



Worldwide R&D Trend, Challenge and Opportunity

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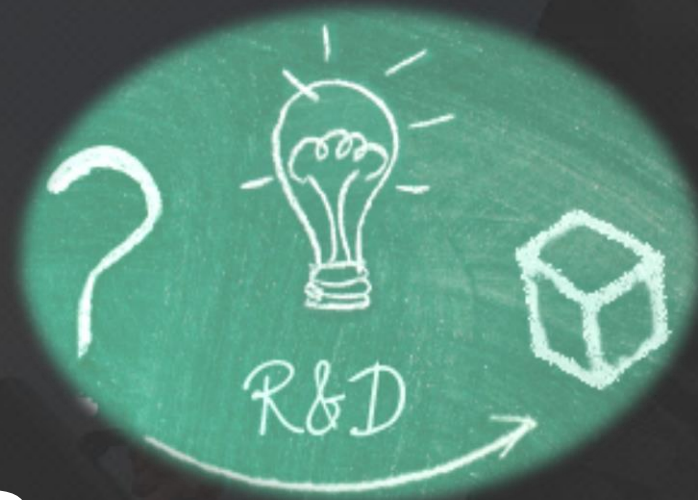
**World R&D
Scoreboard**

Trends

Financing R&D

About R&D

**Challenge and Opportunity
on the global market**



What is between ?



How did we get from the **old phone** to the **smartphone** ?

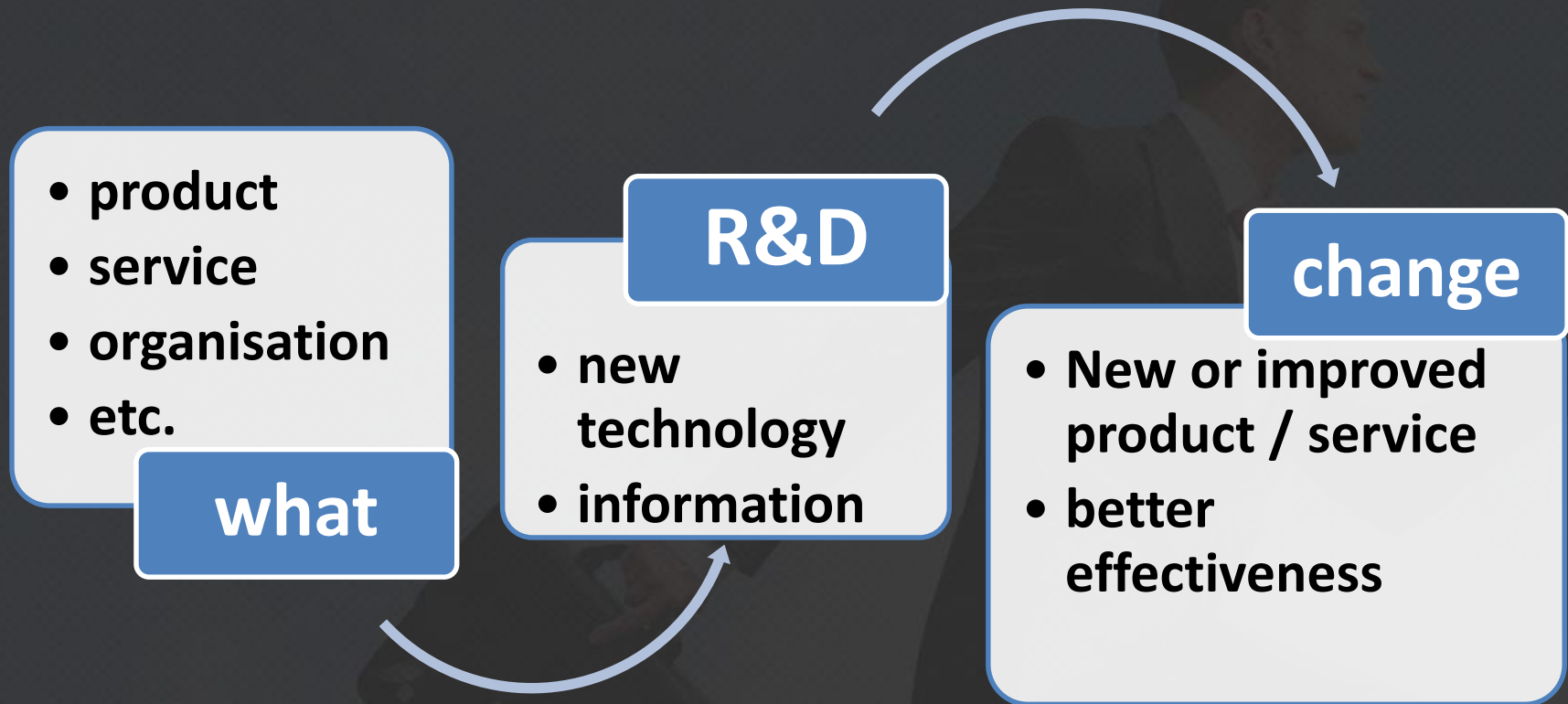
What is between ?



