepancies too**

Region-wise distribution of research groups
(Considered in this Study)



- Europe has the **highest** number of research groups across the four regions
- Almost **43%** of all research groups are in Europe
- More groups could indicate higher **student & faculty concentration** & **research output focused on Design** (publications, accolades etc.)

Data Analysis

Analysis Framework

01

Research Group Identification

- Using a standardized criteria to identify existing research groups

02

Determining Staffing Structure of Research Group

- Student & Faculty demographics, research areas

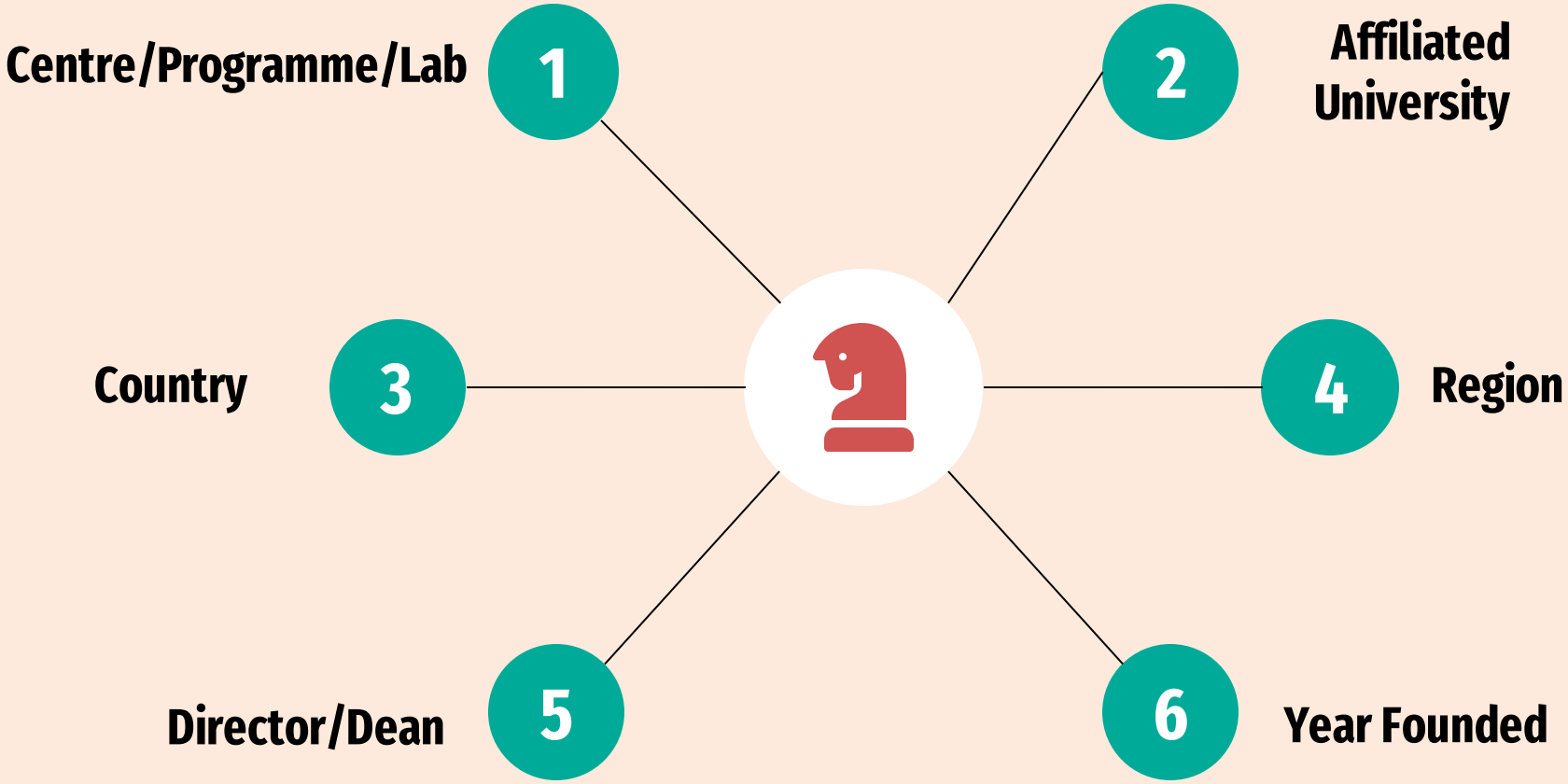
03

Analysing performance of Research group

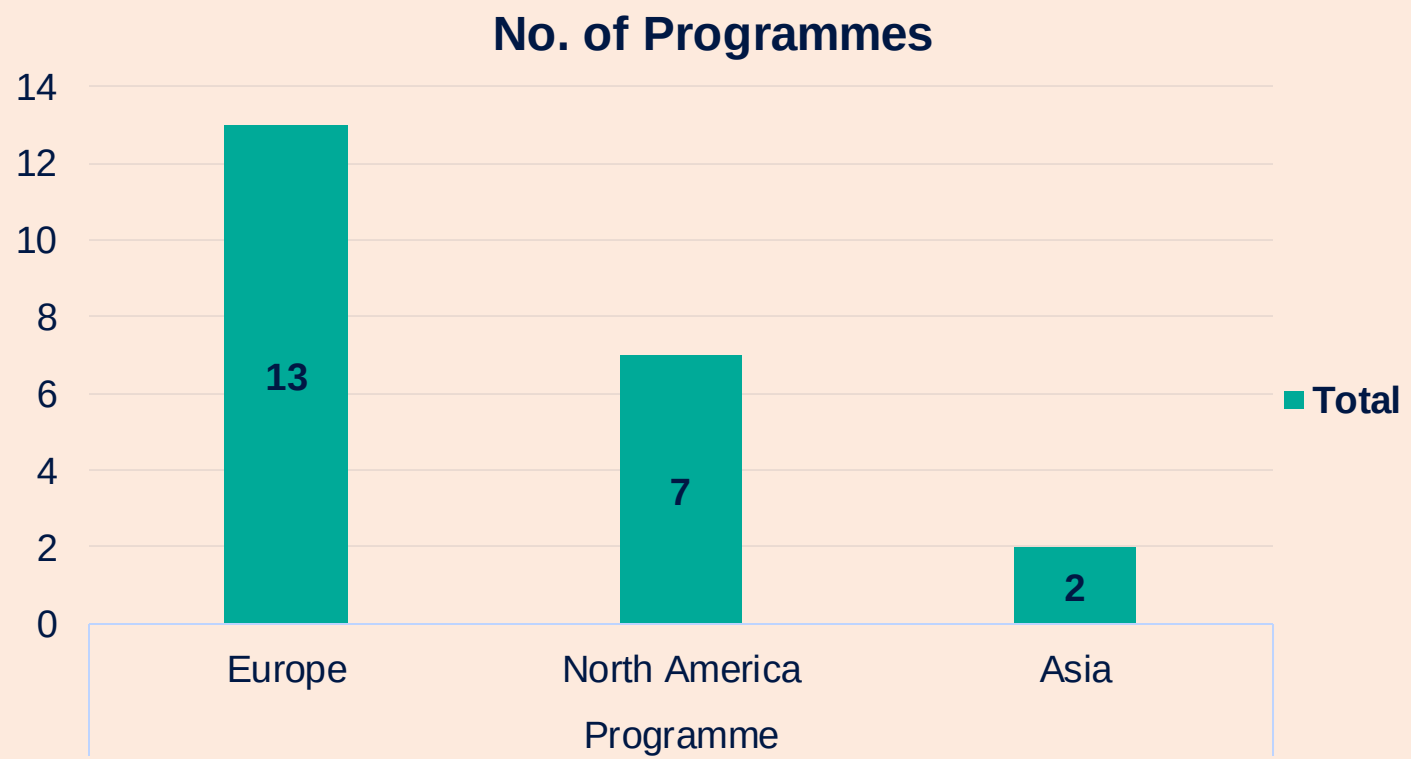
- Research output, accolades, grants

Identification of Research Groups & Topics

Design Research Group Identification

