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**Research costs evolution and new R&D models:  
implications for policy**

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Austrian Institute of Technology	AIT	Austria
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# Introduction

## **Main research question of this presentation:**

How can policy influence the research process in EU companies and PROs, taking into account the challenges posed by rising research cost?

**Policy implications** of our study are built **within a holistic perspective**, i.e. taking into account **R/D cost trends, drivers, impact on strategies and role of private and public stakeholders within the European technology eco-system (system or community involving different innovation stakeholders and their interactions)**.

# Presentation Outline

1. Data and approach
2. Research questions and answers
  - 2.1. Past and future **level and price/volume character** of research cost increase (trend);
  - 2.2. What are the **main drivers of the evolution** of the research costs.
  - 2.3. What are the **managerial and strategy responses** of companies and PROs to the research cost increase.
3. Research policy implications.

# Empirical Study: Sample and Data sources

## Sample

- Survey
  - Population: 2,000 EU Scoreboard firms
  - Sample: 103 EU Scoreboard firms
  - Population 500 Public Research Organisations
  - Sample: 64 PROs
- Case studies
  - 16 European R&D companies
  - 5 non-European companies (from US and China)
  - 16 European Public Research Organisations

## Data sources

- Companies (COMs):
  - **R&D Investment Scoreboard**
- Public (Non-university) Research Organisations (PROs):
  - Database about the participation of European research centers in FP4-FP7 (**EUPRO database**)

# Data and approach

The survey sample consists of 103 companies (83% European) among the most important private R&D spenders from different sectors and 64 small and large (59%) Public Research Organizations (63% located in EU(15)).

## **Definition of R&D cost= Volume x the unitary Price of inputs**

In this way we can distinguish a R&D cost increase due to an increase of R&D activity (expansion) from a price effect (due to a quality improvement or to an inflation effect).

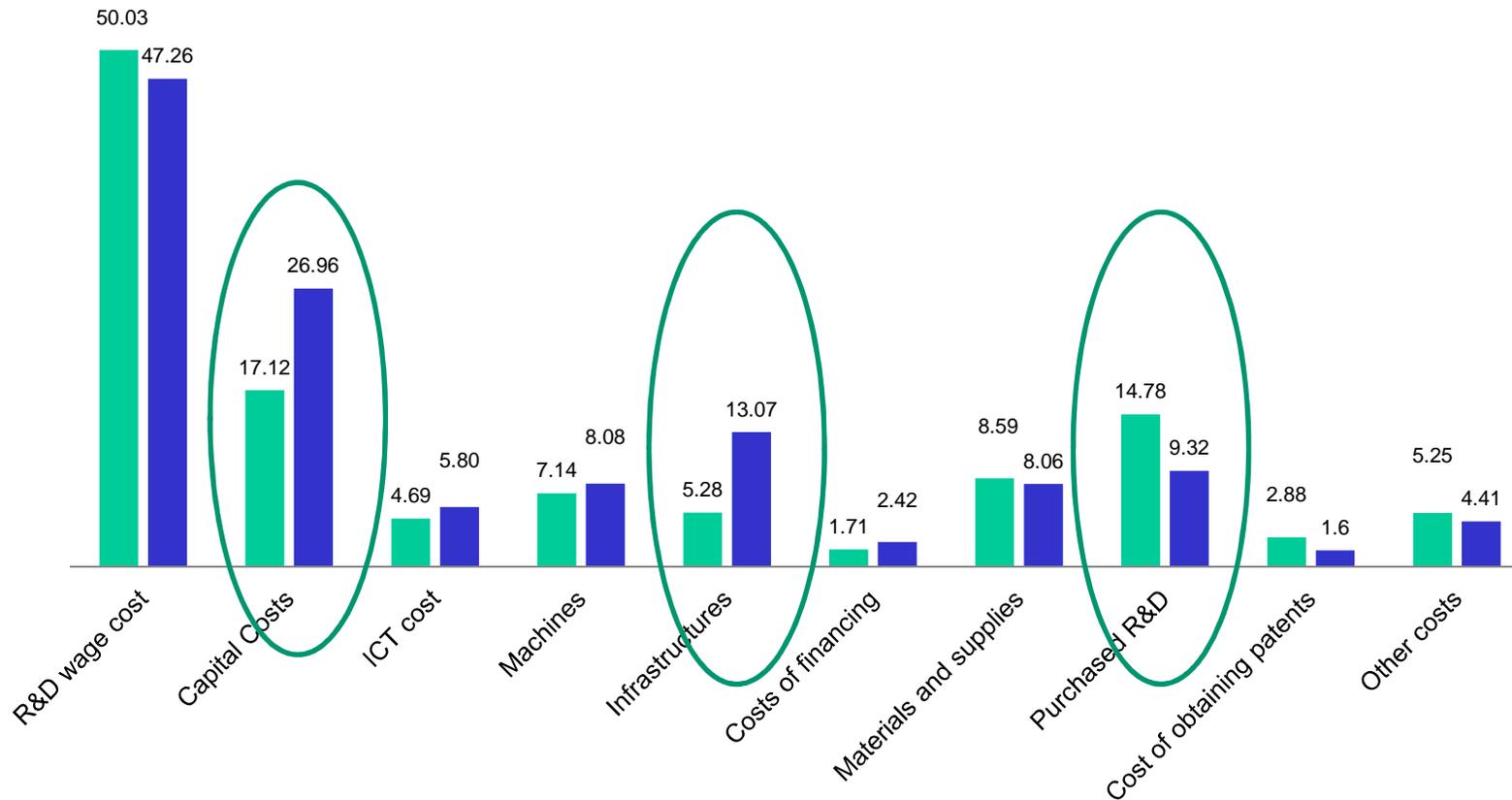
**R&D cost Drivers:** we include internal to the organization and external (general environment, institutions) cost drivers with possible reducing or increasing R&D costs effect.

