

# Educational Needs and Open Education Resources in Micro- and Nanotechnology

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# Background

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- Micro- and nanotechnology (MNT) have had a great impact on markets and industries
- Expected to continue to revolutionize in the years to come
- Study programmes within MNT available in many universities worldwide
- Challenge for a university to cover all aspects of this rapidly developing technology
- A need for higher education institutions (HEI) to **collaborate** and to **share knowledge**  
=> competences and skills that the industry requires

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# NanoEI – project

## Erasmus+ Competence Building in Higher Education

- Transfer knowledge within micro- and nanotechnology between European and Asian HEIs
- 11 partners from 7 countries: China, Malaysia, India, Israel, Bulgaria, Italy and Norway
- By sharing knowledge => renewed and modernized programmes
- Sharing courses by use of open education resources (OERs)
- For the individual university: Broader education offerings within the field of study.
- Courses at MSc level made available and thus facilitating virtual mobility of students and teachers/ researchers



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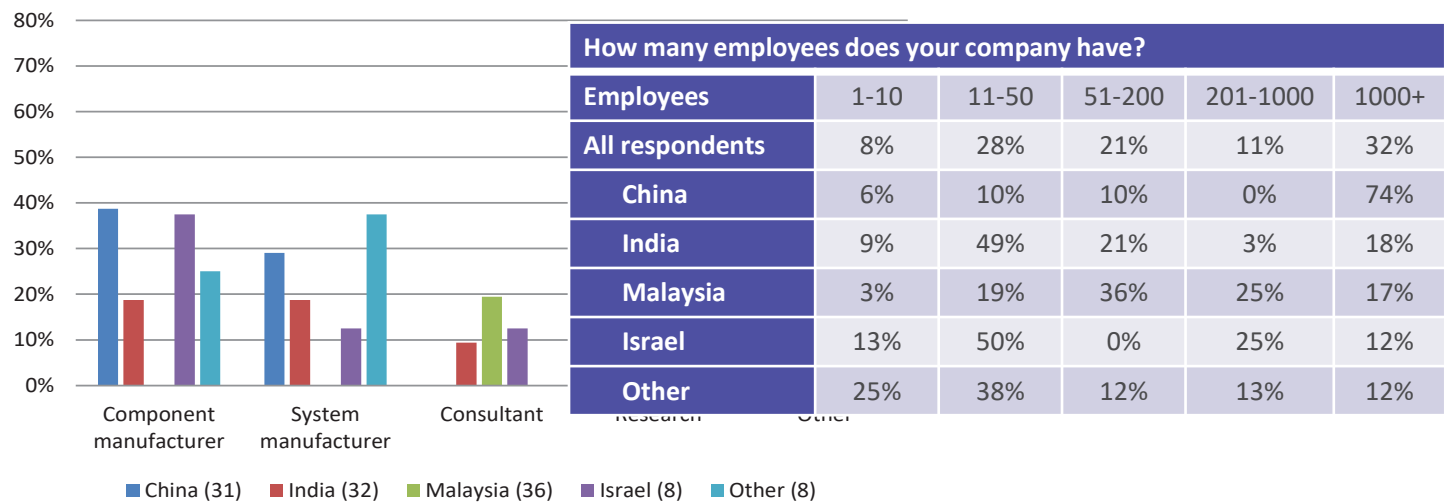
# Mapping

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- Industry needs for competence within micro- and nanotechnology
- Universities' need for and motivation to use OERs in micro- and nanotechnology
- Students' desires and interests in utilizing OERs
  
- Survey tool: Questback

# Survey for Industry

- Mainly targeting companies in China, India, Malaysia and Israel, in total 115 respondents



