

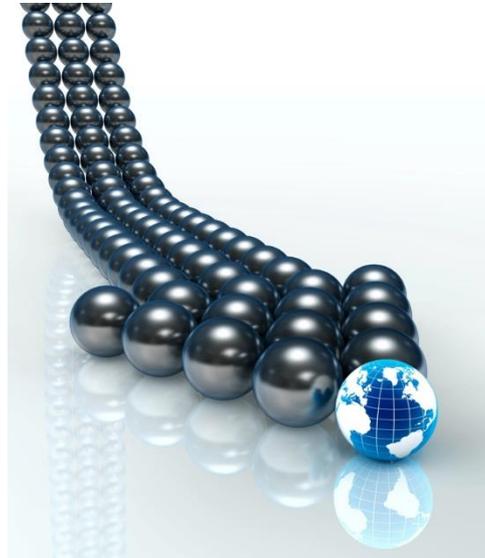
# Study on Assessing innovation capability of EU companies in developing Advanced Manufacturing Technologies

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# Main objective



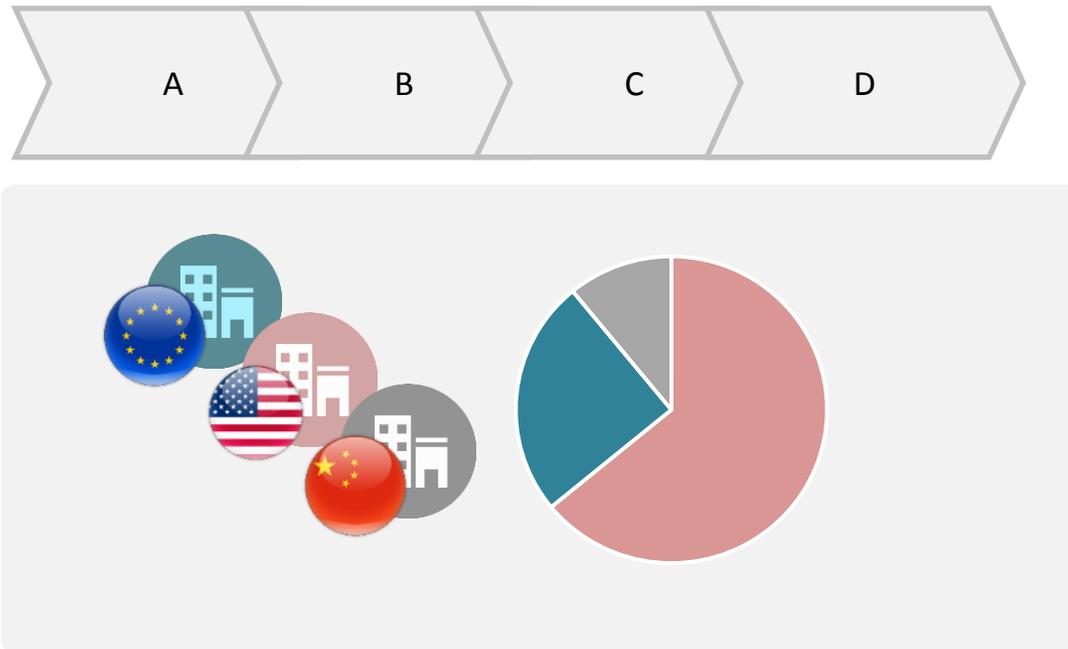
The main objective of this study is to analyse the current **position of the EU** in the **global production of specific KETs based components/products** which are **incorporated in Advanced Manufacturing Technologies (AMTs)** in order to assess upcoming challenges for the EU's competitiveness.