## 2. Research questions and answers

2.1. Past and future **level and price/volume character** of research cost increase (trend)

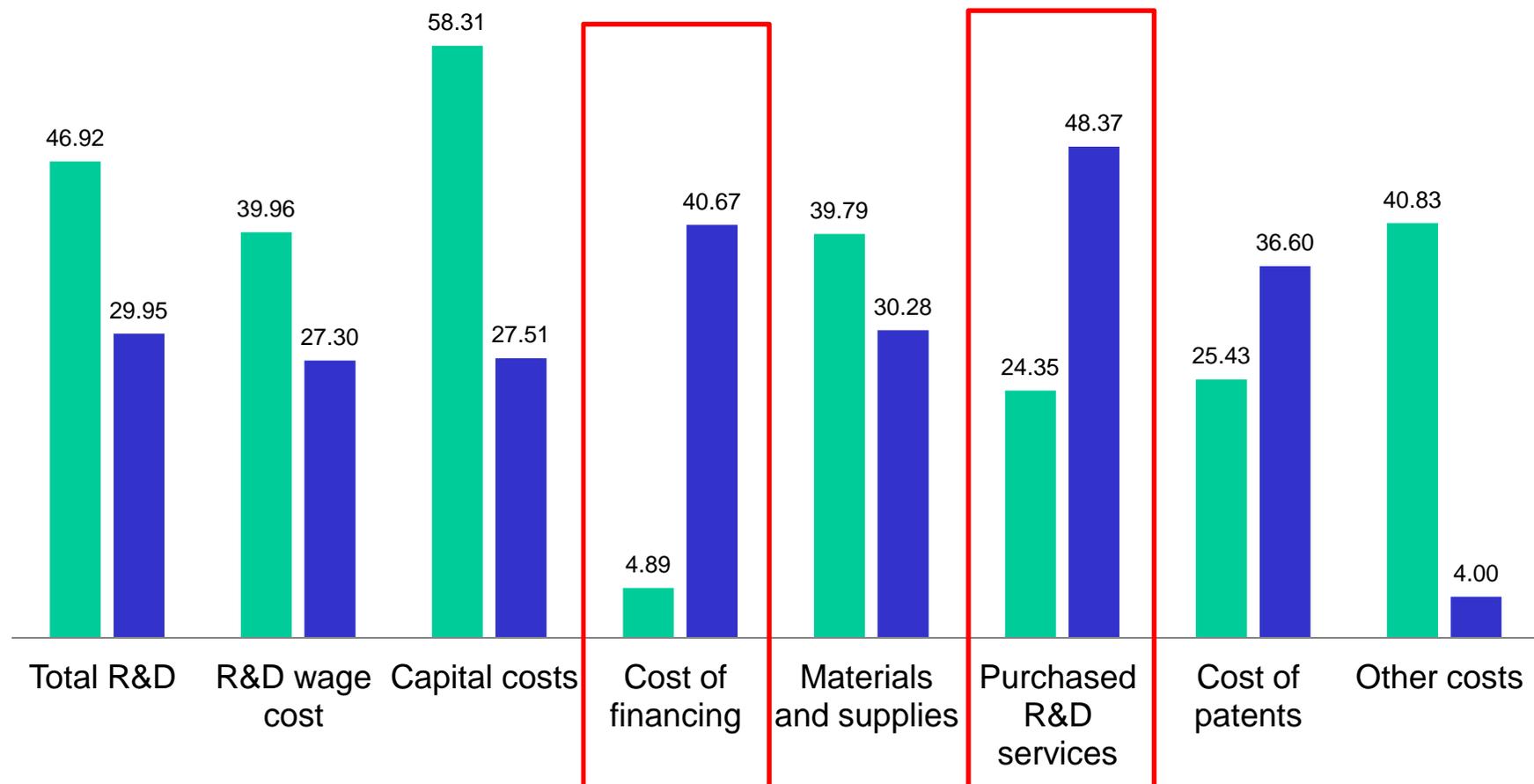
# Current cost composition of R&D in companies (in %)

■ Main world region (N = 65)    ■ Most dynamic region (N = 20)