R&D



The aim of R&D



Main R&D industries in last 10 years

Automotive



Aerospace &
Defence



Computing &
Electronics



Industrials



Environment



Healthcare



Software &
Internet

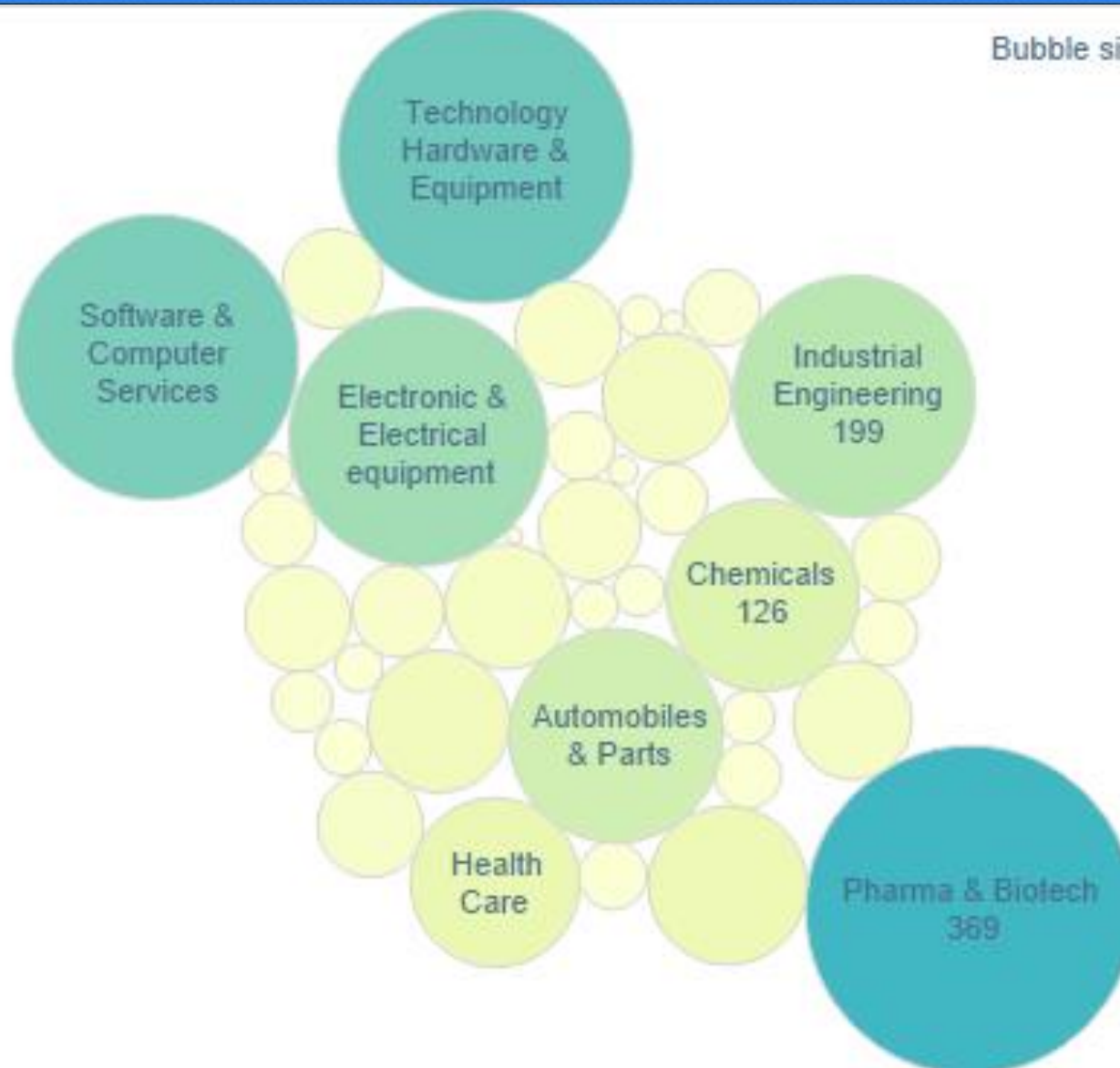


World R&D Scoreboard

(fiscal year 2015/2016)



Bubble size



World R&D Scoreboard

(fiscal year 2015/2016)