# Value chain analyses



1. The decomposition of the value chain into key steps
2. The identification of key players in the value chain
3. Evaluation of the position of each company in the value chain



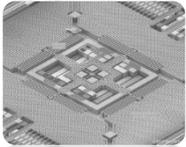
# Three case studies



KETs based component

AMT

Application market



Laser, lens, mask

Mask aligners, projection  
steppers and scanners

Electronics for consumer,  
automotive and medical  
applications

1. Manufacturing equipment for MEMS

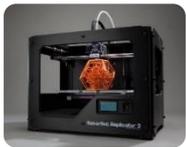


Laser

Femtosecond  
micromachining

Automotive (structural  
components)

2. Ultrafast femtosecond lasers for micromachining



Laser

Sheet lamination,  
powder bed fusion and  
directed energy  
deposition

Aerospace (structural  
components)

3. Metal additive manufacturing

# Overall conclusions



- All three selected value chains are emerging, they have not yet reached the maturity stage.
  - Europe should create the conditions for its mid-cap companies and SMEs to grow so that it is able to deploy its carefully developed technologies and profit from it.
  - Their embeddedness in local ecosystems is equally important. The absence of large and medium cap players in ecosystems makes it difficult to attract substantial investments and realise successful global commercialisation.
- The selected Advanced Manufacturing Technologies have the potential to contribute significantly to the growth of several end-user industries such as automotive, aerospace and medical industry, due to their enabling character.
  - The analyses demonstrate the strengths and vulnerability of the value chains of these emerging technologies at a phase where it is not yet too late to react. A targeted smart specialisation strategy can reinforce the deployment of these technologies and hence stimulate the growth of companies.