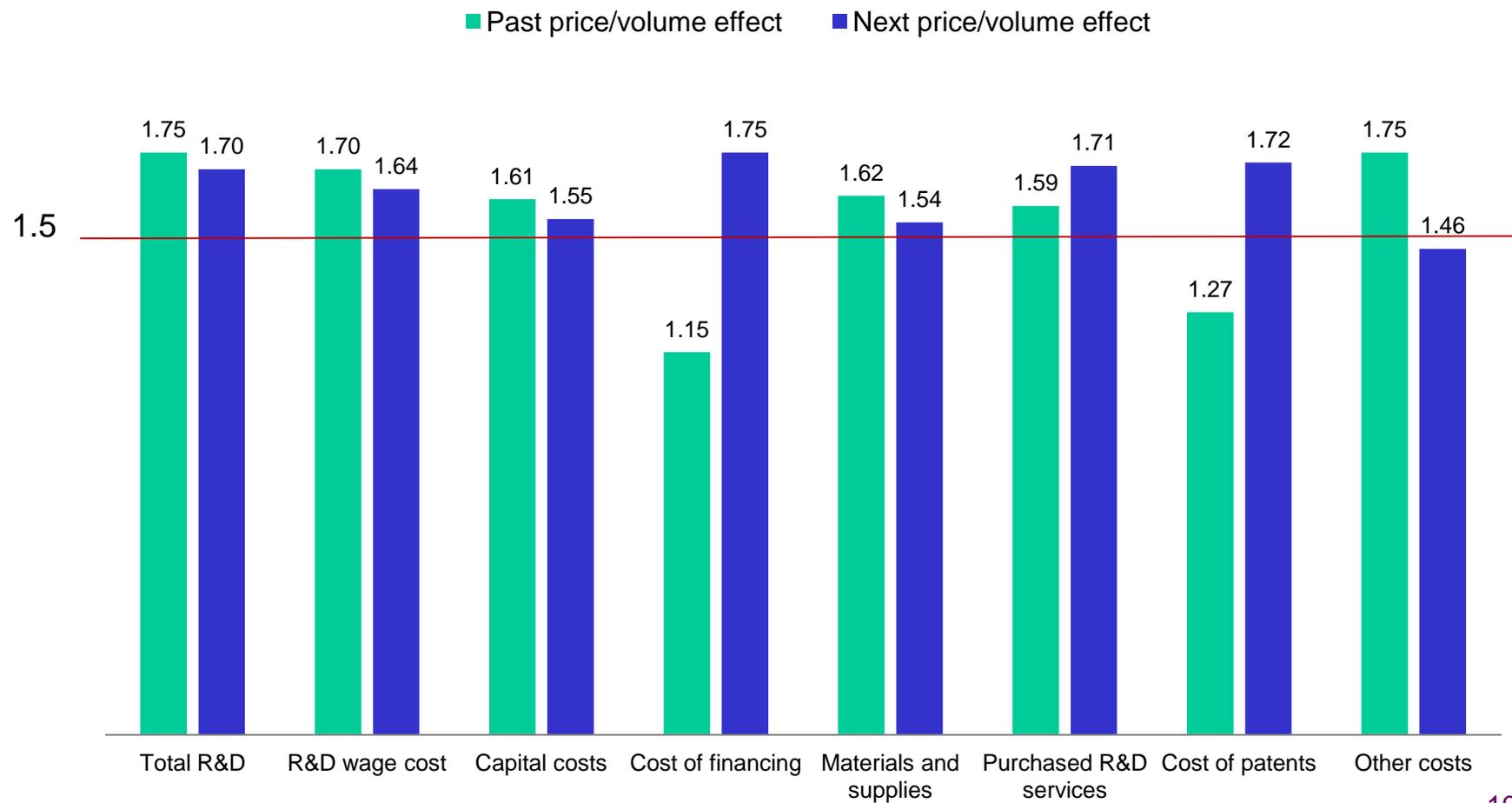


## Percentage change of costs – Past and Next five years

■ % Past change of costs    ■ % Next change of costs

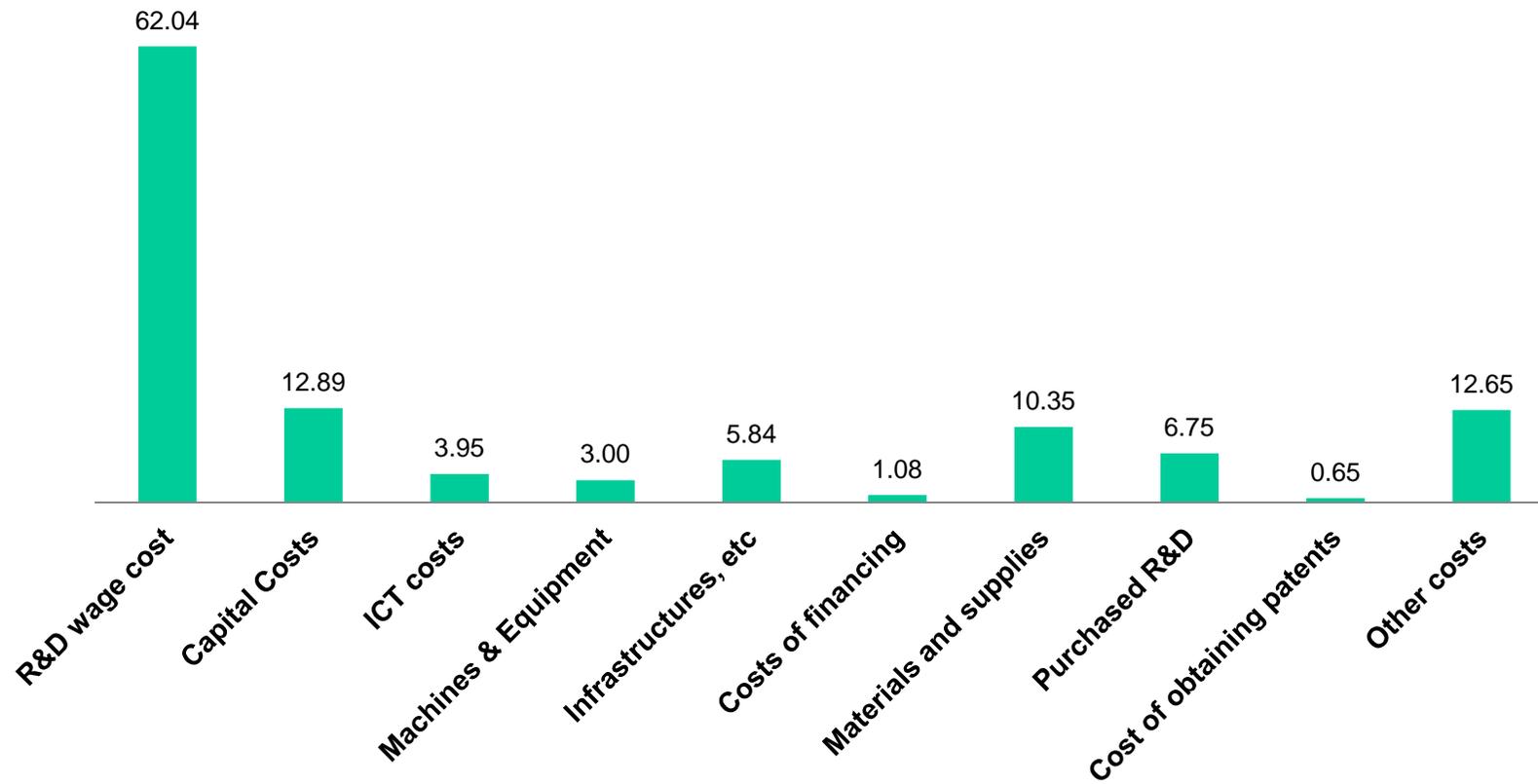


# Price/volume effect over the past five and the next five years



Scale: 1: pure price effect - 2: pure volume effect

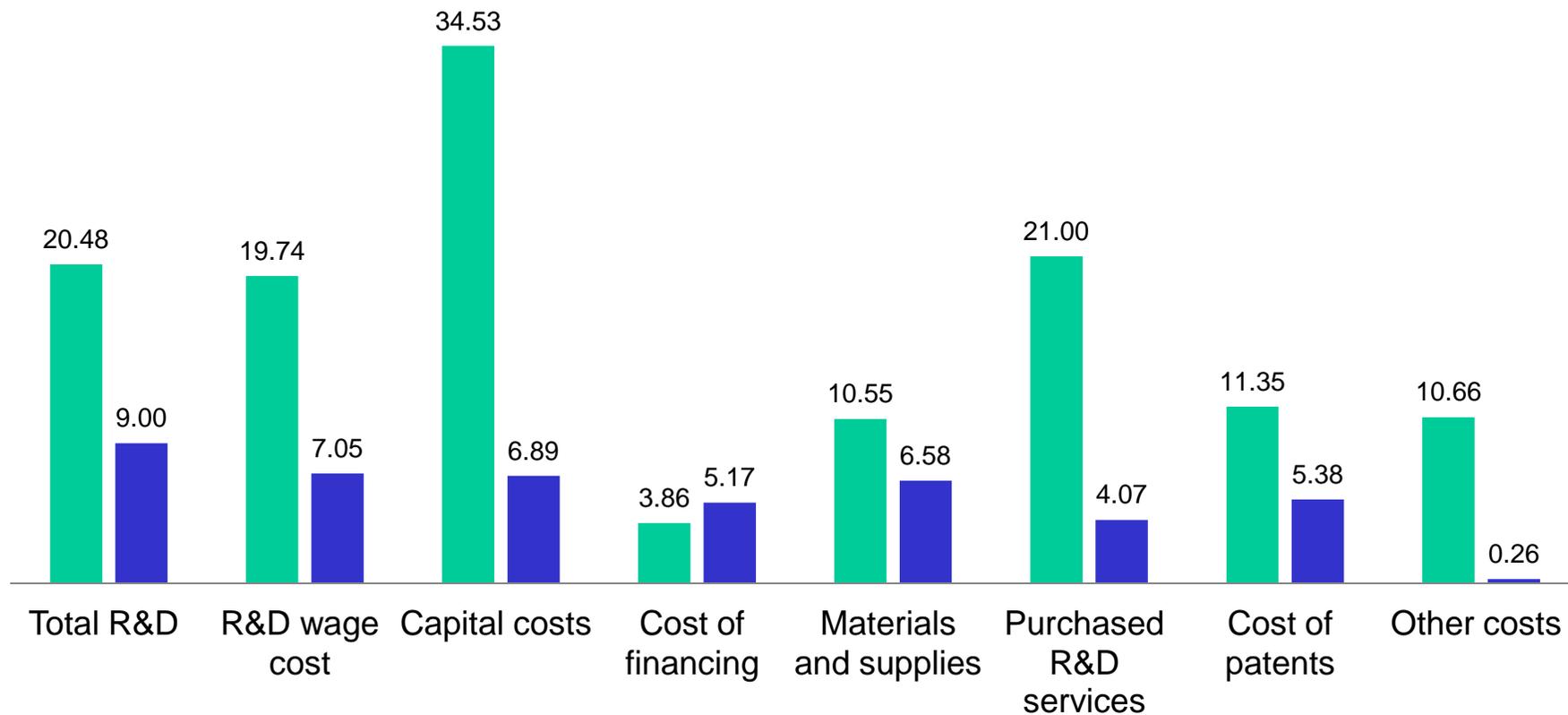
# Cost composition of PROs



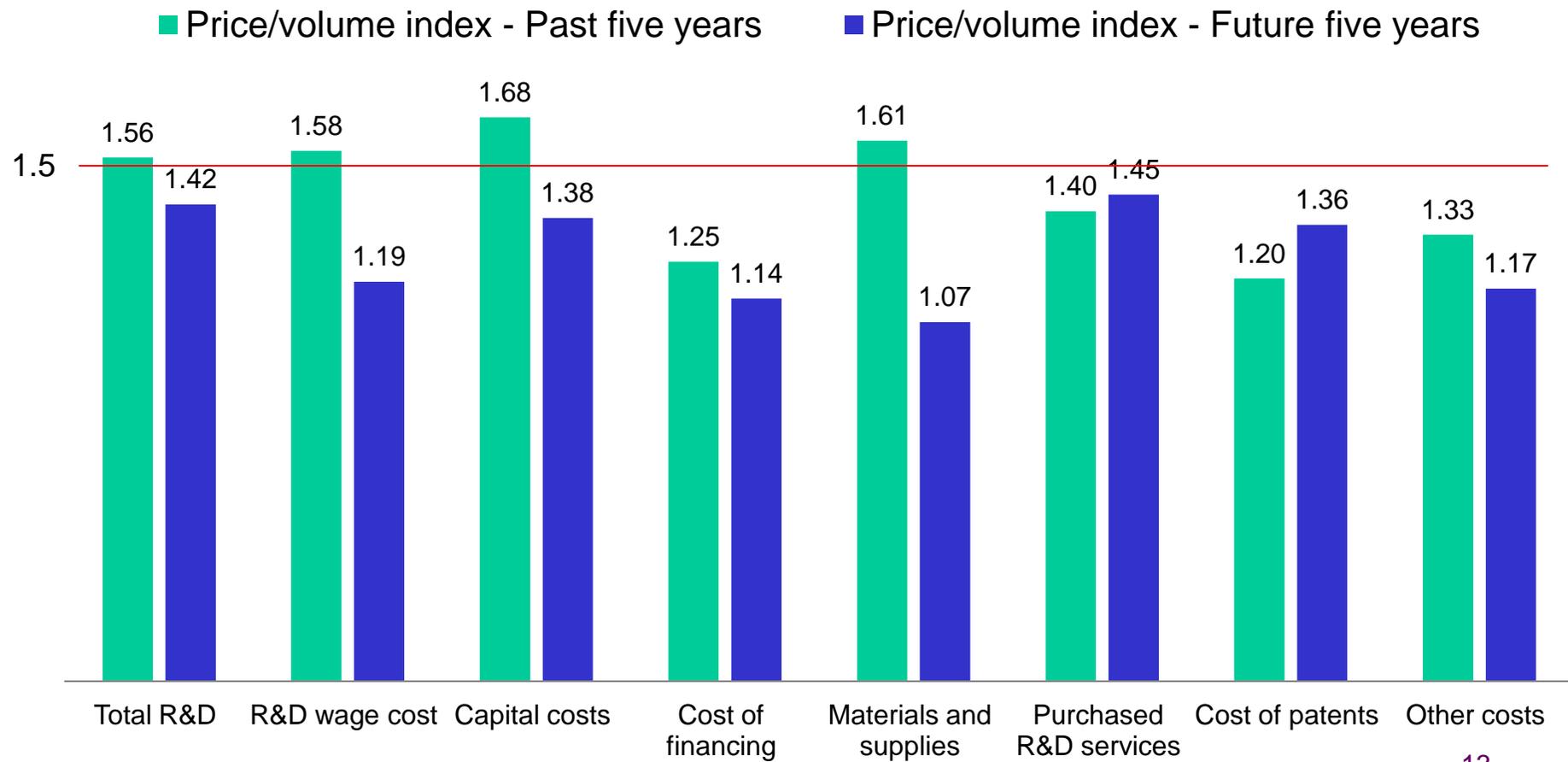
# Cost development in PROs: % change

■ % change of costs - Past five years

■ % change of costs - Future five years



# Cost development in PROs: price/volume effect



Scale: 1: pure price effect - 2: pure volume effect

## Comments (1)

**In the past** five years **R&D costs** increased of 46% for companies and 20% in PROs.

This has been primarily **due to volume increases** for companies (1,75) and for PROs (1,56).

The most important cost increase **for PROs has been the capital (equipments, infrastructures) costs.**

**In the next** five years the increase in research costs is expected to amount to 30% **for companies: a slowing down of the dynamic development of R&D activities**, but the volume effect is always predominant.

Worse are the expectation of **PROs: the cost of all research inputs will grow**, mainly due to an **increase in prices**. **PROs are sceptic on their ability to expand research activities.**

## Comments (2)

R&D expansion in the past : probably due to an expansion in range and scope of business and its R&D requirements + S/T opportunities.

**In future:** companies expect an impact of the economic and financial crisis on the cost of their activities, in particular **companies expect an increase in the cost of finance** to support their research.

An even stronger **increase is expected in the cost of purchases of R&D services**, always due to volume effect.