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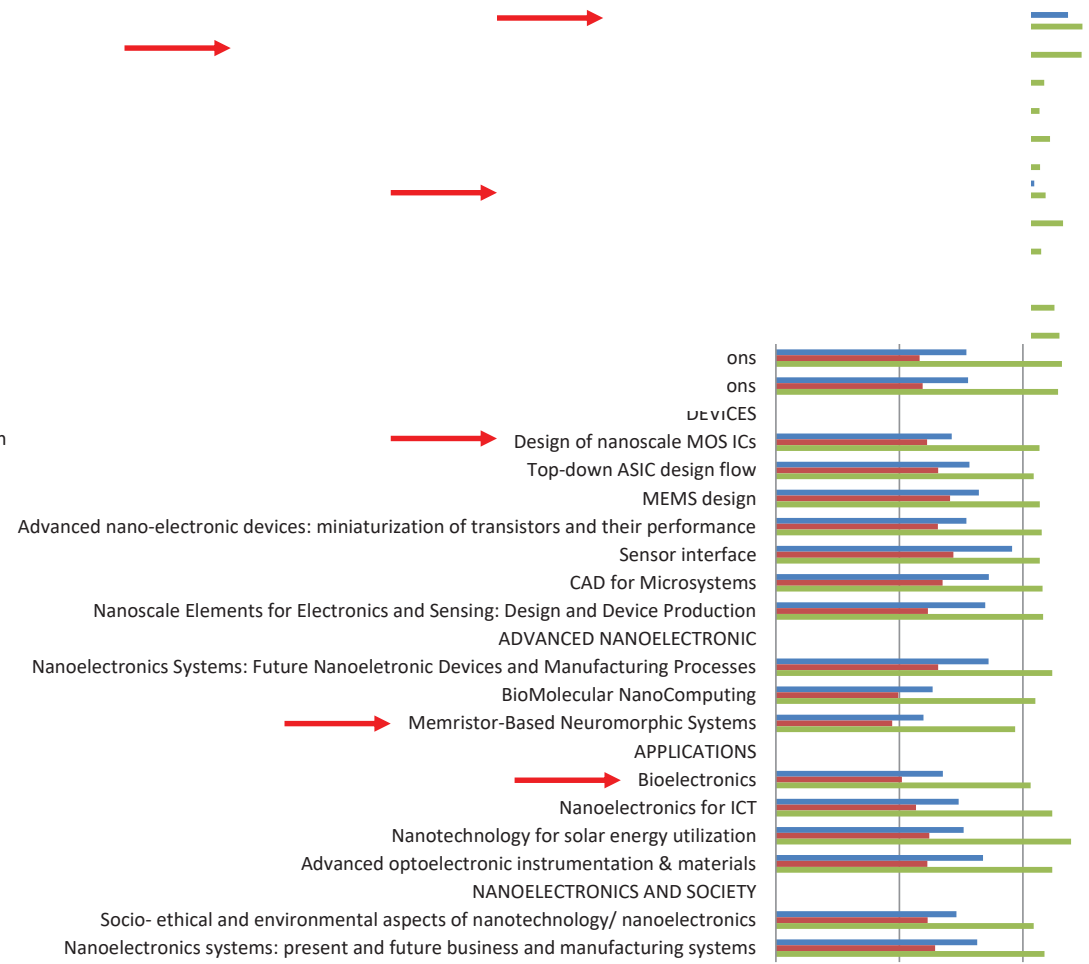
## Survey for Industry cont.

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- On a long term (more than 3 years) point of view:
  - what are the needs for your company in specific domains
  - how many employees does your company need to hire or to be trained within specific domains?
- The list of domains can be grouped in six main fields:
  - Fundamentals
  - Materials
  - Devices
  - Advanced nanoelectronics
  - Applications
  - Nanoelectronics and Society

Performance  
 Interface  
 systems  
 production  
 ELECTRONIC  
 processes  
 computing  
 Systems  
 APPLICATIONS  
 electronics  
 for ICT  
 utilization  
 materials  
 SOCIETY  
 electronics  
 systems

employees ■ Institutions benefits of OERs within the domain



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## Results

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- Malaysian companies have in general lower needs
  - The country is still at an incipient stage when it comes to MNT innovation?
- Comparing India and China
  - Chinese companies seem to have slightly higher need for competences than India
  - Exceptions within bio- and solar energy related subjects in addition to subjects within nanoelectronics and society, where Indian companies scores somewhat higher.
  - The difference may reflect that the respondents from the two countries covers different business areas and hence are not fully comparable



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## Survey for Staff and Teachers