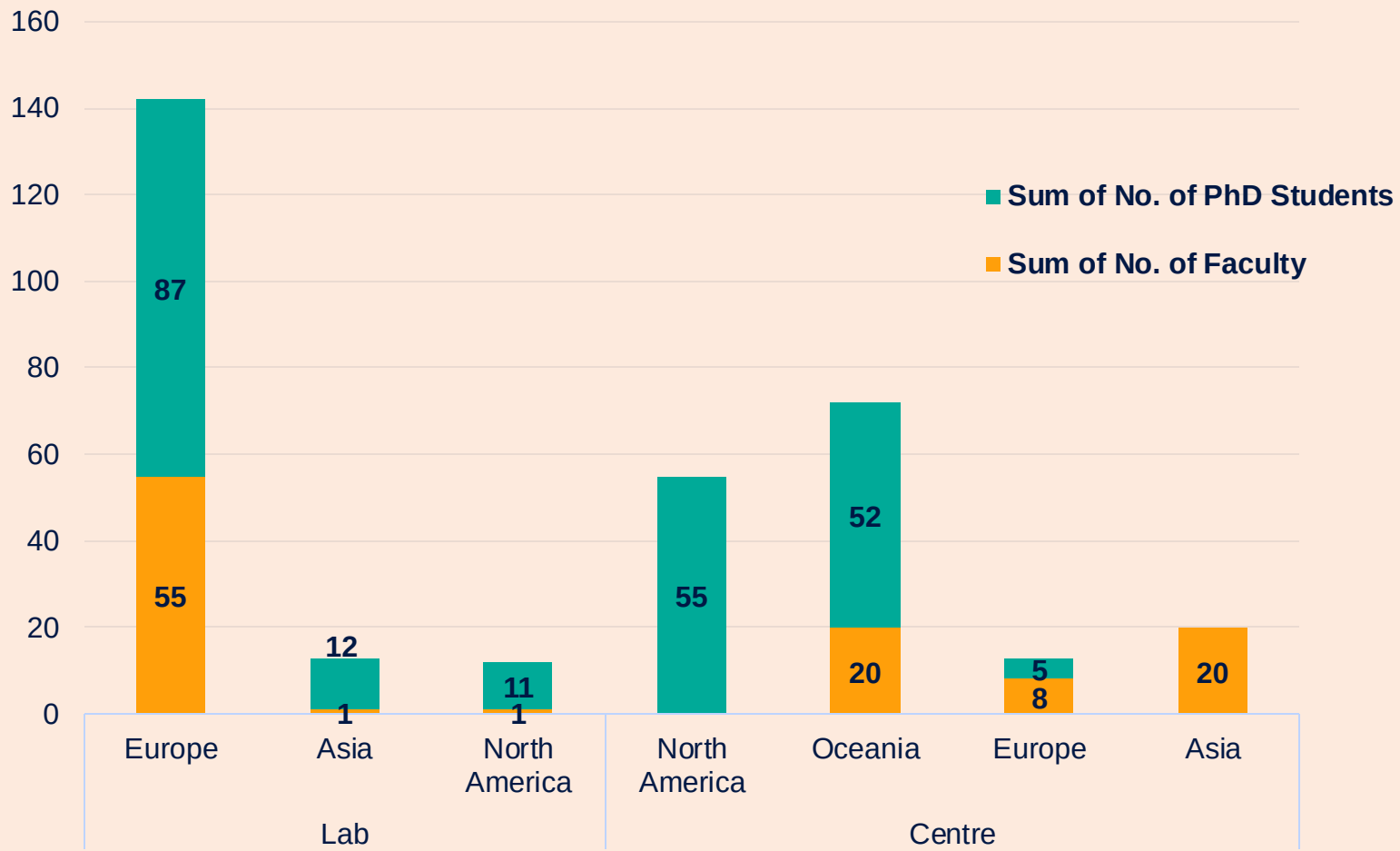


Defining Progammes



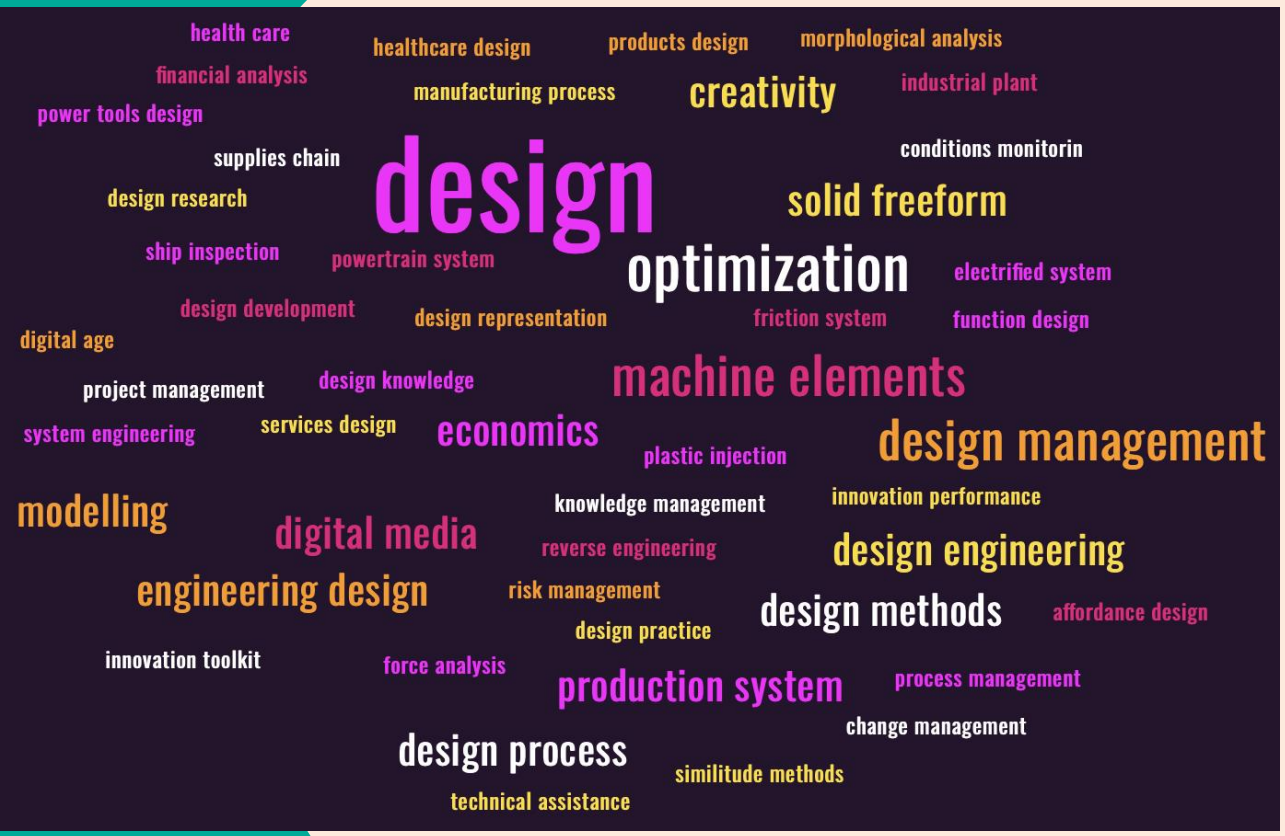
- Programmes offer a **course** of study which can be **undergraduate** or **postgraduate** to attain a degree or a specialization
- European groups offer the **highest** number of courses of study in context of design & research
- Higher number of programmes also indicates more **faculty** & **students** involved

Defining Centres and Labs



- We compared centres and lab by considering their **manpower**.
- Labs in **Europe** hold more significance, having more faculty and PhD students
- **Centres** are of larger size typically in North America, Asia and Oceania
- Depending upon the research group, the **core values** of the group could differ as different groups hold **varied significance** & involve different number of people in different regions