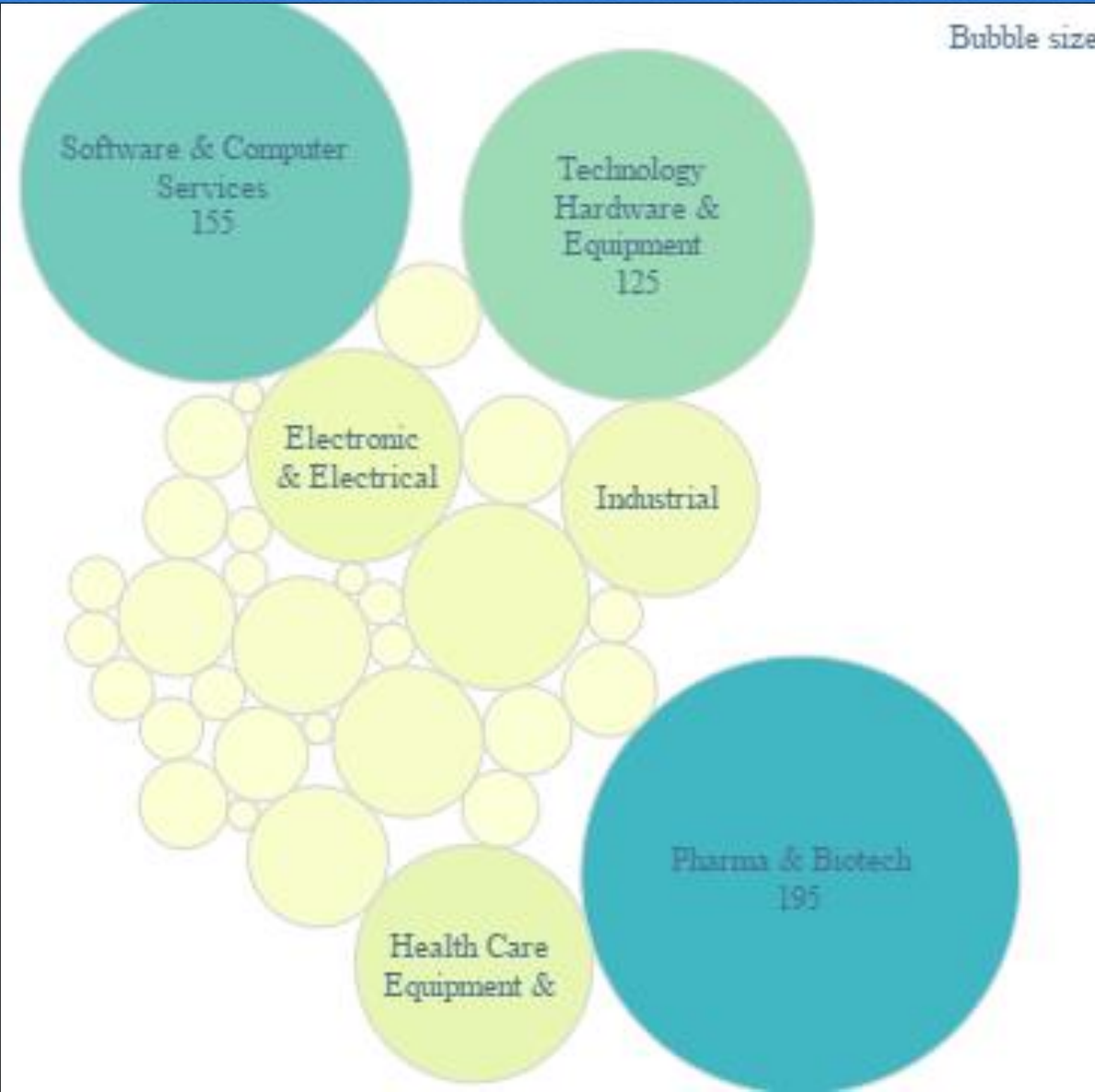


(World 2500 Top R&D Investors, together 696 bn EUR)

| Industrial sector | Number of companies | Million EUR |
|-----------------------------------|---------------------|----------------|
| Pharma & Biotech | 369 | 132.352 |
| Technology Hardware & Equipment | 298 | 111.049 |
| Software & Computer Services | 278 | 79.303 |
| Electronic & Electrical Equipment | 228 | 52.355 |
| Industrial Engineering | 199 | 27.543 |
| Automobiles & Parts | 156 | 107.831 |
| Chemicals | 126 | 23.175 |

World R&D Scoreboard (fiscal year 2015/2016)

USA



World R&D Scoreboard

(fiscal year 2015/2016)

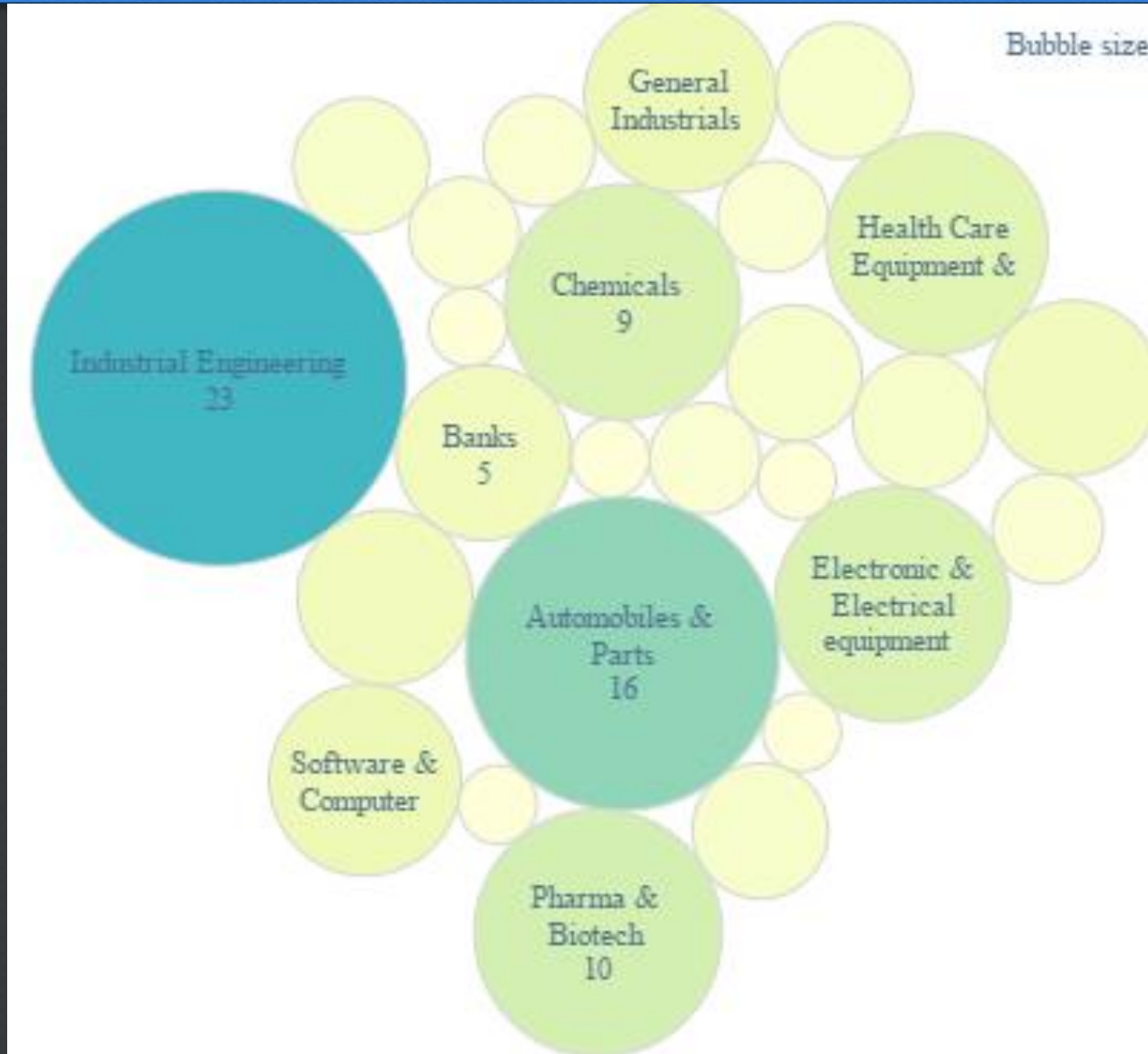
USA



| Industrial sector | Number of companies |
|--|---------------------|
| Pharma & Biotech | 195 |
| Technology Hardware & Equipment | 125 |
| Software & Computer Services | 155 |
| Electronic & Electrical Equipment | 46 |
| Industrial Engineering | 39 |
| Healthcare Equipment & Services | 57 |
| Chemicals | 35 |