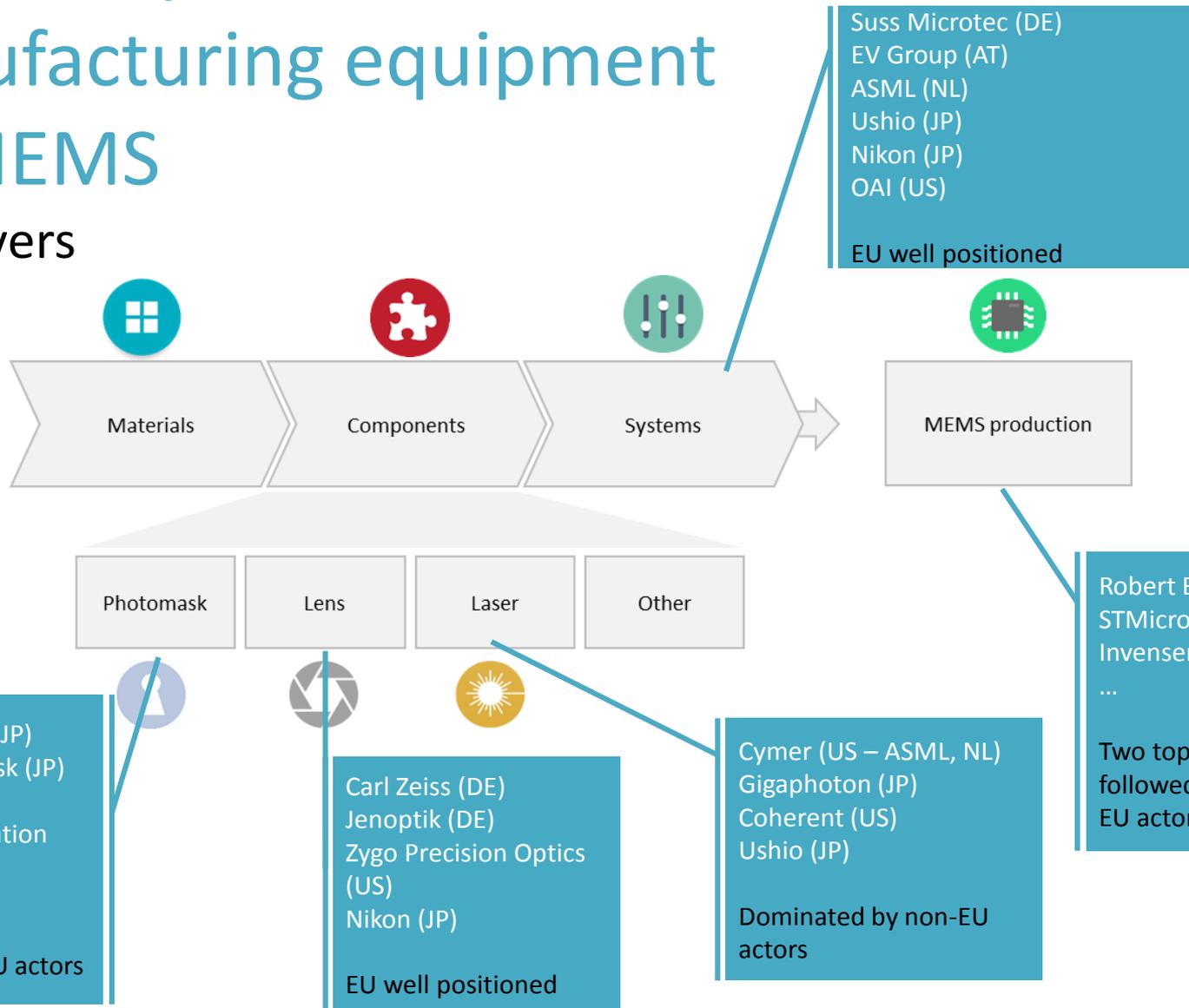
# Overall conclusions



- The analysis provide insight in the kind of emerging technologies that are **truly important for several industries** through their enabling character.
- It demonstrates the **strengths and weaknesses of the value chain** and shed insight on the actions that can be taken by policy makers to anchor the selected value chains in Europe.
- In the author's view, **this kind of analysis is essential to come to targeted and well-documented smart specialisation strategies which can make a substantial contribution to the reindustrialization of Europe.**