Topical Areas Of Research



2014

2021

Most Common Topical Areas

2014

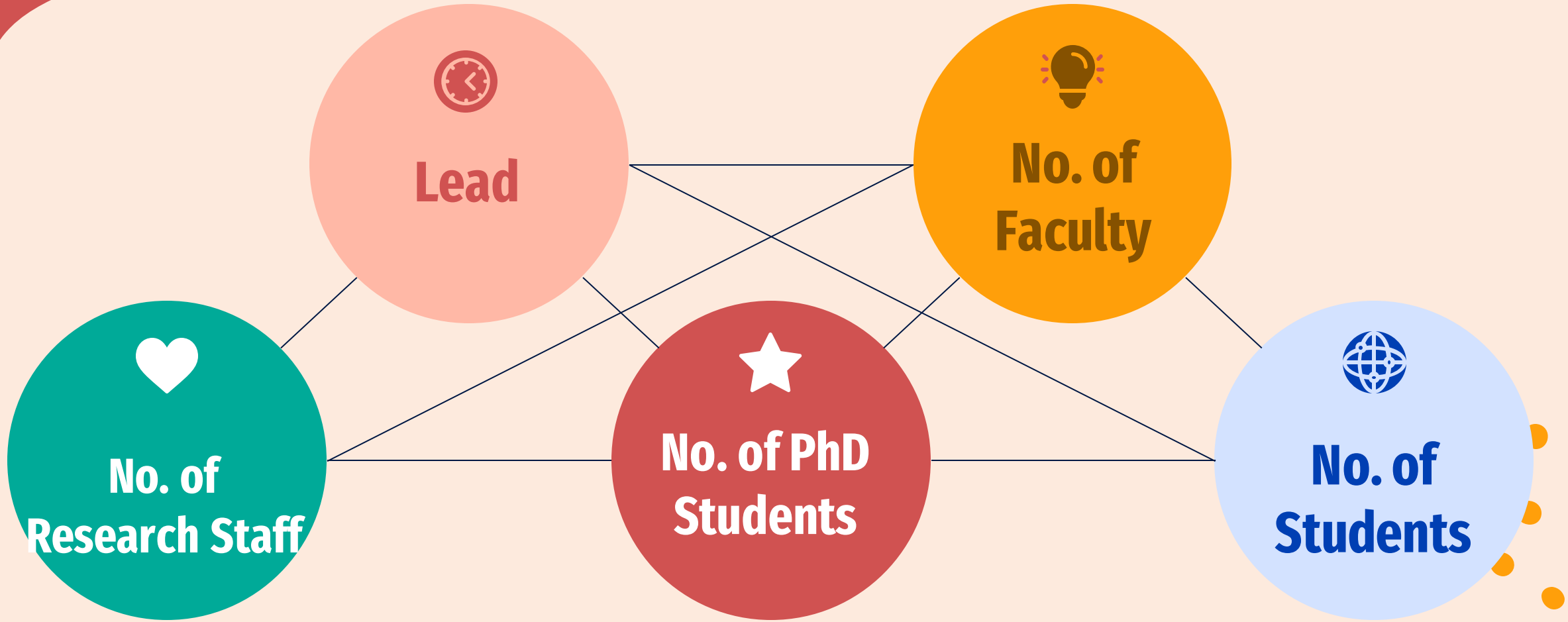
- Design
- Design Management
- Machine Elements
- Optimization
- Design Management
- Modelling

2021

- Design
- Design Thinking
- Mechanical engineering
- Innovation
- Management
- Product Development