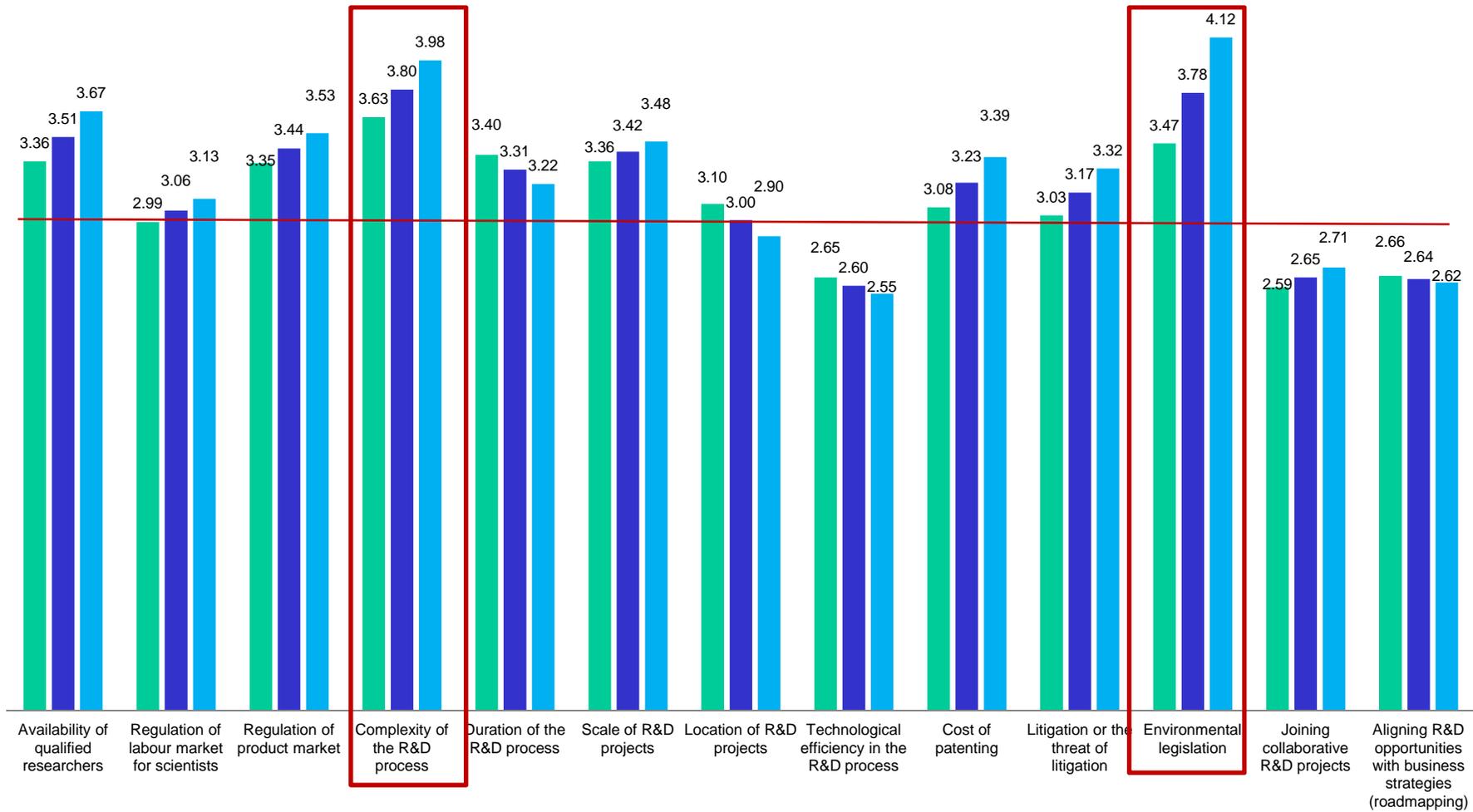
## 2. Research questions and answers

2.2. What are the (past and future)  
**main drivers of the evolution** of  
the research costs.

# Drivers of the cost of R&D: all companies

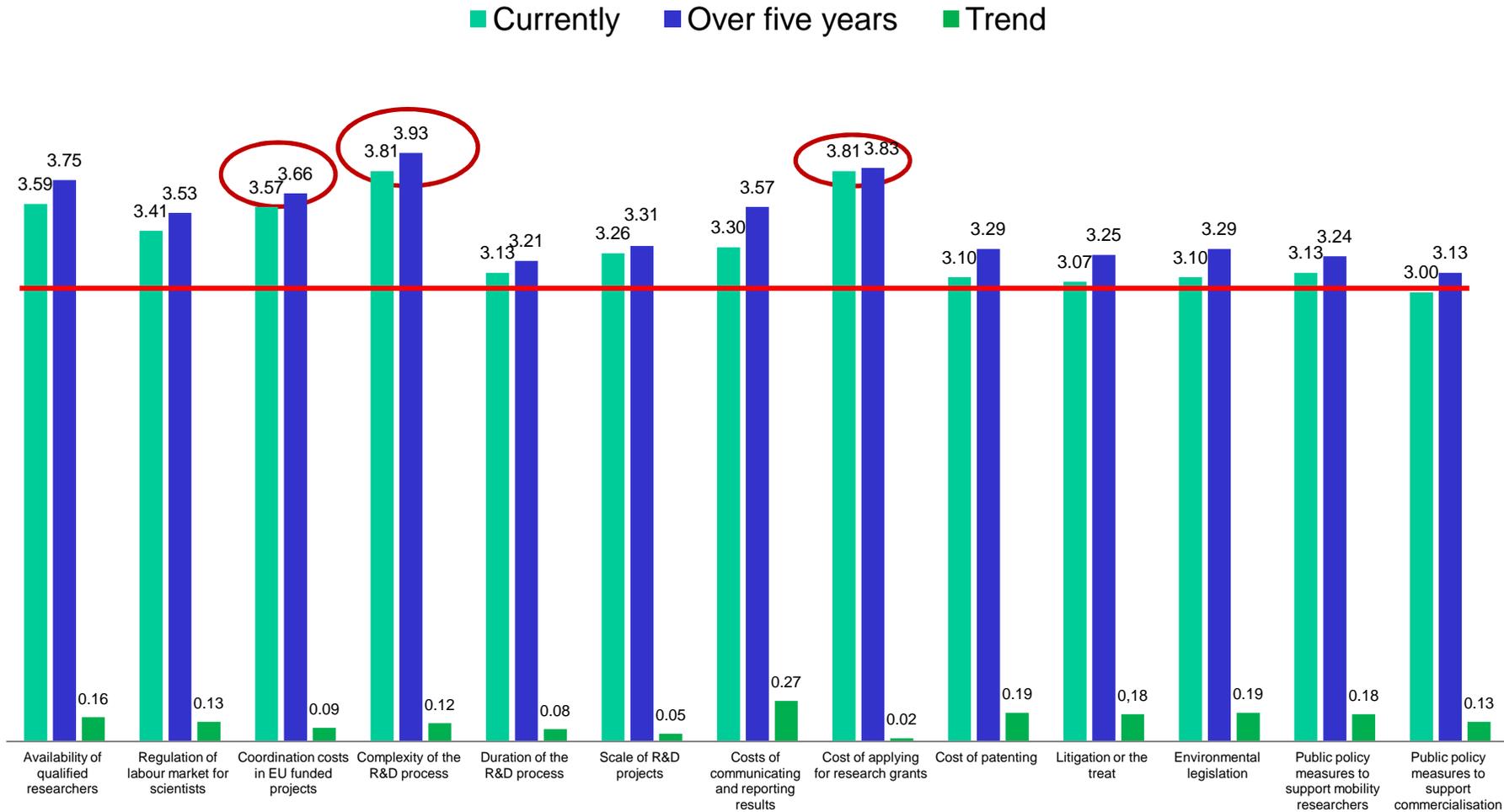


■ Currently (N = 83) ■ Over five years (N = 75) ■ Extrapolation



Scale: Importance from 1 (= very important cost reductions) to 5 (= very important cost increases).

# Drivers of the cost of R&D in PROs



## Comments (1)

The main drivers of the past and future (expected) increase in **R&D costs of companies** are, in the order, the **complexity** of the R&D process and the **environmental regulation**.

**Complexity** entails multidisciplinary projects, fusion of technologies, interaction with many actors in the value chain .

Our case studies suggest that **regulation entails costs but it can also** represent a stimulus to strengthen R&D choices with an **effect on R&D returns**.

## Comments (2)

The main **drivers of research cost for PROs** in the past and in the next future are, in the order.

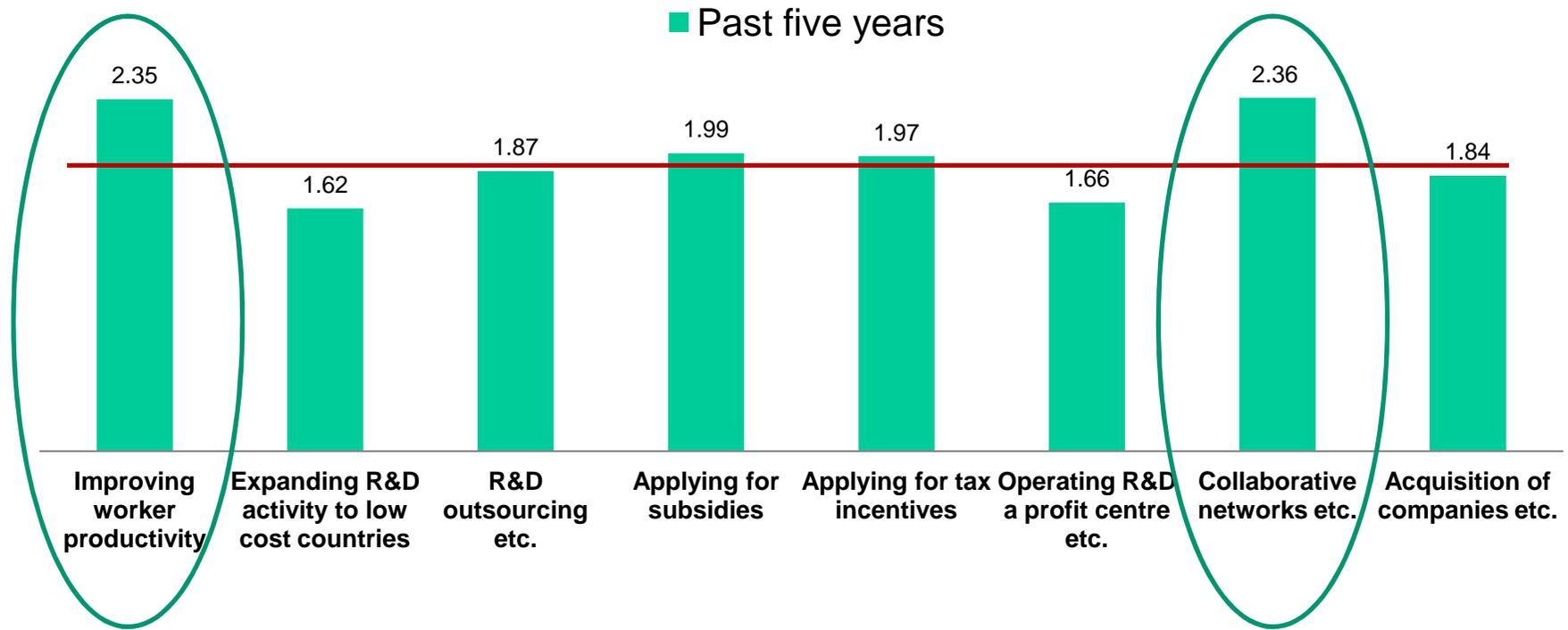
- the **complexity of R&D processes**;
- **applying for research grants** (project funding);
- **attracting qualified researchers**
- the **coordination of the European projects** (administrative costs).

The reduction of core funding and the increased competition among PROs and other actors seems to drive the cost involved in applying for grants and subsidies (to use time and resources for responding to a number of calls for financial, more than for research, reasons).