# Case Study 1: Manufacturing equipment for MEMS

## Key players



# Case Study 1: Manufacturing equipment

## for MEMS

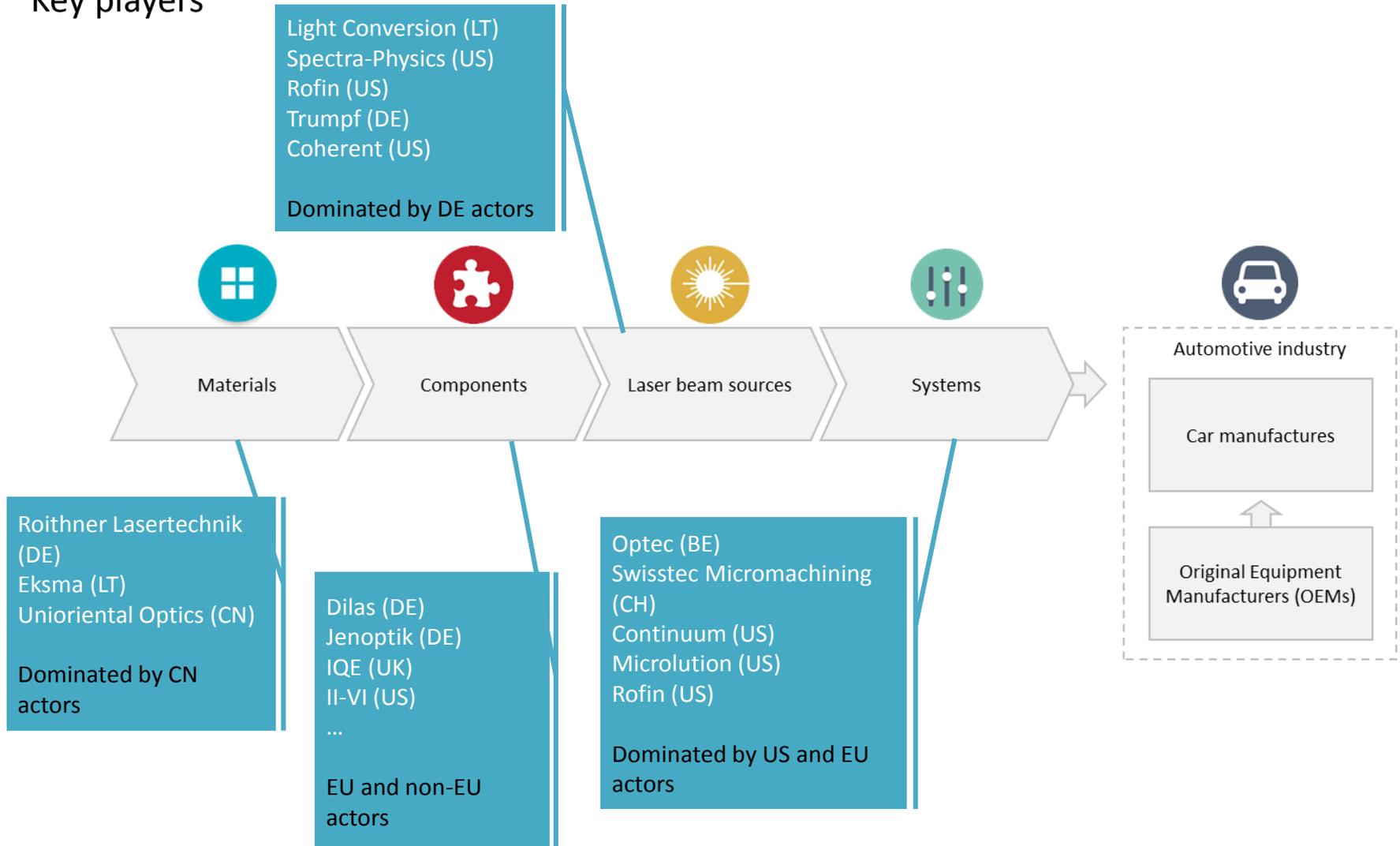
### Competitiveness of EU companies

- The value chain analysis indicates a **good position of EU companies**, especially at system level, but also for a number of optical components such as lenses and to a lesser extent also lasers.
  - Firstly, the **technical capabilities** in building high performance components and systems of EU companies are often world-class, providing a major source of comparative advantage. The development of these capabilities have benefitted from a good cooperation with EU knowledge institutes, such as imec.
  - Secondly, the European equipment companies have a long history in the MEMS and IC markets, providing them **the advantage of the incumbent**. Their knowledge of the market and customer needs, together with the costs associated with changing equipment suppliers, creates a certain shield from competition.
  - Thirdly, the EU counts **two top players in MEMS production** and some smaller MEMS foundries, providing an important **'home market'** for MEMS equipment manufacturers and bringing an **'end-to-end'** advantage.
- Maturity of industry: shift to Asia?
  - TSMC (TW) and UMC (TW) **are increasing their presence** in the MEMS market
  - MEMS is one of the areas that **China is focusing on**

# Case Study 2: Ultrafast femtosecond lasers for micromachining



## Key players



# Case Study 2: Ultrafast femtosecond lasers

## for micromachining

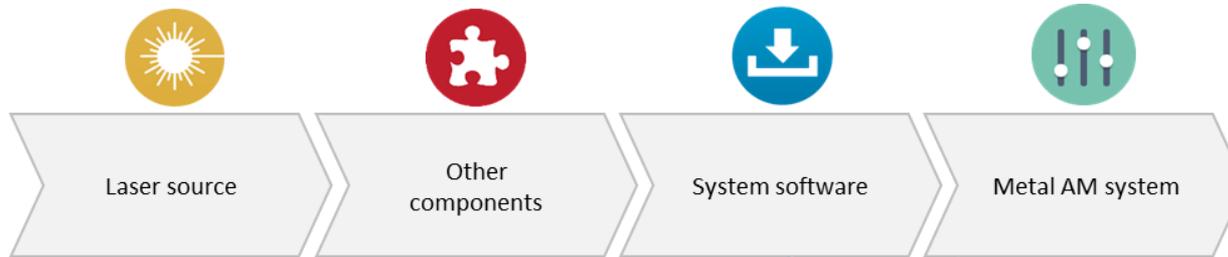
### Competitiveness of EU companies

- American and European companies are dominating the field of femtosecond lasers.
  - Europe has the technological leadership position (particularly German research is very advanced in the field of ultrafast lasers)
  - In the German laser industry the close collaboration between the industry and research institutes (e.g. the Fraunhofer Institute for Laser Technology and the Laser Zentrum Nord) is acknowledged.
  - Besides the femtosecond laser sources and systems, the position of European companies seems to be relatively strong as well along the other elements of the value chain.
- Threat from Asian laser industry is perceived on a medium term