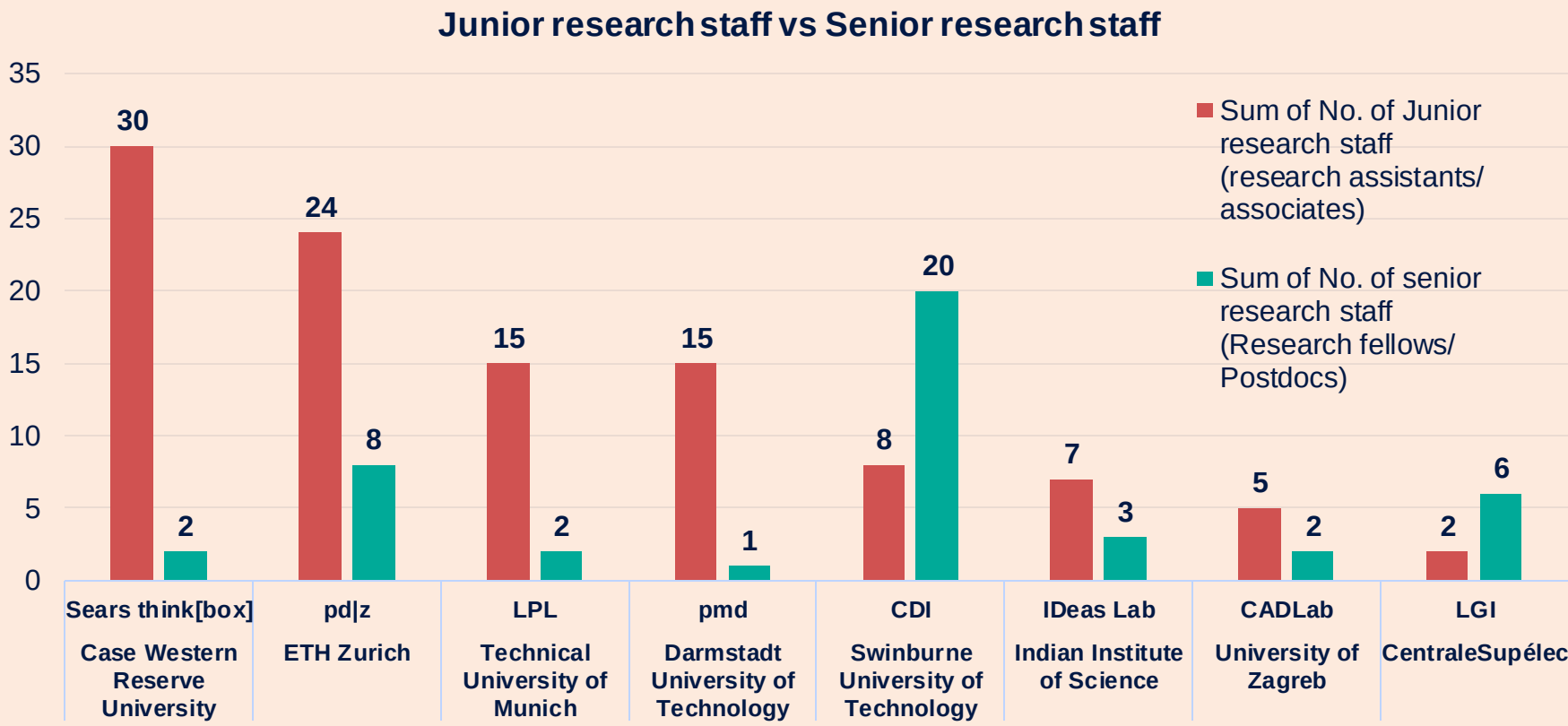
Staffing Structure

Staffing Structure of Design Research Groups

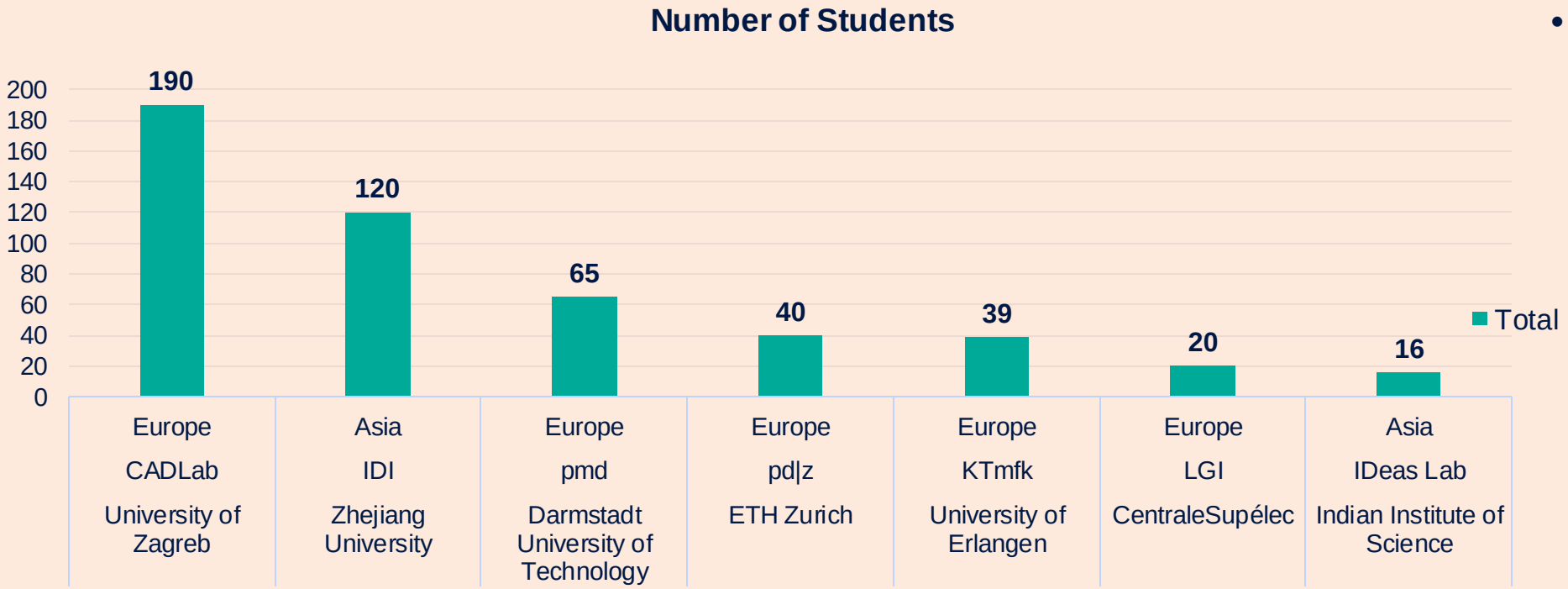


Research Staff

- **Junior** Research staff – research assistants or research associates
- **Senior** Research Staff – postdocs or research fellows
- The number of junior/senior research staff gives an indication on the experience of the staff
- Majority of the cases have more Junior Research Staff which could indicate that **more projects** are take up by lesser experienced staff
- The staff strength & experience gives an insight on **publications** & **accolades** for the research group

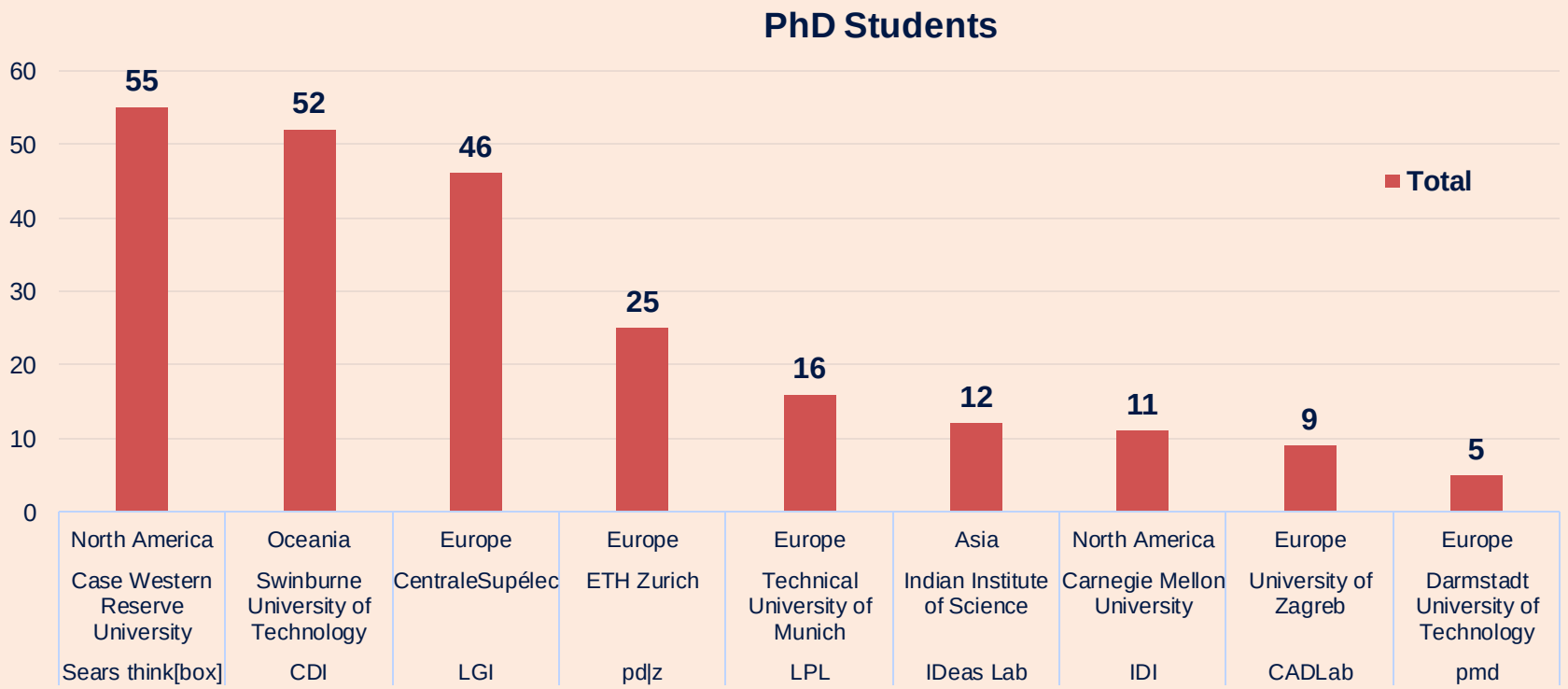


No. of Students



- Students that are **currently enrolled** as an undergraduate or a postgraduate student
- **European** groups have the highest number of students enrolled which could also indicates why they have **highest** number of programmes

No. of PhD Students



Considered in this study –

- Current PhD students **active** in the research groups and carrying out research
- Majority of the research groups with PhD students are in **Europe** while groups in **N. America** and **Oceania** have the highest number of PhD students
- This number could be an indicator of the **research output** from the groups in terms of publications, number of research projects, accolades etc.

European Institutions' Analysis

(based on verified dataset)

72% of all UG + PG students involved in European design research groups

57% of all PhD students enrolled in European design research groups

59% of all research staff (Junior & Senior) in European design research groups

In terms of PhD students, research staff and number of students, European institutions assert dominance

Benchmarking performance of Research groups

Analysing Research Performance

Research Projects	Ongoing and Completed Projects
Accolades	Accolades won by faculty/students or Research Group
Publications	Journal Papers, Conference Letters, Books
Grants	Industrial and Competitive grants