World R&D Scoreboard (fiscal year 2015/2016)

Germany



World R&D Scoreboard

(fiscal year 2015/2016)

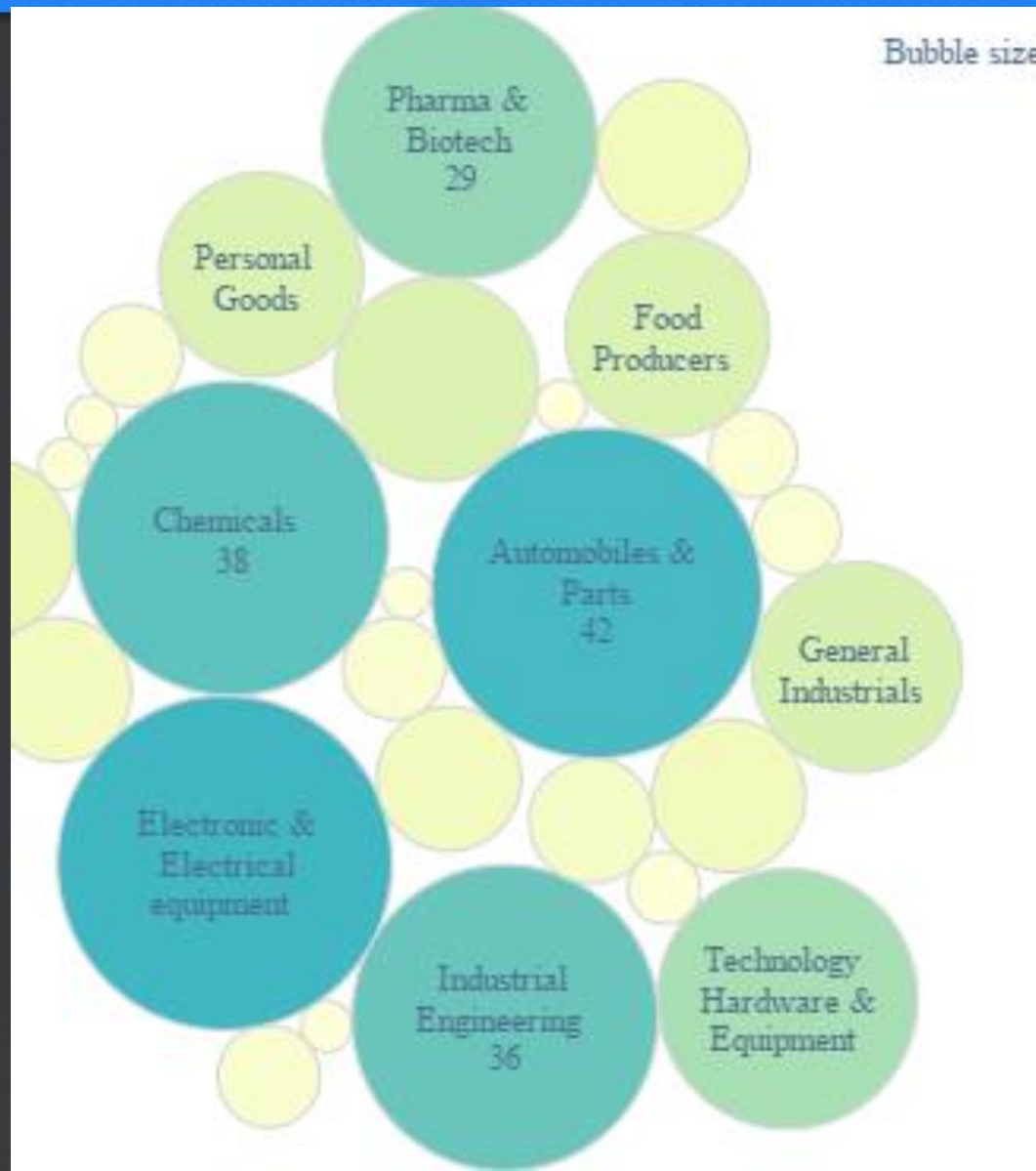
Germany



| Industrial sector | Number of companies |
|-----------------------------------|---------------------|
| Pharma & Biotech | 10 |
| Technology Hardware & Equipment | 5 |
| Software & Computer Services | 6 |
| Electronic & Electrical Equipment | 9 |
| Industrial Engineering | 23 |
| Automobiles & Parts | 16 |
| Chemicals | 9 |

World R&D Scoreboard (fiscal year 2015/2016)

Japan



World R&D Scoreboard

(fiscal year 2015/2016)