# Case Study 3: Metal additive manufacturing



## Key players



Jenoptik (DE)  
ROFIN-SINAR (DE)  
Trumpf (DE)  
SPI Lasers (UK)  
Coherent (US)  
IPG Photonics (US)

EU well positioned

Materialise (BE)  
Fabbify Software (DE)  
Netfabb (DE)  
3DSim (US)

Dominant position for  
Materialise

EOS (DE)  
Concept Laser (DE)  
Phenix Systems (FR)  
Trumpf (DE)  
SLM Solutions (DE)  
Realizer (DE)  
Renishaw (UK)

Dominant position of EU in metal  
printing, but aggressive acquisition  
by large US players

# Case Study 3: Metal additive manufacturing



## Competitiveness of EU companies

- In general, the US is leading the additive manufacturing market, with key players such as Stratasys and 3d Systems.
- In the field of metal additive manufacturing however, Europe has a leading position, with most of the metal additive manufacturing system providers located in Germany.
- Also regarding the other segments of the value chain analysed in this chapter, Europe has a strong position.
- The strong European position will be challenged by American and Asian players.
  - In countries such as the US, China and Singapore, additive manufacturing is regarded as the key enabling technology for innovation in products and the supply chain, and is receiving substantial government funding to increase the maturity level.
  - A threat for the competitive position of the European metal additive manufacturing companies is also the aggressive acquisition of metal printing companies by large American additive manufacturing companies such as Stratasys and 3D Systems (together owning about two-third of the total additive manufacturing market).

# Conclusions value chain analyses



## Competitive position of EU companies in the selected value chains

Europe demonstrates a solid position in AMT markets of the selected value chains, having good coverage in the different steps of the value chain:

- **Strong R&D institutes** such as Fraunhofer Institute for Laser Technology, Laser Zentrum Nord (LZN) and imec that actively collaborate with EU industry, leading to a rapid development and adoption of new innovations
- **Suppliers of high quality components** in several of the segments analysed, notably optical elements such as laser sources, laser scanning and beam shaping systems, objective lenses and others
- **System integrators** that are among the market leaders in different segments such femtosecond lasers, metal additive manufacturing and mask aligners

# Conclusions value chain analyses



The value chains studied in this report are **growing fast**, and are therefore attracting a lot of interest.

- **Business level**: especially in the case of metal additive manufacturing and MEMS (small and young value chains), **the market growth is attracting a number of new entrants**.
- **Political level**: the value chains studied here fall under the different Key Enabling Technologies as identified by the European Commission, but also have the **priority status of enabling technologies in other parts of the world**.

# Framework conditions for a competitive European industry in the selected value chains



In the context of this global race, it is of utmost importance to provide **favourable overall framework conditions** for EU actors.

- Firstly, the **availability of funding** for innovation actions, also for higher TRL levels, as it is important to continue to be at the forefront. In addition, the availability of world-class R&D institutes in Europe that support industrially relevant research is key.
- Secondly, **investments in the availability of skilled personnel** through education is also of fundamental importance.