Benchmarking metrics

Ongoing & Completed projects

Faculty strength & No. of accolades

Students & No. of accolades

Research Staff & No. of Accolades

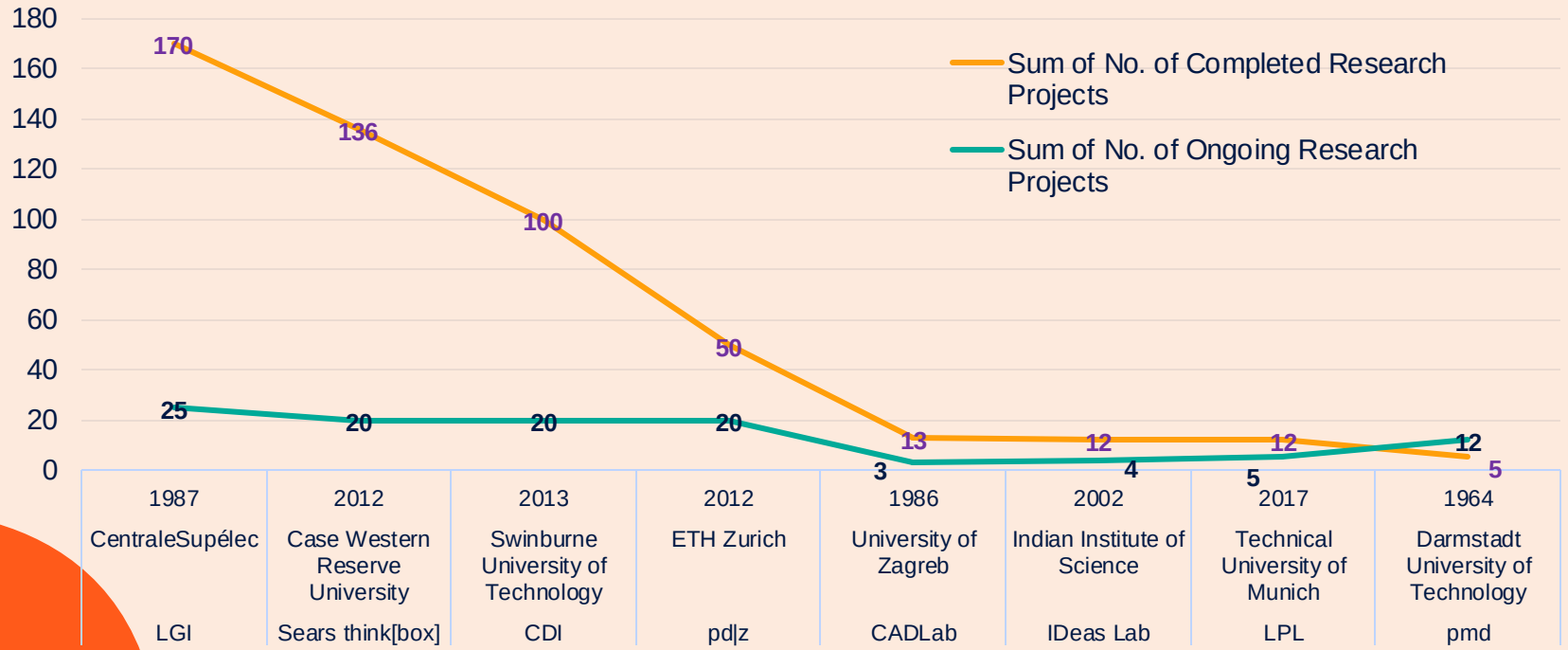
PhD Students & No. of Publications

Research Staff & No. of Publications

Competitive & Industrial grants

Ongoing & Completed Projects

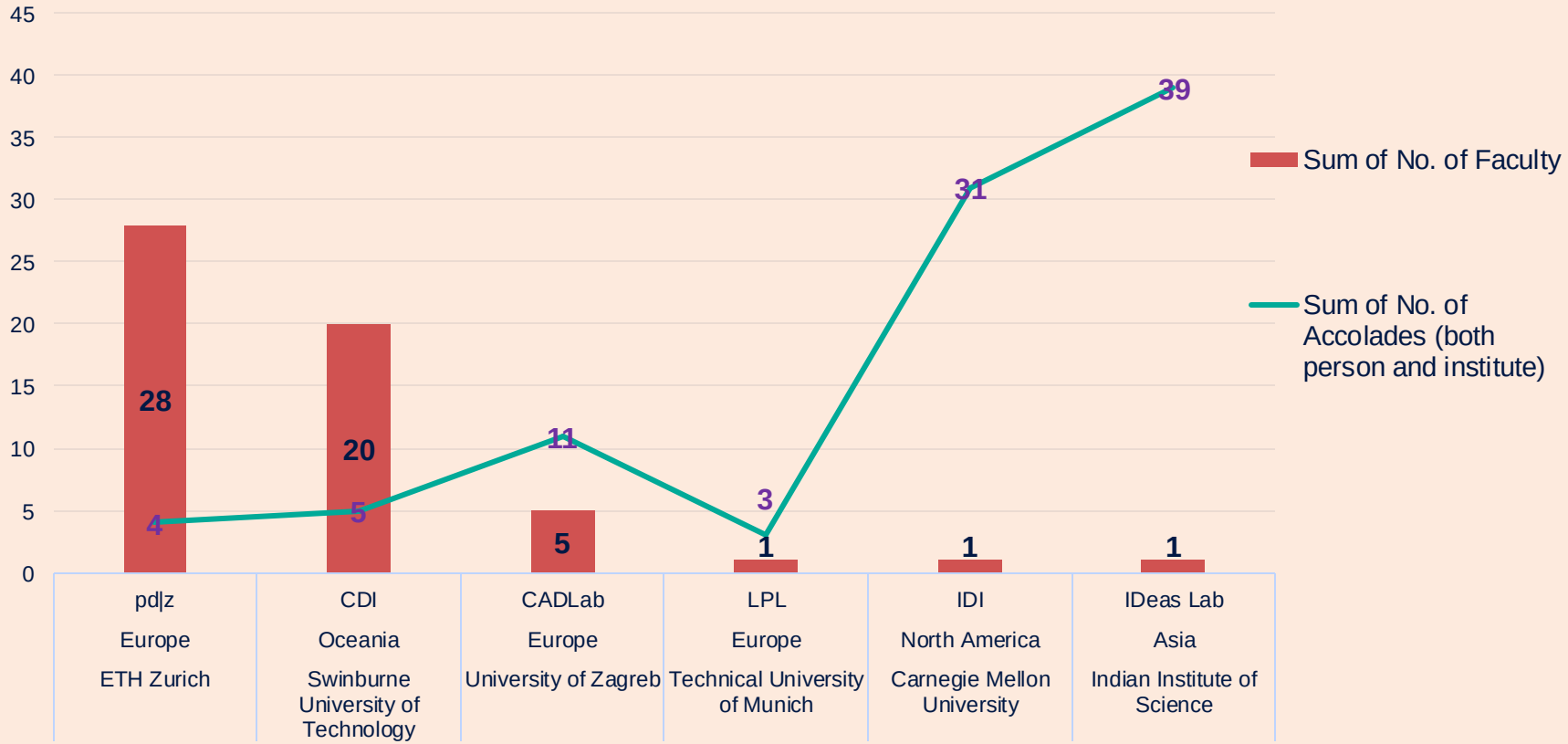
(based on verified dataset)



- The **older** research groups do not necessarily have the most of number of completed projects.
- Newer groups such as think box have completed **more projects** than pmd.
- Higher number of **ongoing/completed** projects indicates that more student, researchers, or faculty is involved, and number of **publications** is higher too

Faculty Strength & No. of Accolades

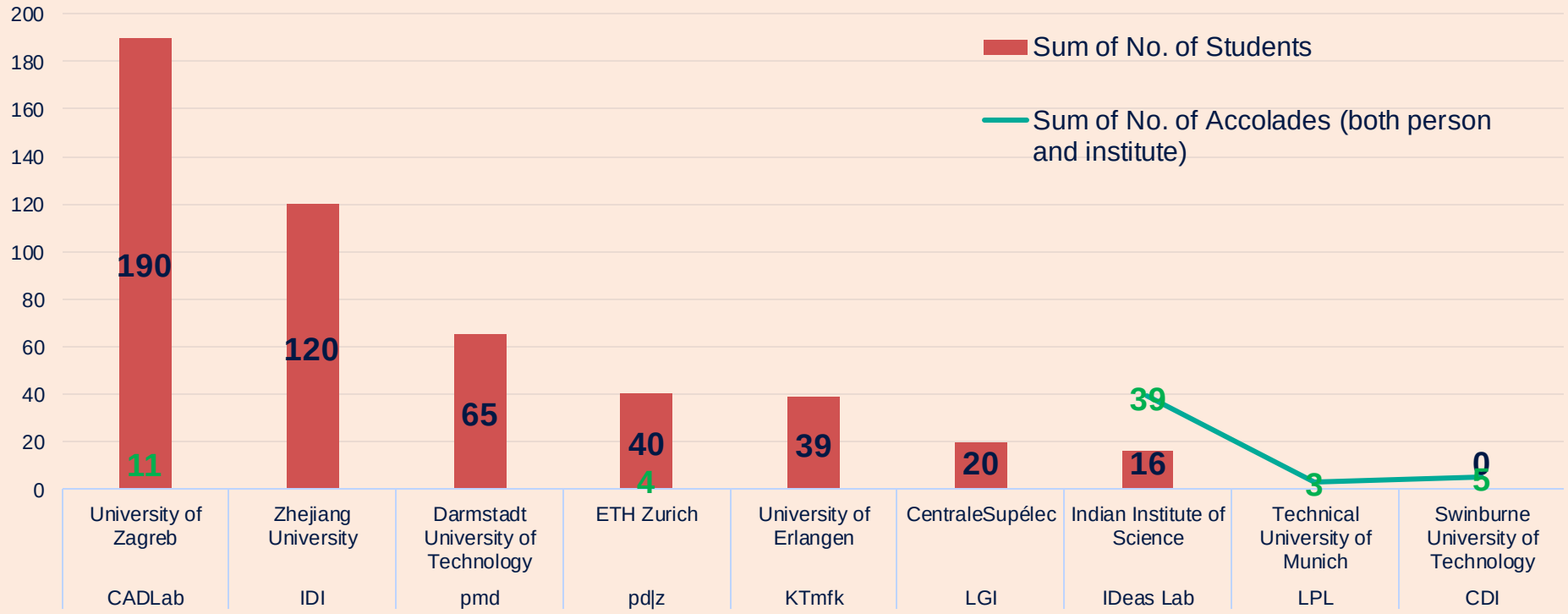
(based on verified dataset)