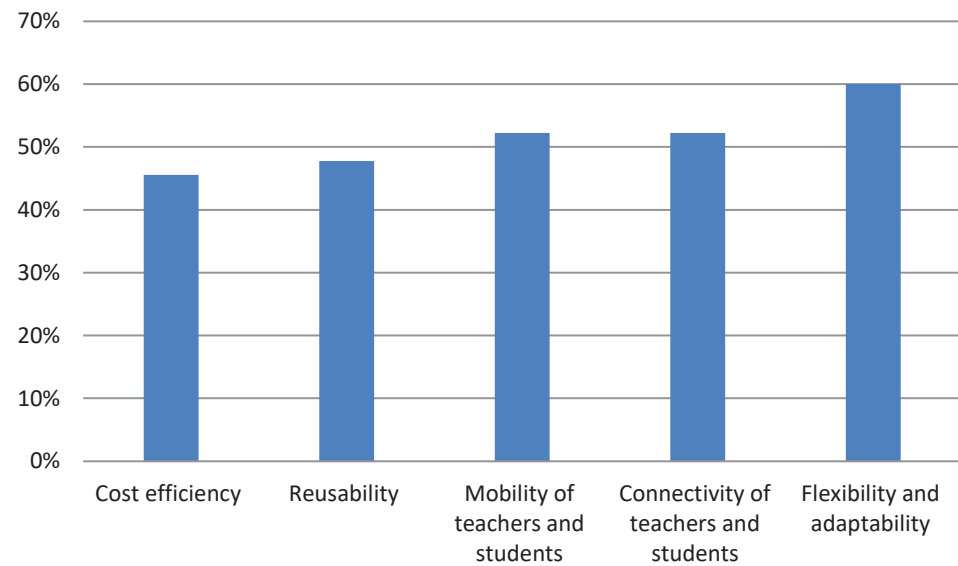
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- 90 respondents, mainly university teachers
- 74% claims their university uses OERs within engineering and technology
- Among the remaining, not using OERs
  - they are not familiar with these resources
  - see no benefit
  - think it is too complex
- How often OERs is being used:
  - 14% uses it rarely
  - 35% uses it occasionally
  - 30% uses it frequently
  - remaining 22% do not use OER

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## Survey for Staff and Teachers

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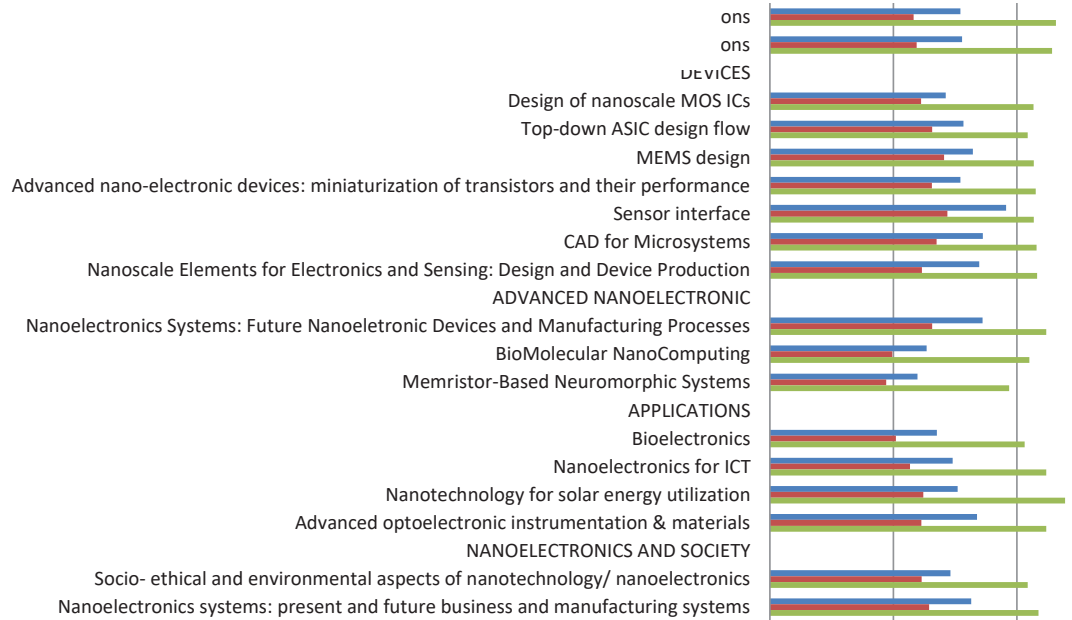
## Disadvantages of using OERs

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- No face-to-face interaction
  - Teaching becomes less interactive and a risk of low engagement for the students
  - Student's possibility to ask questions in the class, initiating discussions among the students and between teacher and students will not be the same
- For some, the low or unstable access to internet is a hinder
- Quality and reliability of current available OERs is a challenge
  - Many options and it takes time to distinguish between what is good and not so good
  - Difficult to organize and integrate OERs efficiently into the teaching
- In technical courses with laboratory sessions, some think OERs are not relevant