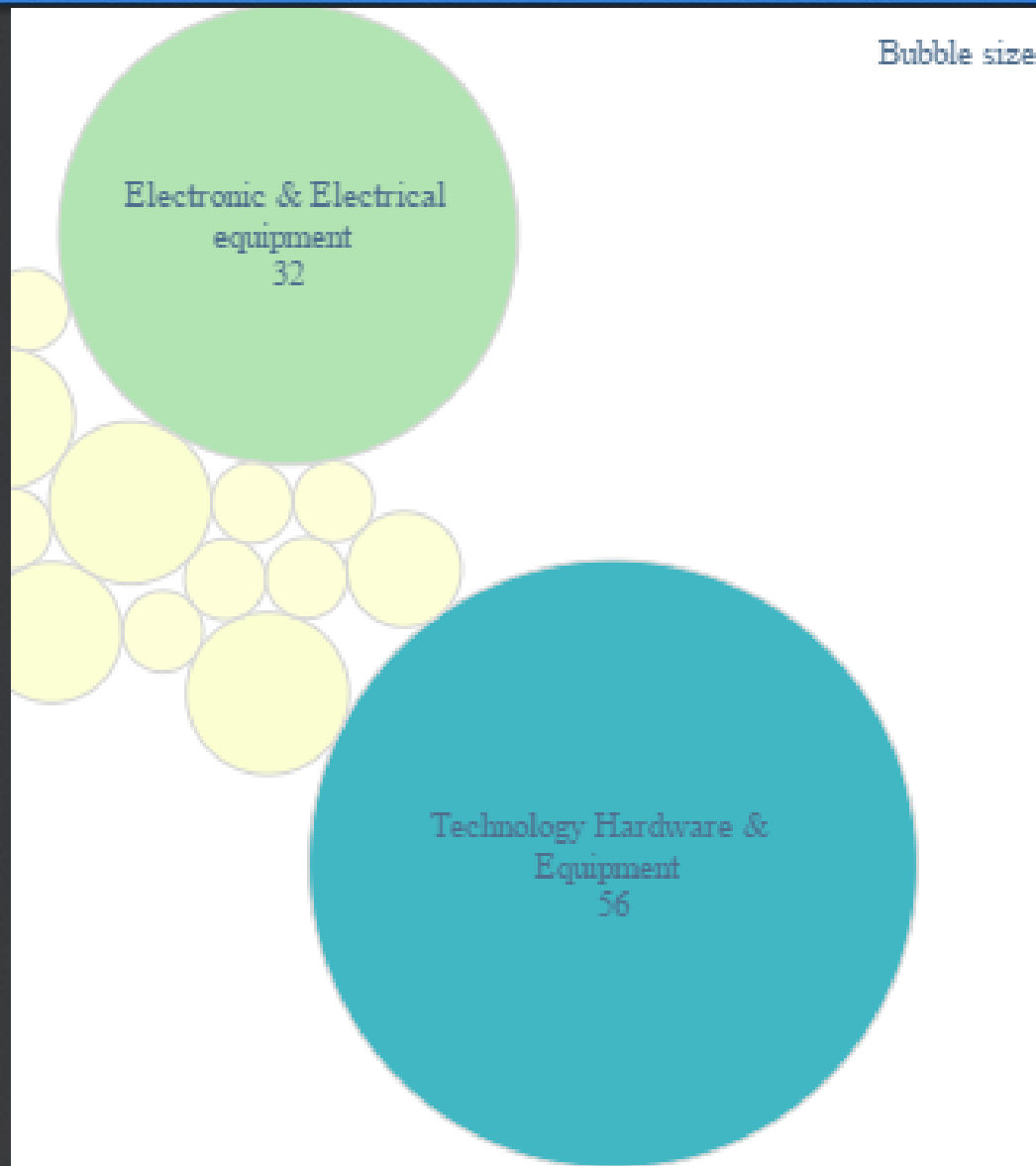
Japan



| Industrial sector | Number of companies |
|--|---------------------|
| Pharma & Biotech | 29 |
| Technology Hardware & Equipment | 26 |
| General Industrials | 17 |
| Electronic & Electrical Equipment | 43 |
| Industrial Engineering | 36 |
| Automobiles & Parts | 42 |
| Chemicals | 38 |

World R&D Scoreboard (fiscal year 2015/2016)

Taiwan



World R&D Scoreboard

(fiscal year 2015/2016)

Taiwan



| Industrial sector | Number of companies |
|--|---------------------|
| Pharma & Biotech | 1 |
| Technology Hardware & Equipment | 56 |
| Software & Computer Services | 2 |
| Electronic & Electrical Equipment | 32 |
| Industrial Engineering | 1 |
| Automobiles & Parts | 4 |
| Chemicals | 1 |

10 Most **Innovative** Companies in 2016



| 2016 Rank | 2015 Rank | Company | Geography | Industry | R&D Spend (\$Bn) |
|-----------|-----------|----------------|--------------|---------------------------|------------------|
| 1 | 1 | Apple | UnitedStates | Computing and electronics | 8.1 |
| 2 | 2 | Alphabet | UnitedStates | Software and internet | 12.3 |
| 3 | 6 | 3M | UnitedStates | Industrials | 1.8 |
| 4 | 3 | Tesla Motors | UnitedStates | Automotive | 0.7 |
| 5 | 5 | Amazon | UnitedStates | Software and internet | 12.5 |
| 6 | 4 | Samsung | SouthKorea | Computing and electronics | 12.7 |
| 7 | NA | Facebook | UnitedStates | Software and internet | 4.8 |
| 8 | 8 | Microsoft | UnitedStates | Software and internet | 12 |
| 9 | 7 | General Elect. | UnitedStates | Industrials | 4.2 |
| 10 | 9 | IBM | UnitedStates | Computing and electronics | 5.2 |