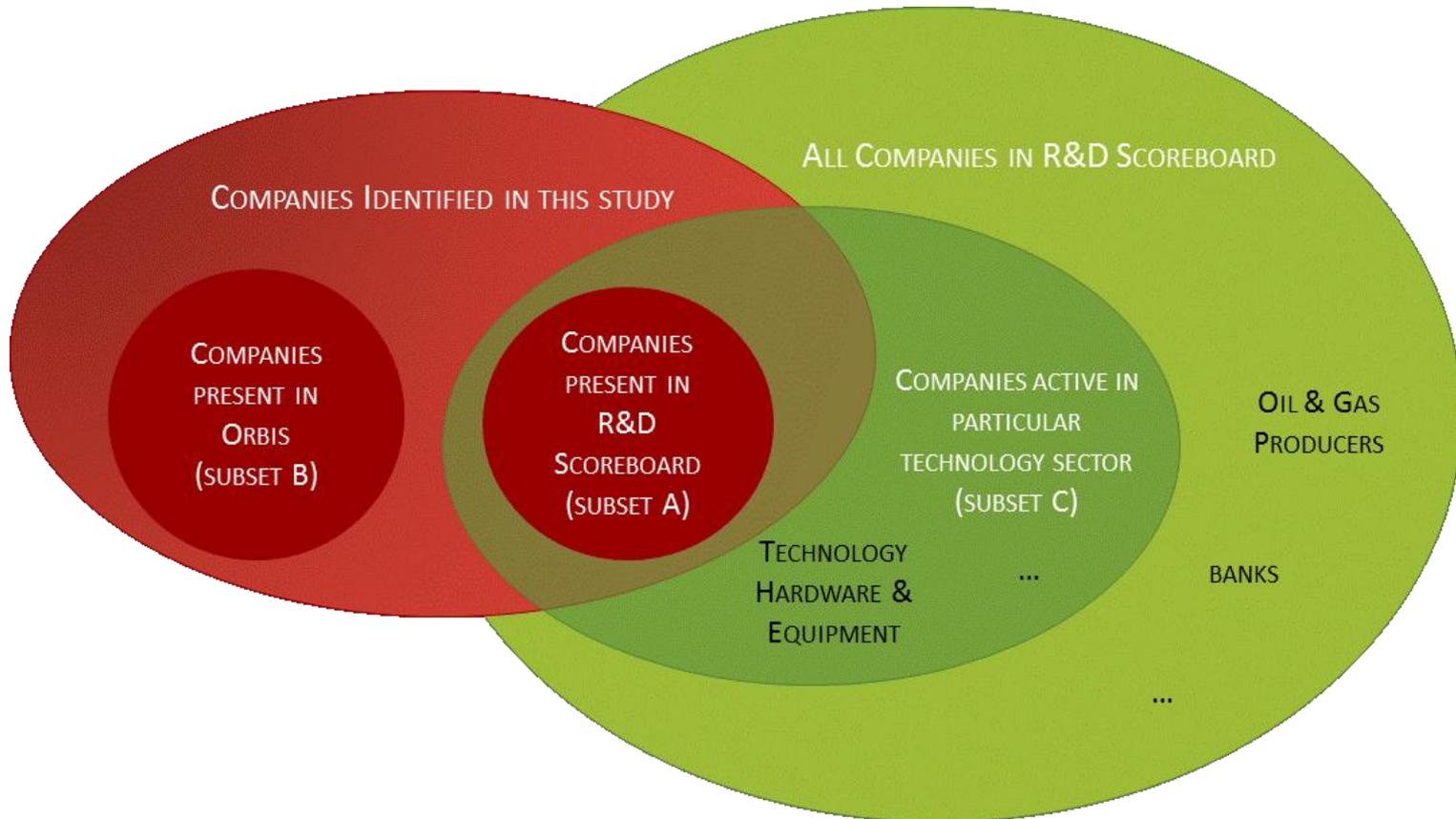
In the face of fierce global competition, governments worldwide are using smart specialisation strategies (S3) to foster the growth of key strategic industries.

- S3 should be based on **effective monitoring** of regional strengths
- **Active monitoring** of the performance of these companies such that significant changes can be detected early on.
- Governments should be ready to take **industry or even value chain specific measures** to address negative changes.