## 2. Research questions and answers

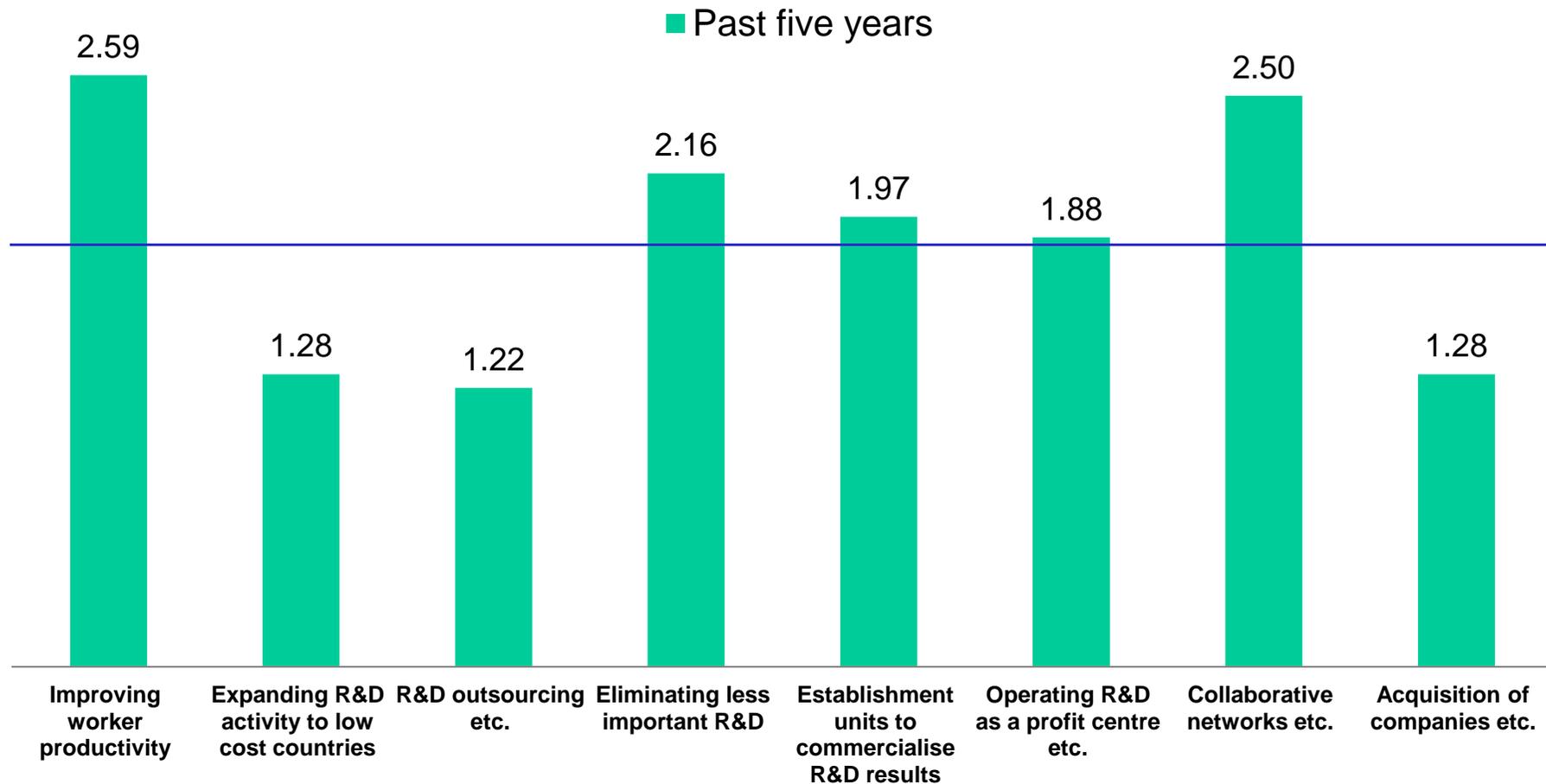
2.3. What are the **managerial, organizational and strategy responses** of companies and PROs to the research cost increase.

# R&D management and strategies: All COMs



Scale: importance from 1 (= not important) to 3 (=very important)

# Organisational responses in PROs



**Legend:** 1 (= not important), 2 (= neutral), 3 (=very important)

## Comments (1)

COMPANIES' answer to driving R&D cost factors:

Complexity has been faced through a re-shaping of the organizational structure of R&D activities, first of all for **redistributing costs** and **reducing risks**, through more open and flexible models of deploying corporate R&D resources (R&D outsourcing, off-shoring, R&D services purchasing, collaborations, technology markets development). These more open strategies allow the exploitation of **scope economies, spillovers** from other R&D projects and actors, division of R&D labour.

These new models bring additional costs, even if positive aspects can exceed the negative ones.

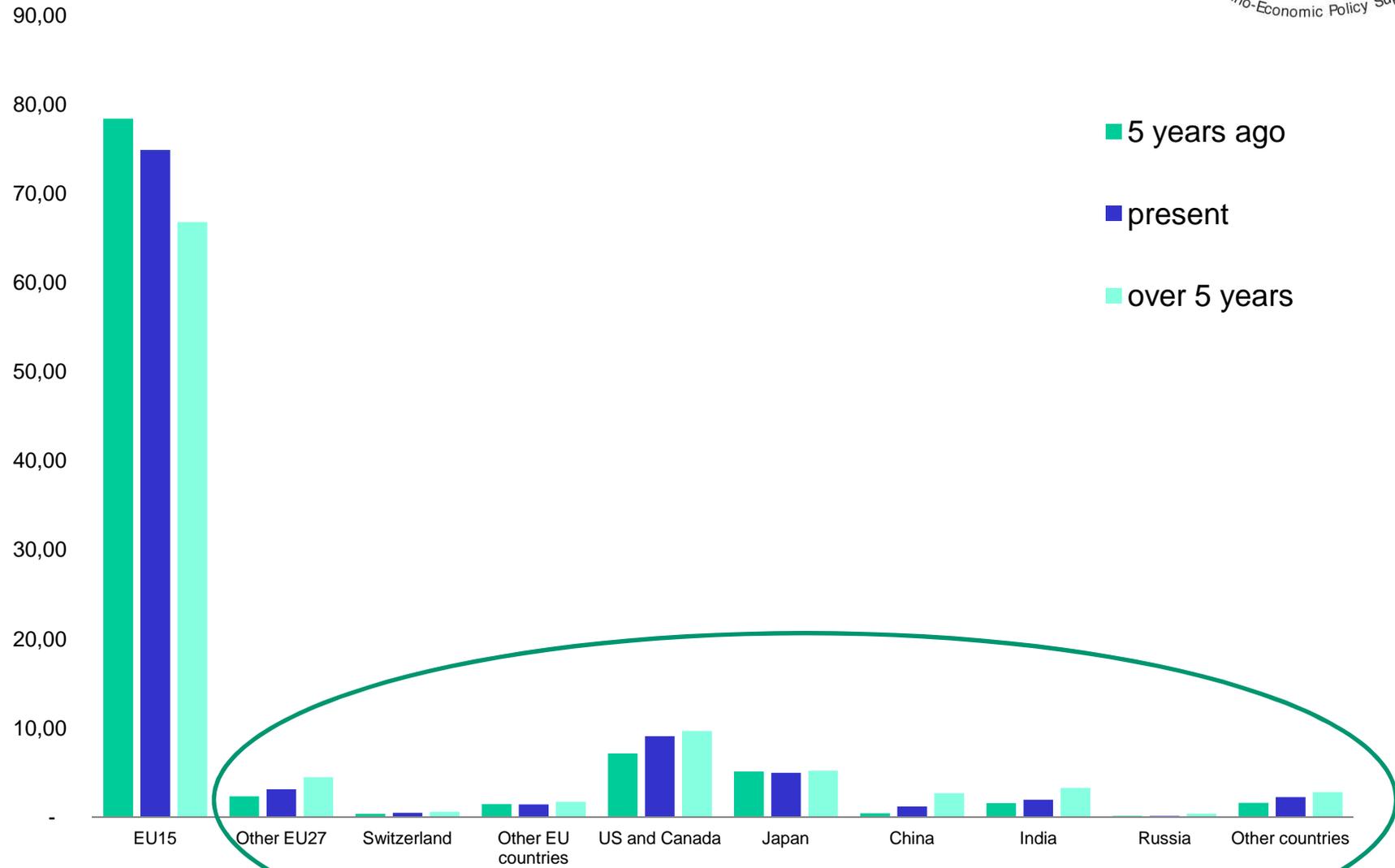
## Comments (2)