- Accolades won by **group** or **staff/ students**
- Higher number of faculty doesn't imply more **accolades** won
- Research groups in N. America and Asia have the **least** faculty, but **highest** accolades won
- Lesser accolades could be due to lesser **research output** (publications & projects) produced because of less students or research staff active in the group

Students and Accolades

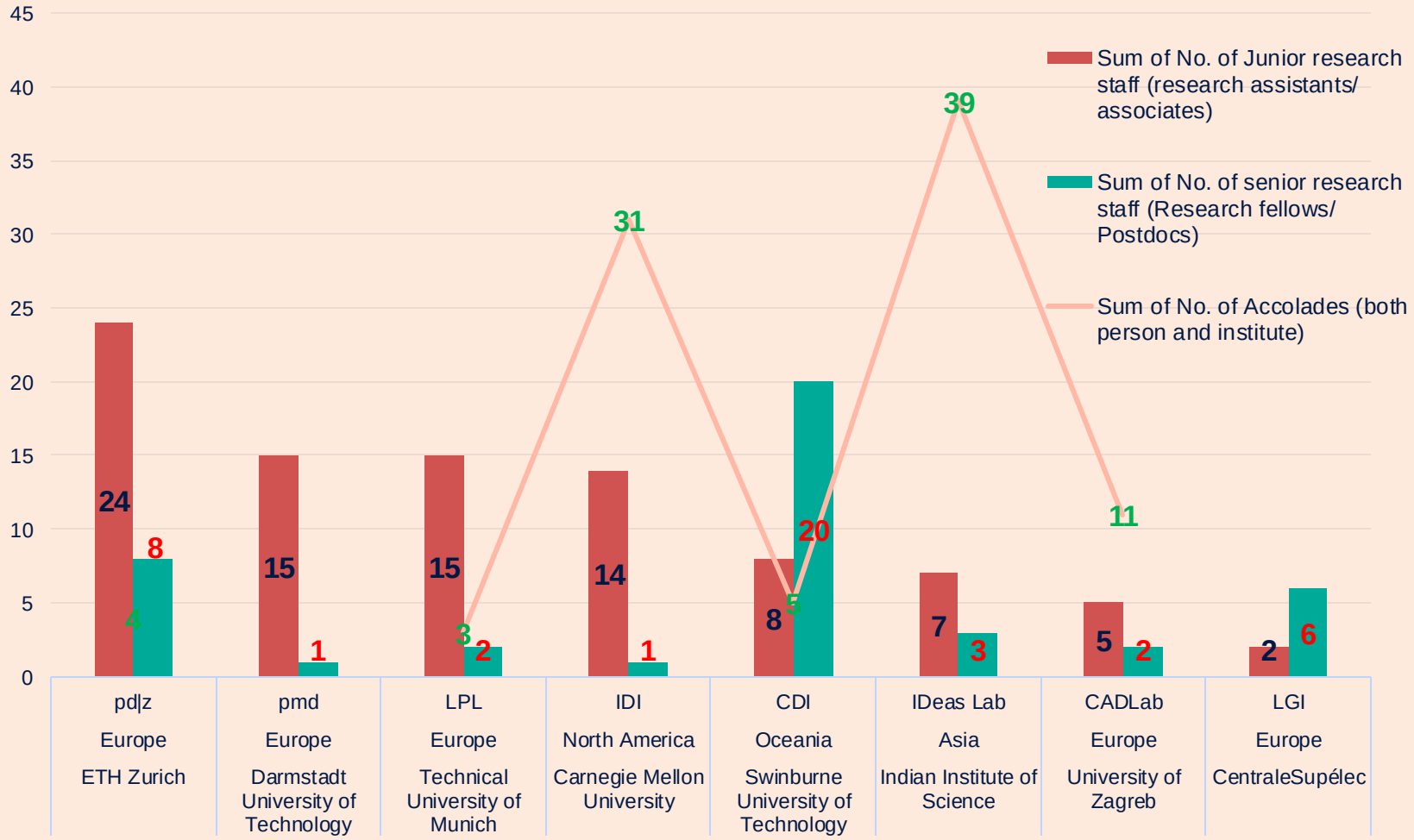
(based on verified dataset)



- High number of students **doesn't necessarily** imply higher accolades
- Accolades could depend on multiple other criteria such as **research output** & the **research staff** engaged wherein students may not be involved

Research Staff and Accolades

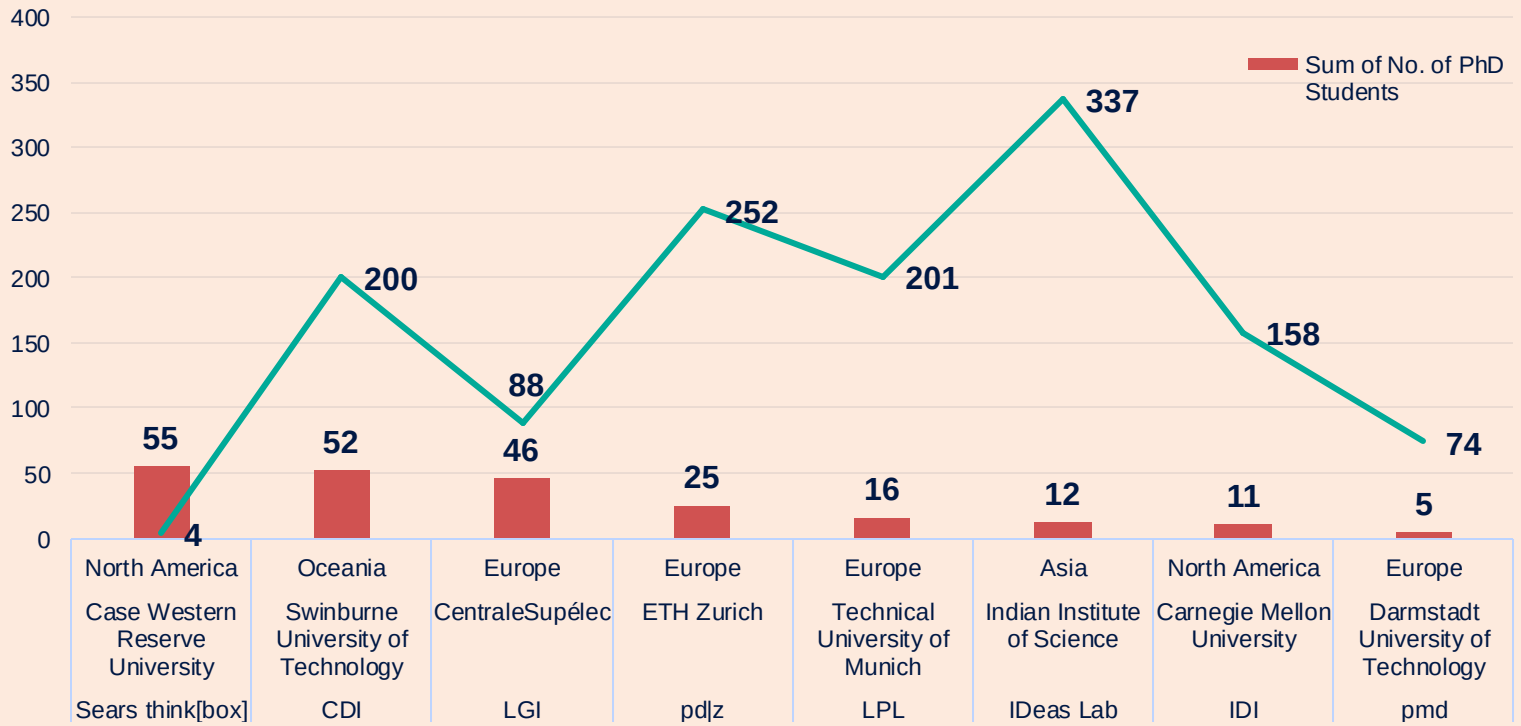
(based on verified dataset)