Top 20 R&D **Spenders** in 2016



| 2016 Rank | 2015 Rank | Company | Geography | Industry | R&D Spend (\$Bn) |
|-----------|-----------|---------------------|--------------|---------------------------|------------------|
| 1 | 1 | Volkswagen | Germany | Automotive | 13.2 |
| 2 | 2 | Samsung | South Korea | Computing and electronics | 12.7 |
| 3 | 7 | Amazon | UnitedStates | Software and Internet | 12.5 |
| 4 | 6 | Alphabet | UnitedStates | Software and internet | 12.3 |
| 5 | 3 | Intel Co | UnitedStates | Computing and electronics | 12.1 |
| 6 | 4 | Microsoft | UnitedStates | Software and internet | 12 |
| 7 | 5 | Roche | Switzerland | Healthcare | 10 |
| 8 | 9 | Novartis | Switzerland | Healthcare | 9.5 |
| 9 | 10 | Johnson & Johnson | UnitedStates | Healthcare | 9 |
| 10 | 8 | Toyota | Japan | Automotive | 8.8 |
| 11 | 18 | Apple | UnitedStates | Computingandelectronics | 8.1 |
| 12 | 11 | Pfizer | UnitedStates | Healthcare | 7.7 |
| 13 | 13 | General Motors | UnitedStates | Automotive | 7.5 |
| 14 | 14 | Merck | UnitedStates | Healthcare | 6.7 |
| 15 | 15 | Ford | UnitedStates | Automotive | 6.7 |
| 16 | 12 | Daimler | Germany | Automotive | 6.6 |
| 17 | 17 | Cisco | UnitedStates | Computingandelectronics | 6.2 |
| 18 | 20 | AstraZeneca | Britain | Healthcare | 6 |
| 19 | 32 | Bristol-MyersSquibb | UnitedStates | Healthcare | 5.9 |
| 20 | 22 | Oracle | UnitedStates | Software and internet | 5.8 |