PROs answer to driving R&D cost factors:

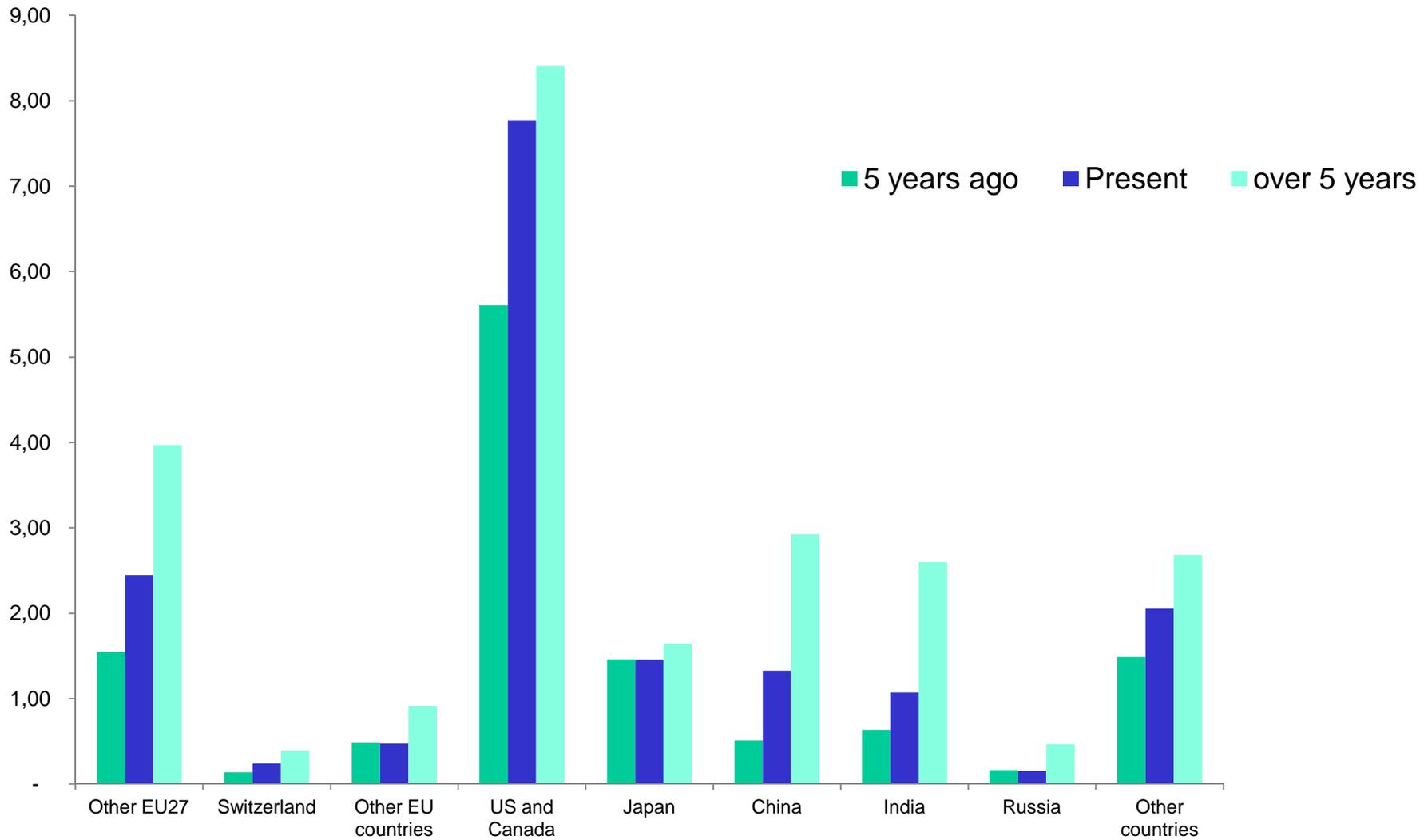
- The most important strategy to contain cost is to **improve research workers' productivity**, through managerial activity, i.e. using scientific facilities and the staff delivering scientific services to their full potential, for instance sharing research facilities; attracting best researchers (which asks for autonomy in managing scientists reward policy and updating of equipments);
- **Elimination of less important R&D**; this is done specially when PROs adopt some R&D cost or performance monitoring;
- Complexity is faced by improving **collaborations and networking**.

R&D costs and location decisions of companies (globalization of research).

# Share of locations in R&D financed by EU companies (in %) - including EU15



# Share of locations in R&D financed by EU companies (in %) - excluding EU15



## Comments (1)

**Overseas R&D activities are complementary rather than substituting for R&D activities in Europe.**

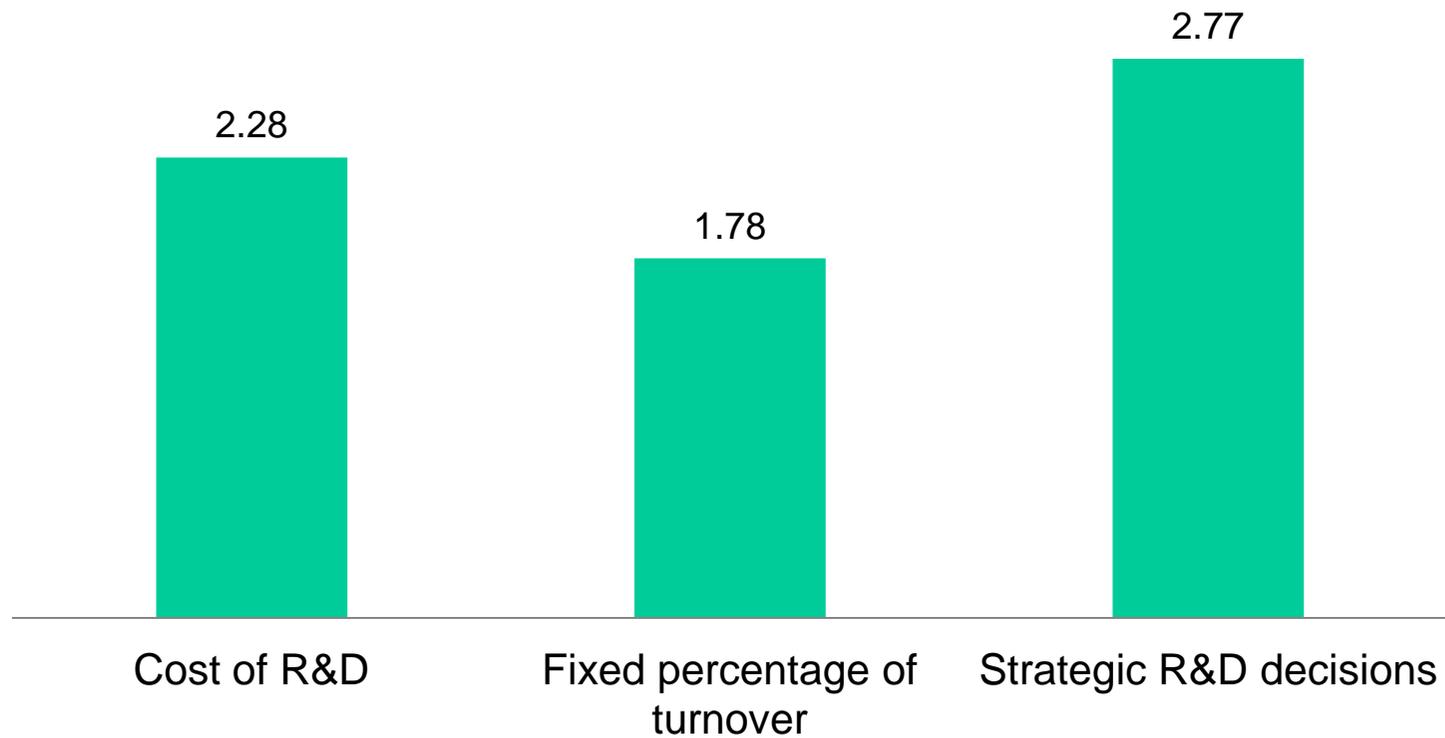
Companies do not regard going abroad as an important strategy to reduce R&D cost, but **to expand and adapt** to new markets (consumer demand, regulation, environment conditions etc.) and sometimes **to overcome a lack of qualified researchers.**