- Research groups having the **highest** accolades are in mainly **Asia** and **N. America**
- **European groups**, even though highest in number do not have the highest accolades
- In general, **junior research staff** is more dominant in these institutions which could imply their lower accolades strength
- **CDI** in Swineburne has more senior research staff, but lesser accolades received
- Accolades could also mean what the research group's **focus** is as high number of accolades help newer institutes to gain recognition faster

PhD Students & Publications

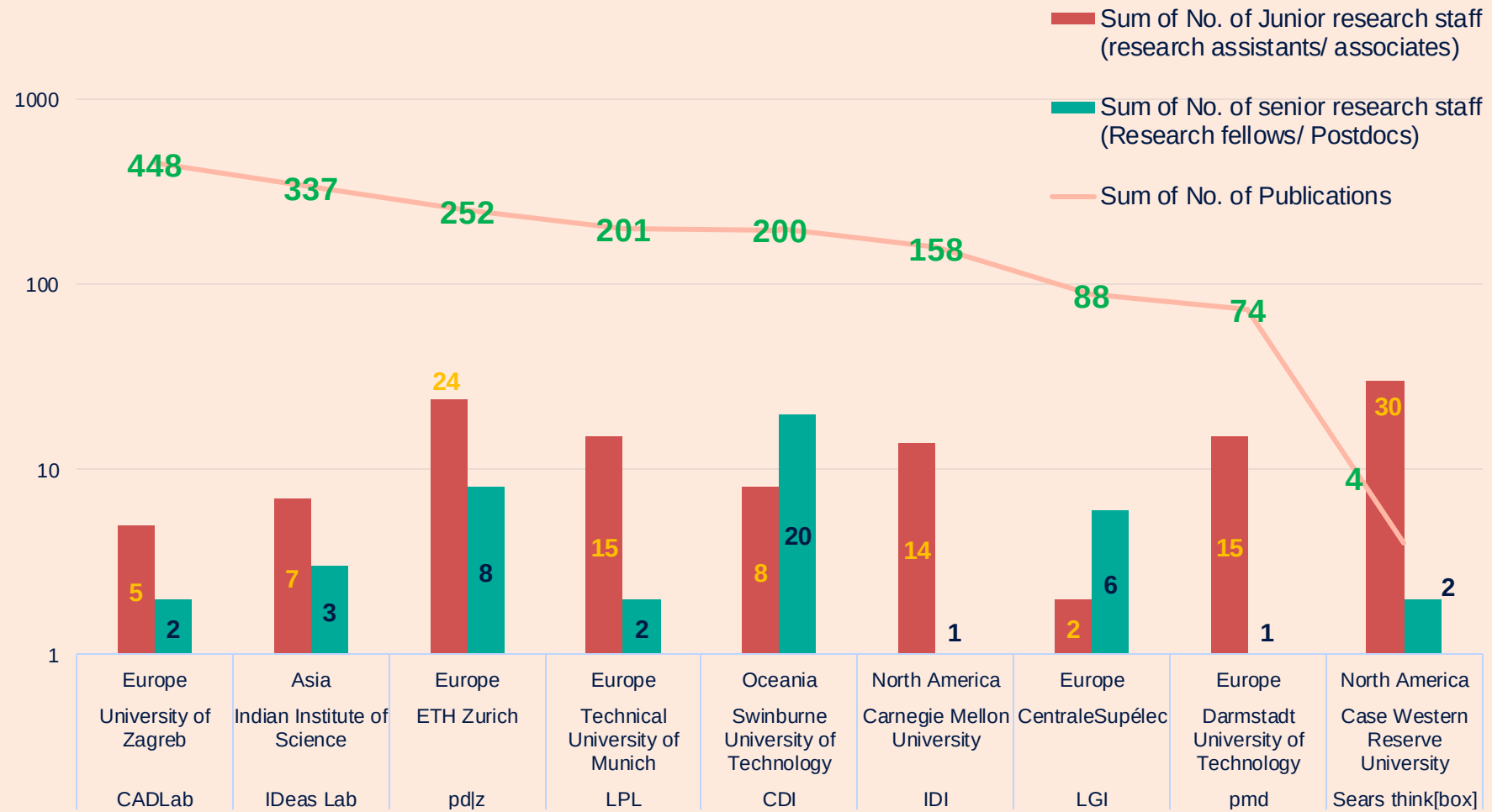
(based on [illegible] data)



- Research groups with **high** number of PhD students can have **low publications too**, which can tell about what the groups focuses on.
- **IDeas Lab** outperforms its counterparts by having the highest number of **publications** with one of the least number of PhD students, which could imply their focus on **research output - publications**.
- More PhD students doesn't necessarily imply more publications out as seen in the case of **European institutes**
- PhD students could have different **focii**, research projects that do not involve publications

Research Staff & Publications

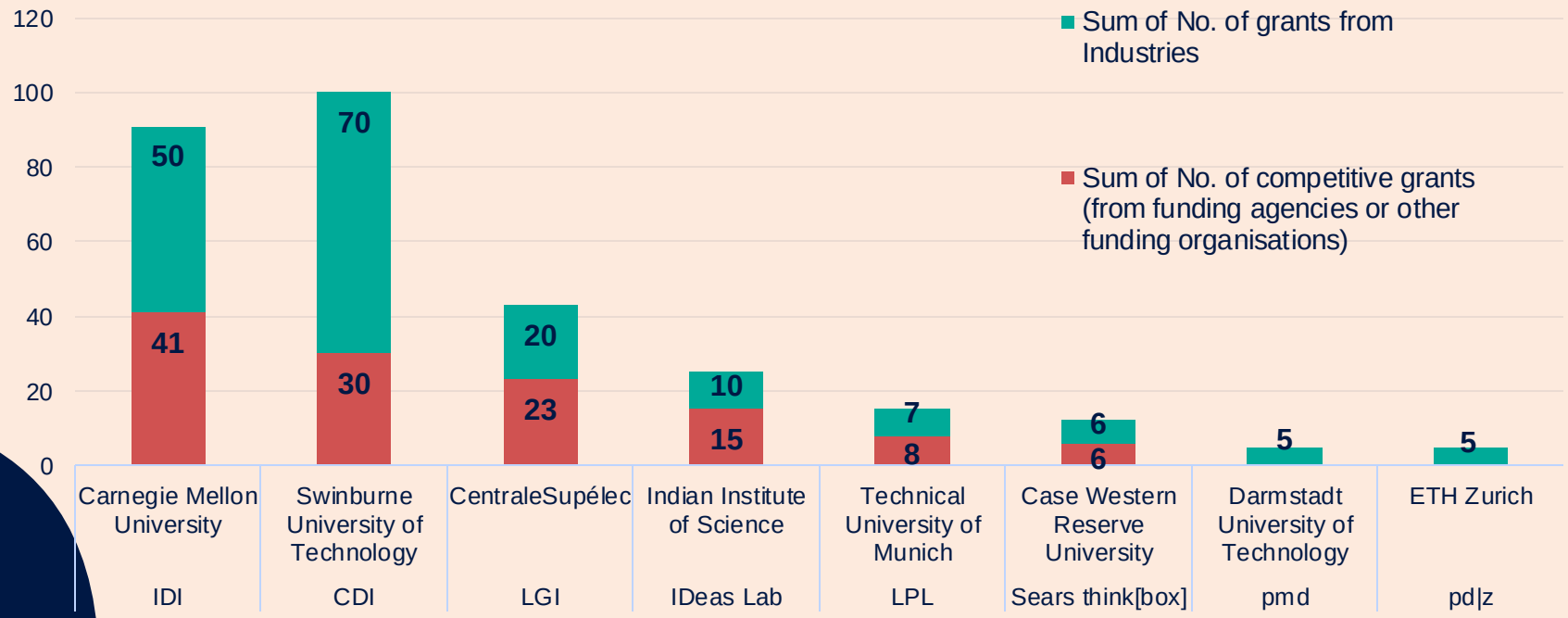
(based on verified dataset)