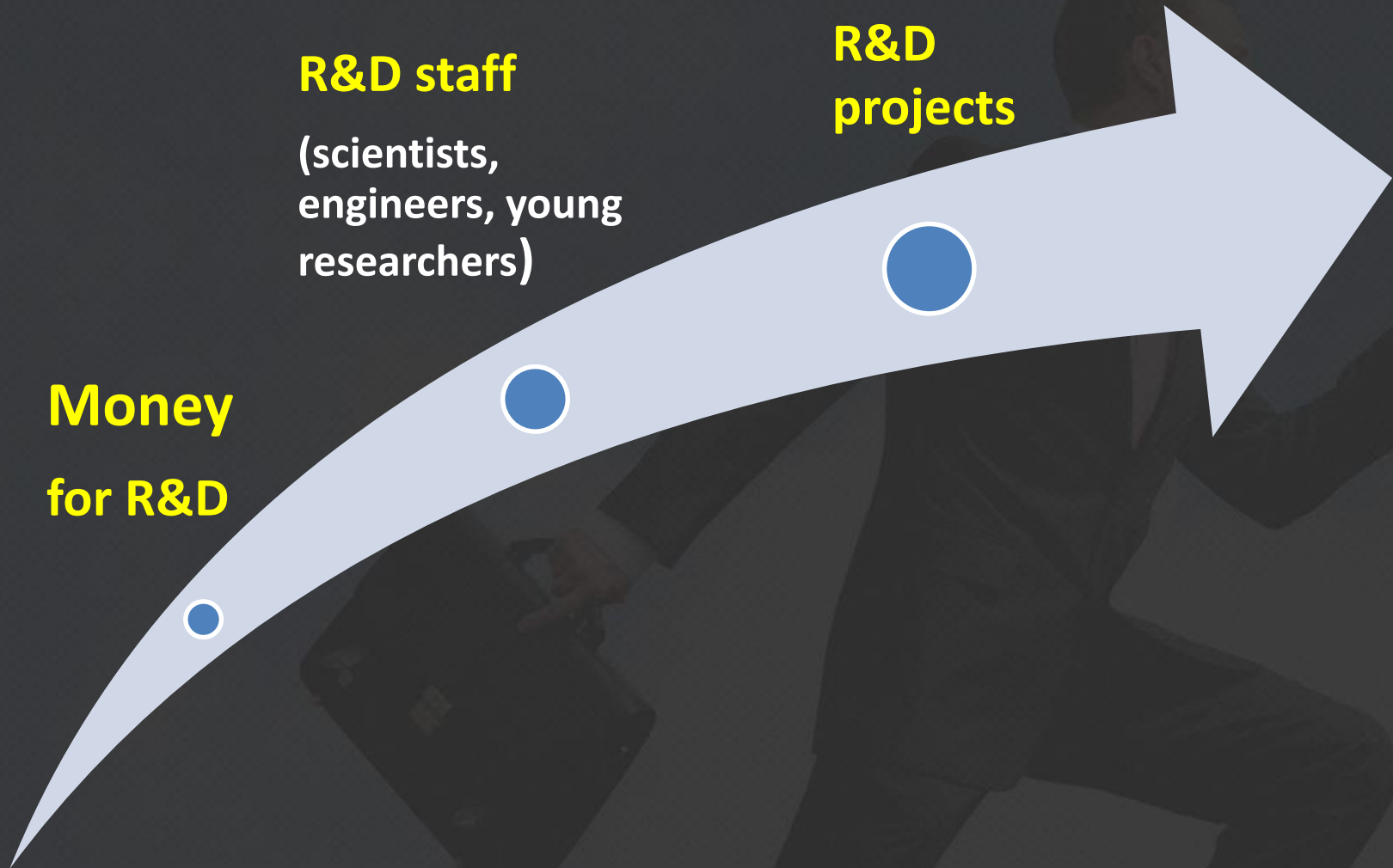
R&D environment

R&D staff

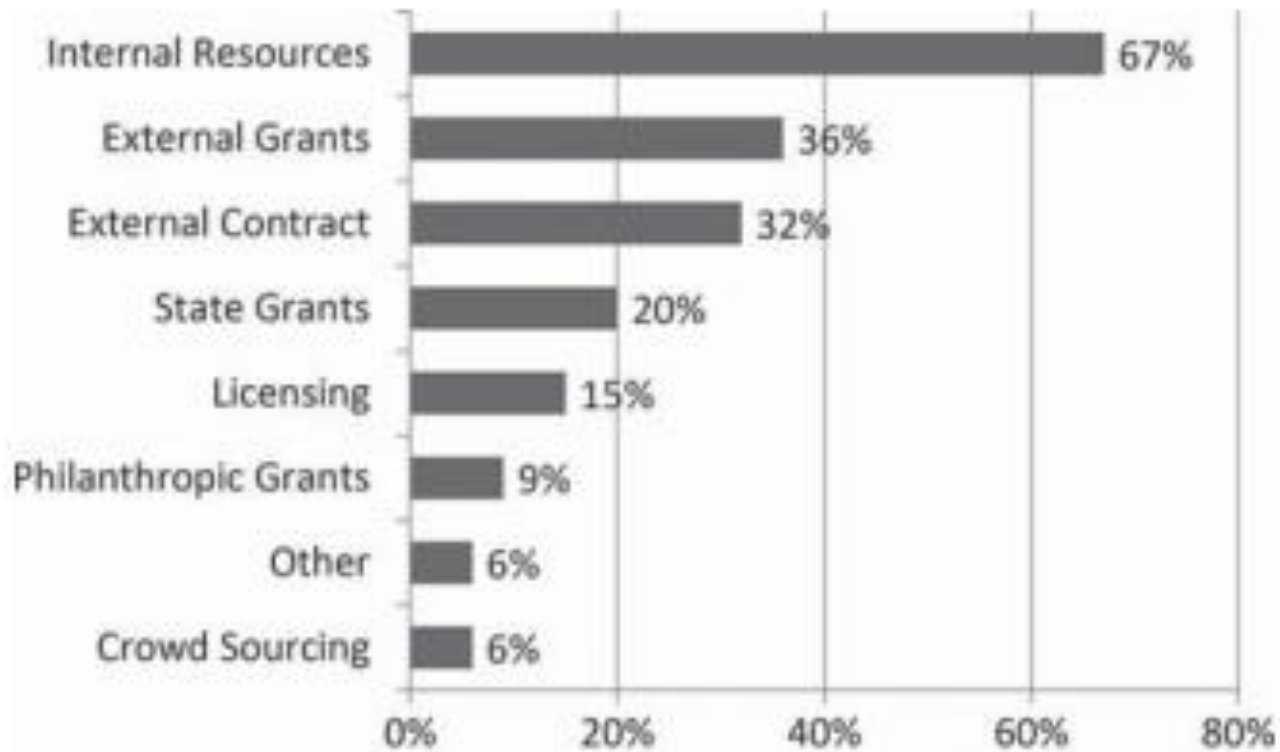
(scientists,
engineers, young
researchers)

R&D projects

Money for R&D

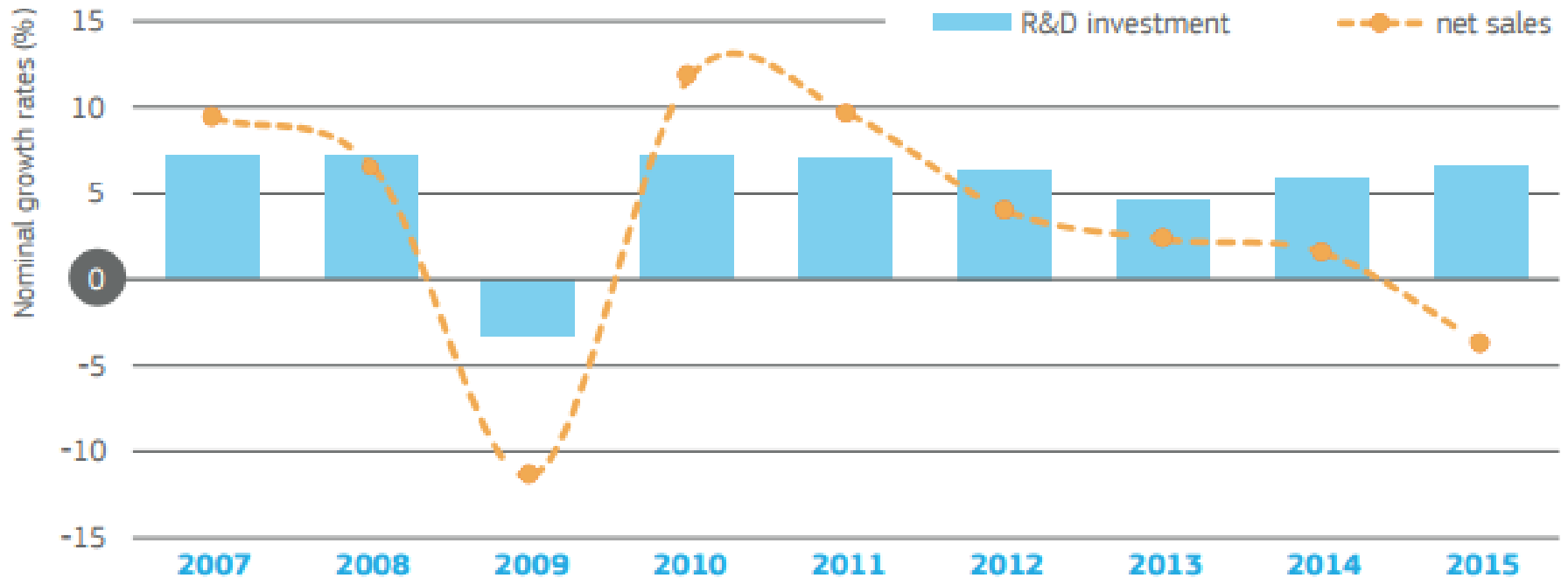


Financing R&D



(Research between companies spenders $\geq 0,5$ mio EUR / year)

Financing R&D



(Industrial Research Institute, 2016 R&D Trends Forecast)

Financing R&D

| FACTOR | GLOBAL | EU | USA | JAPAN | CHINA | RoW |
|--------------------------|-----------------|---------|---------|---------|---------|---------|
| No. OF COMPANIES | 2 500 | 590 | 837 | 356 | 327 | 390 |
| R&D IN 2015/16, €bn | 696.0 | 188.3 | 268.6 | 99.9 | 49.8 | 89.4 |
| World R&D share, % | 100.0 | 27.1 | 38.6 | 14.4 | 7.2 | 12.8 |
| One year change, % | 6.6 | 7.5 | 5.9 | 3.3 | 24.7 | 2.4 |
| Net Sales, €bn | 17 686.8 | 5 678.4 | 4 518.8 | 2 859.6 | 1 978.9 | 2 651.2 |
| World net sales share, % | 100.0 | 32.1 | 25.5 | 16.2 | 11.2 | 15.0 |
| One year change, % | -3.6 | -3.6 | -4.0 | 0.3 | -6.2 | -4.8 |
| R&D intensity, % | 3.8 | 3.2 | 5.8 | 3.3 | 2.5 | 3.3 |

TABLE S.1 - OVERALL PERFORMANCE OF THE 2500 COMPANIES IN THE 2016 SCOREBOARD.