Case studies in Europe and in China indicate that the competitive advantage of China (and most dynamic regions) in H-T sectors is diminishing: the share of wages as % of total R&D costs is not very different: **the market for highly skilled international researchers has become global with globally “comparable” wages.** Moreover costs of materials, R&D services and capital are not competitive (**in dynamic regions R&D services are still less developed**).

The companies' strategic orientation to outsourcing R&D and to align R&D with the core business may reduce the trend of off-shoring driven by market exploitation, in favor of home based augmenting strategies.

Finally a positive sign for the development of ERA is the **expanding of R&D activities in European new Member States**, even if it goes slowly. 29

## Importance of factors determining R&D budget



Scale: Importance from 1 (not important) to 3 (very important)

# Main conclusions



- **R&D players in Europe adopt mixed strategies** to respond to increases in the cost of research (open innovation but also alignment of R&D to core business and increase of R&D productivity)
- Need to strengthen ways of **appropriating the returns from research spending**
- Monitor research cost developments and private sector responses - timely policy responses need to be developed .
- Increasing complexity of research is a key driver of the cost of research - emphasis on collaborative research is highly appropriate
- Take account of **positive productivity effects from R&D investment abroad**
- Ensure that the necessary absorptive capacity is in place to enable the 'reverse technology transfer' effect.
- **Strengthening collaboration and easing the mobility and access of researchers** and students from abroad will be an important lever in integrating the cultural and market sensitivity this bring into European research teams.

## 3. Implications for Policy

# R&D costs, efficiency, outcome and impact.

Companies consider spending on research not in terms of cost, but rather as an investment. **Decision about research investments and budgets** are taken on **expected outcomes, risks (of failure) and the strategic development of internal and external competencies.**

Cost indicators are used for strategic research management, but companies are cautious in their use because of the difficulties in **measuring research outputs. Costs have to be compared with risks or with performance.**

Uncertainty make difficult to measure **R&D efficiency** and bring to prefer a measure of **R&D impact.**

**R&D productivity** could be better improved by managing well creativity and risk, balancing scale and scope economies, and through a full exploitation of new scientific and technological equipment.

# Policy implications

How can policy influence the Research process in companies and PROs taking into account the challenges posed by rising R&D costs?

The study provides **evidence of a reshaping of the organizational structure of R&D activities:**

A more “efficient” knowledge eco-system, with a growth of R&D services, the creation of new (more flexible) business models for R&D, division of labour and sharing of risks more than merely off shoring for market reasons, accessing a larger pool of patents, a relevant role of (environment, products) regulation taking more into account societal needs.

To what extent are European companies and PROs equipped to face these changes, which bring also new costs?

# The future outlook...

- In total, the increase in research costs is expected to amount to about 30% in the next five years which indicates a **slowing down of the dynamic development over the past five years.**
- Although managers' estimations of future developments always have to be regarded with care, these findings could suggest that **further steady growth is not possible** as business confidence or productivity gains are not expected to increase as they have done in the past.
- While our survey suggests that companies expect to spend more on R&D in the future, **reaching the 3% target will remain challenging** and it **seems unlikely that this level will be reached soon.**

## A List of issues for the policy makers

Growth of capital costs

Growth of cost of finance

Costs of patenting

Design of regulation

Improve the returns from globalisation

Networking and collaboration

Role of PROs

# Growth of capital costs

- **Capital costs show the strongest growth rate** in the past in COMs (60%) (particularly in capital-intensive industries such as energy) and PROs (34%), though, in the future, this development will slow down, **PROs have increasingly problems in funding their research infrastructure. Specific policies** are required to support the funding of infrastructure in PROs.

# Growth of costs of financing

- While finance costs have not grown significantly in the last five years (5%), however, it is expected that **finance costs will grow considerably (41%) in the coming five years**. **External funding** will be more important.
- The **policy need to create favourable market conditions for the private financing of R&D** including venture capital and developing the financial instruments to promote greater private R&D investments (guarantee funds, etc.) for R&D in general and capital investment (see also EU 2020)
- A European venture capital Fund?
- PROs have specific problems: continuing public funding is seen as a fundamental requirement to nurture the internal capabilities, also for attracting private sector clients.
- Funding schemes could include R&D outsourcing.

# Costs for patenting

- **Costs for obtaining patents** are quite low compared to other cost categories (only about 2% of all R&D costs) and have grown less, compared to other cost elements (25%).
- However, patenting costs **will grow more strongly in the next five years (37%)** mainly due to a volume effect.
- While the importance of patenting costs for R&D decisions may be overrated in general terms, European Commission activities to harmonise the **IPR system** across Europe (e.g. create the single EU Patent) remain an important initiative in view of companies' expectations regarding rising patenting costs.

# Regulation: barrier or enabler?

- **Environmental legislation** was considered the most important cost driver and one that most urgently requires proactive strategies in response.
- Environmental legislation can create an impetus to identify and exploit **new opportunities**. To focus on end results more than on means (Lankoski 2010).
- Regulation should stimulate research that is directed **towards societal challenges** (Grand Challenges) such as climate change.
- However, regulation activities **needs to be harmonised across Europe**.
- Good policy examples at EU level are the Lead market initiatives and the proposed Innovative partnerships, addressing social issues and offering opportunities for competitive advantages.

# Research costs and globalisation

- There is a policy need to help firms to strengthen ways of **appropriating the returns from research spending from overseas** ('reverse technology transfer').
- There may even be a policy role in **supporting domestic companies in identifying key locations and centres of excellence** in emerging economies to maximise associated productivity gains.
- The **harmonising of fiscal incentives for R&D in different EU Member States** and discouraging of distortions of the competitive landscape within Europe is a further important policy goal.

# Networking and collaboration as new paradigm

- Collaborations bring with them transactions costs .
- EU 7 FP have fostered collaborative strategies, but concerns have been expressed as returns was too uncertain: large scale projects are too difficult to manage to make sure each partner delivers and thus the whole consortium benefit. There is the risk that costs and benefits become unbalanced.
- It is important to find a balance between a European policy of fostering **excellence** (picking the winners) and sustaining variety and **cohesion**.
- There is a need for a new balance between scale and scope economies and between centralised and decentralised R&D governance solutions.
- There is a need for the real application of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, in order to establish similar conditions (salaries, career, ...).

## The role of PROs

- Careful policy attention is required with regard to understanding and helping to shape the **balance of activities between different R&D players**, that is required to ensure optimum outcomes for European societies.