- Publications **aren't proportional** to the number of research staff
- Institutes with **low research staff** generally have a higher publications output
- Institutes with more **junior research staff** relative to senior staff, generally have **more publications**
- Research groups in **N. America** have publications below the overall publications average of this dataset **(198.66)**

Competitive & Industrial Grants

(based on verified dataset)



- A **comparison** to get an insight on how much **grants** are received by a research group
- **Industrial grants** involve grants by companies
- **Competitive grants** involve grants from funding agencies, government agencies, or funding organizations
- **Majority** receives grants from industries

Analysis of grants

(based on verified dataset)

Industrial Grants

Centre

Lab

Competitive Grants

***The dots represent percentage of all the verified data with each a value of 10%**

Analysis of research performance

(based on verified dataset)

		Publications	Accolades	Grants	Completed research projects
Labs		52%	94%	61%	45%
Centres		48%	6%	39%	55%

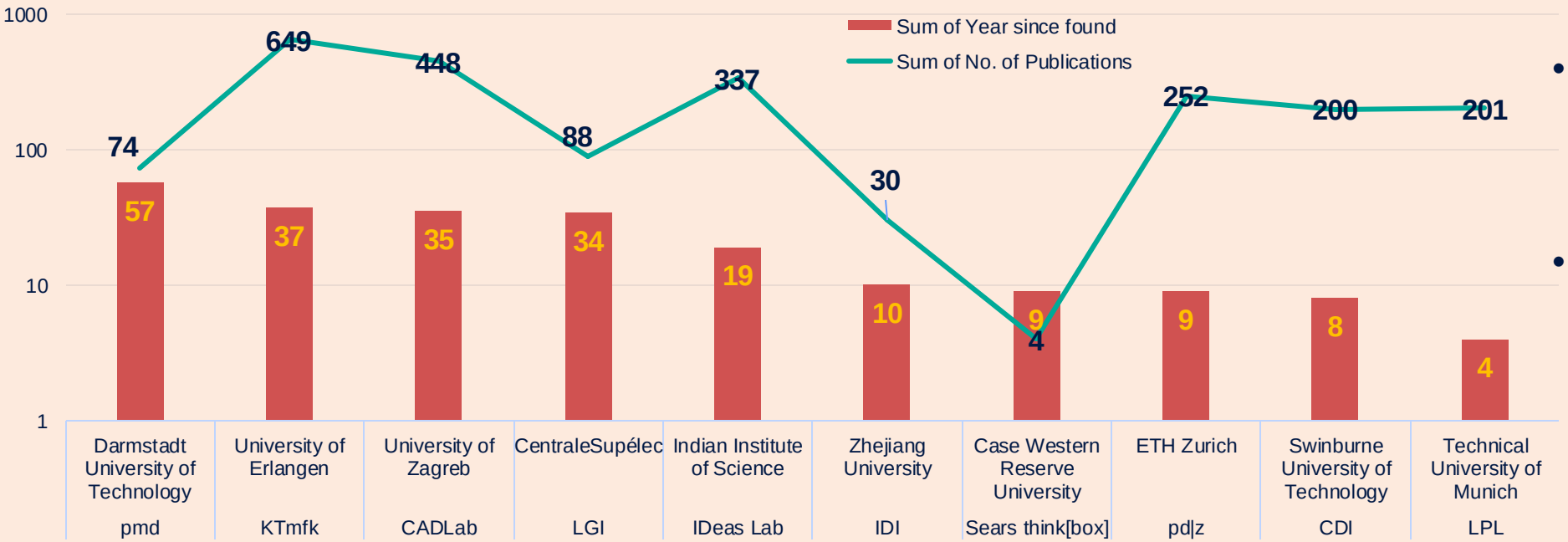
Accolades/Years since Research group founded

(based on verified dataset)

- This ratio would give an insight on how much a research group has **progressed** since its inception by comparing it with the overall accolades won
- The groups with highest ratios display that they have been **rising** in the least amount of time
- **IDeas lab** outperforms other and is the only Asian research group in this set of data
- The **ratio** is calculated as (No. of accolades/No. of years since founded)

Years since Research group founded & Publications

(based on verified dataset)



- **Older** research groups aren't necessarily the ones with **highest publications**
- Some **newer** groups have high number of publications relative to the year founded
- The Publications/Year Founded ratio would tell us an **average rate** of publications each year for these research groups

Main Findings & Conclusions

Shift in Topical Areas between from 2014 to 2021

Insight 1

Shift in topical areas – Sustainability, AI, Social Science etc.

Shift in topical areas – Manufacturing, Management

Focus on being innovative, problem solving and a rising emphasis on sustainability

Insight 2

Integration of design with various fields such as Technology & Management

Reduction in core design areas such as fabrication, molding etc.

Higher technological adaptability and applications of design in various fields

Key take-aways

CADLab (UNIZG, Croatia) is performing best in terms of **research output**

Industrial Engineering Laboratory (CS, France) is performing best in terms of **research projects**

IDeasLab (IISc, India) is performing best in terms of **accolades**

Sears think [box] (CWRU, USA) is performing best in terms of **research staff demographics**

Rising & High-Performing Research groups

Rising

LPL
(TU Munich, Germany)

Pmd
(TU Darmstadt, Germany)

IDI
(ZJU, China)

KTmfk
(FAU, Germany)

LGI
(CS, France)

High Performing

Sears think[box]
(CWRU, USA)

CDI
(SUT, Australia)

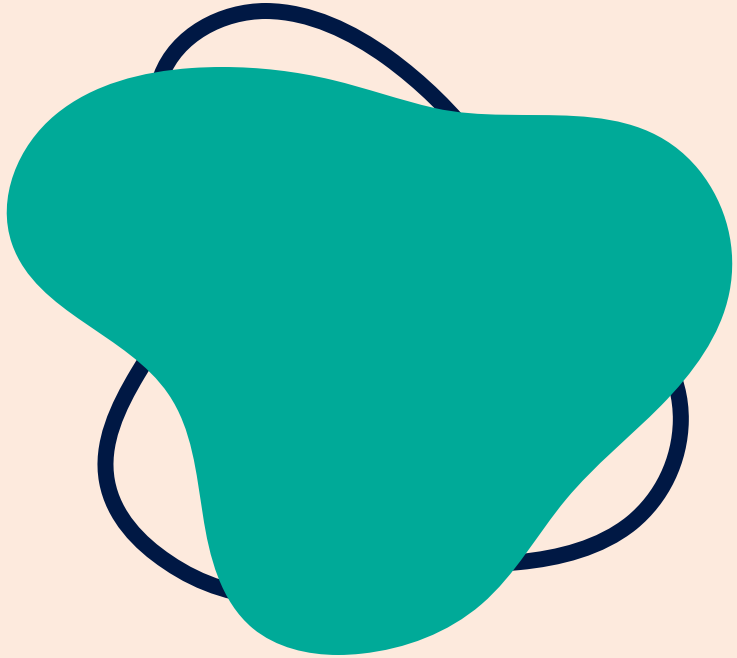
CADLab
(UNIZG, Croatia)

IDeas Lab
(IISc, India)

Pd|z
(ETH Zurich, Switzerland)

To conclude

Adapting some of the most common Topical Areas that are taken up by other high performing research groups to be at par with them



Thank You