Note : The RoW group comprises companies based in Taiwan, South Korea, Switzerland, Canada and a further 19 countries.

Source: The 2016 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD.

Financing R&D

| FACTOR | SWITZERLAND | SOUTH KOREA | TAIWAN | CANADA |
|---------------------|-------------|-------------|--------|--------|
| No. OF COMPANIES | 58 | 75 | 111 | 32 |
| R&D in 2015/16, €bn | 28.0 | 25.4 | 14.0 | 4.7 |
| World R&D share, % | 4.0 | 3.7 | 2.0 | 0.7 |
| One year change, % | -1.5 | 3.7 | 7.1 | -2.3 |
| Net Sales, €bn | 377.6 | 822.5 | 511.9 | 115.1 |
| One year change, % | -3.3 | -1.7 | -0.3 | 1.7 |
| R&D intensity, % | 7.4 | 3.1 | 2.7 | 4.1 |

TABLE S.2 - PERFORMANCE OF COMPANIES BASED IN THE LARGEST COUNTRIES OF THE RoW GROUP.

Source: The 2016 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD.

Trends

Global expenditure on R&D will continue **to grow**.

Developing countries **increase R&D spendings**.

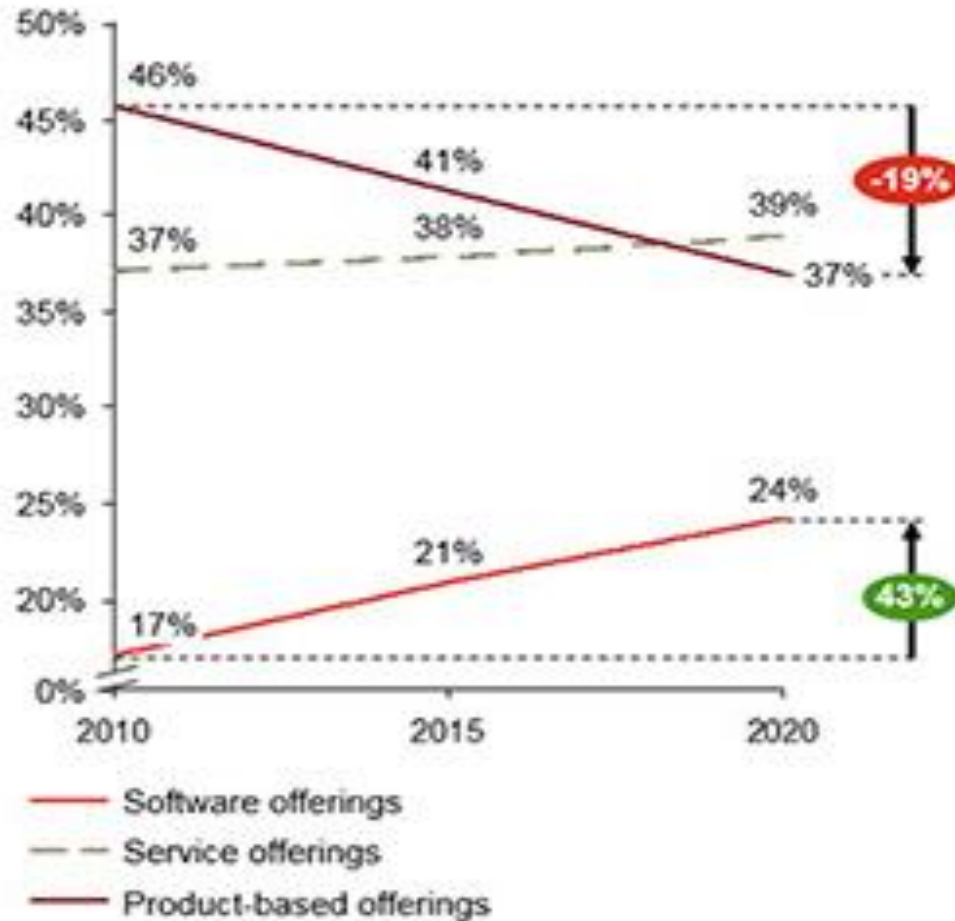
Academia and industry will both **fund R&D**.

Global expansion of the **R&D staff** will continue.

Healthcare will pass Computing and Electronics to become the largest by R&D spending (in 2 years).

Trends

Average allocation of R&D spending to types of offerings



Challenges

- **positive relationship** between spending on R&D and profitability,
- expenditure R&D for physical products remove to **software & service**,
- **innovation-driven bussines** instead of cost efficiency approach,
- needs for **data and software engineers** instead of electrical and mechanical engineers.

Challenges

Trend (future) R&D sectors

**PHARMA &
BIOTECH**

**HEALTH CARE
(equipment, service)**

**SOFTWARE &
COMPUTING**

**AUTOMOTIVE
(electric, self –v)**

**ELECTRONICS
(virtual, mobile)**

**FOOD &
WATER**

What about Taiwan ?

- **Spend more** on R&D.
- Remove to sectors with **higher added value**.
- Invent, inovate and **be first** (don't be follower).
- Invest in **R&D staff**.
- Keep to **work hard and good**, keep to **be TAIWAN**.

Any questions ?