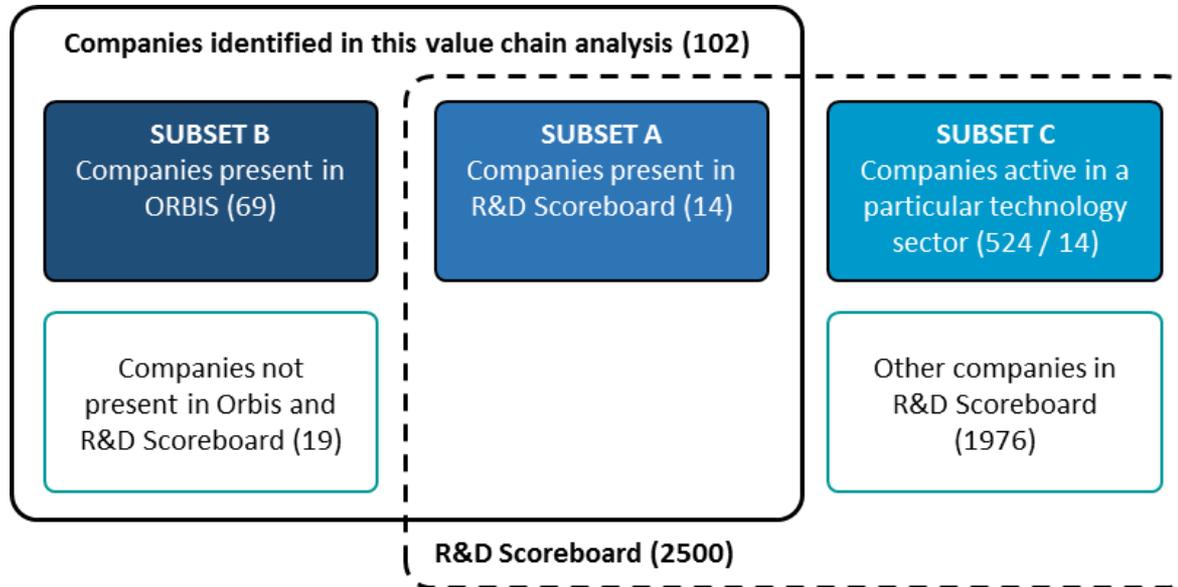
# Analysis of technological capabilities



## Different subsets of companies



# Analysis of technological capabilities



The overall aim is to investigate the relationship between a certain company characteristic (being in a value chain or not, being a patent taker in laser fields or not, being in the R&D scoreboard or not) and its performance (measured as R&D intensity, profitability or sales growth).

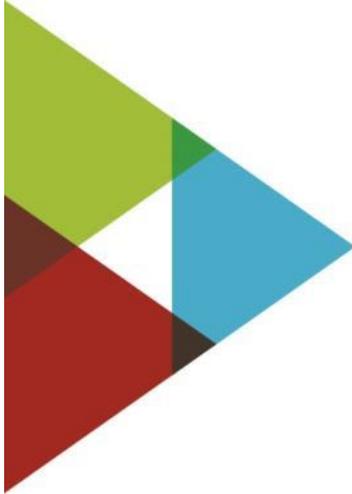
Moreover, within groups of companies having one of these characteristics, it is investigated if there are regional differences between companies (EU versus Asian and American companies).

# Conclusions from the analysis of technological capabilities

- Companies active in the three studied value chains or in laser patenting, tend to outperform companies in broader manufacturing value chains:
  - Companies active in the VCs demonstrate significant higher R&D intensity compared to the benchmark of industrial firms not active in the VCs.
  - For companies active in laser patenting, there is a significantly higher R&D intensity and higher profitability compared to companies from the three benchmark sectors.
  - Similar result on R&D intensity are found for Germany in photonics industry report (2013)
- A number of clear regional differences can be observed in the sample of industrial firms:
  - Asian companies tend to have lower R&D intensity than EU firms, however they demonstrate a higher sales growth
  - American companies do not differ significantly from EU companies in terms of R&D intensity or sales growth, but demonstrate a higher profitability
- Restricted to either companies in the VCs, or companies active in laser patenting, the regional differences change to the benefit of the EU:
  - The gap in R&D intensity between EU and Asian companies becomes higher, while a significant positive gap in terms of profitability emerges for VC companies. Moreover, the overall observed higher sales growth rate for Asian companies disappears.
  - The higher profitability for US companies disappears (VC companies) or becomes less significant (laser patent group)

# Conclusions from the analysis of technological capabilities

- A number of top players from the three VCs are not present in the scoreboard
- These companies are not large enough to be part of the scoreboard, which relates to the fact that the markets wherein they are active are not large enough (yet).
- However, companies like these are of strategic importance to the EU economy as they may become the industrial champions of tomorrow.
- Hence, a closer monitoring of these mid-sized companies may be warranted.



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