Performance  
 Interface  
 Systems  
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employees → ■ Institutions benefits of OERs within the domain



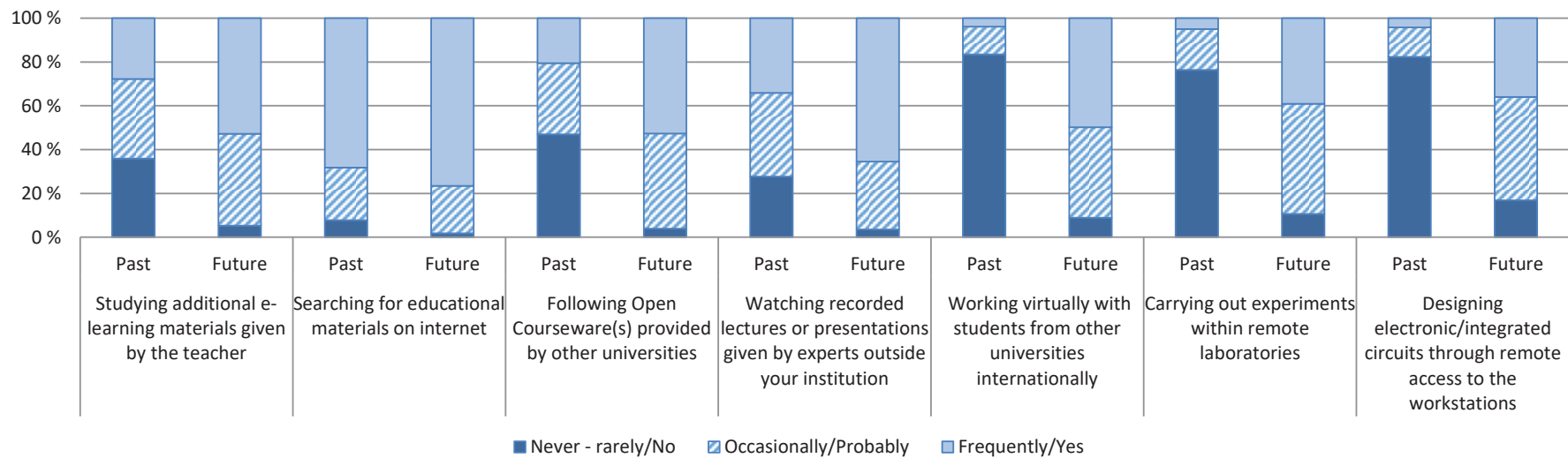
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## Survey for Students

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- 286 respondents, of which
  - 52% study micro- and nanoelectronics, electronics or informatics/information technology
  - Remaining is a mix of computer science, biomedical engineering, material science and chemical engineering students
  - 56% Bachelor, 27% Master and the rest are PhD/postdocs
- Majority (78%) are in a programme that uses e-learning materials or OERs the rest (22%) is not and hence unfamiliar with these kind of resources
- 53% of the students are using e-learning materials or OERs from other institutions
  - lack of knowledge with OERs from universities elsewhere is the main reason for not using it.
- Frequency of using OER tools varies.
  - 32% use it rarely
  - 47% occasionally
  - 21% use it frequently

# Survey for Students



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## Students: Benefits in Using OERs in Education

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- The majority (73%) thinks flexibility and adaptability is an advantage
- A lot (60%) also believes cost and time efficiency is an advantage
- Less than half (42%) thinks that virtual mobility of students is an advantage
- Connectivity of teacher and students is regarded as an advantage by only 39%
- The survey clearly shows that the **students prefer to use a multitude of OERs** in the form of electronic books, interactive courses, powerpoint presentations and video recorded lectures
- 73% agrees or strongly agrees to that the use of OERs lead to improvement in learning
- 67% thinks that use of OER makes the learning content more attractive

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# Conclusion

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- **Industry**
  - mean interest in the multitude of subjects that the partner universities aims to offer as open educational resources.
- **Universities**
  - the majority is familiar with open education resources and appreciate the benefits of using them in the teaching
  - an interest and a desire in offering the students a more diversity of topics within micro- and nanotechnology
- **Students**
  - the majority are in an educational programme that uses open education resources
  - prefer to use a multitude of open education resources
  - open educational resources lead to improved learning and makes the learning content more attractive.

Even though the surveys have their limitations, the results provide valuable insights and input to the further development of the open educational courses in the NanoEl project