



Footprint of R&D investments in the microelectronics industry

Graz, February 24, 2009

ATKEARNEY

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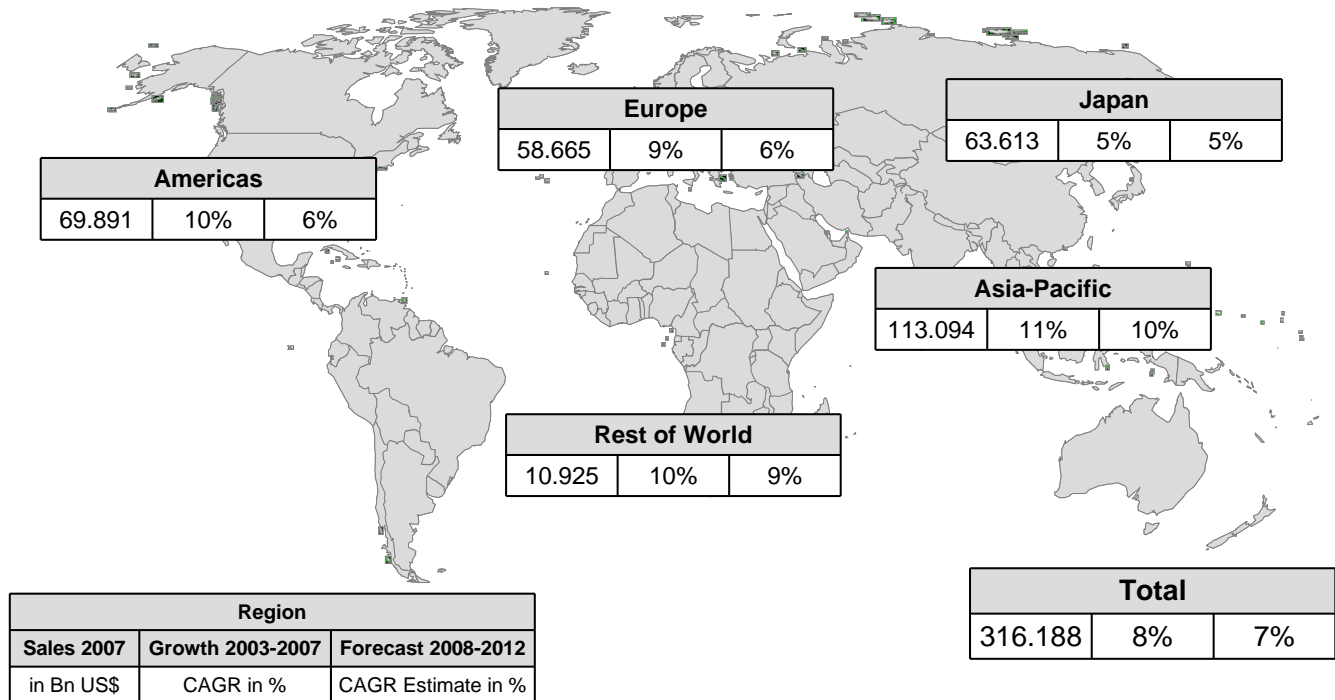
In a focus study of the microelectronics industry, we identified major trends which will affect R&D

Executive summary

- The total global market for microelectronics sums up to US\$ 316 bn. and is growing specially in emerging markets
- The microelectronics industry is in the start of consolidation
- Value growers (specially smaller players from emerging markets) might be the consolidators
- Consolidation will drive R&D offshoring – but not completely and not only driven by costs
- Growth opportunities for microelectronics with an impact on R&D come from Automotive and computer industry

The total global market for microelectronics sums up to US\$ 316 bn. and is growing specially in emerging markets

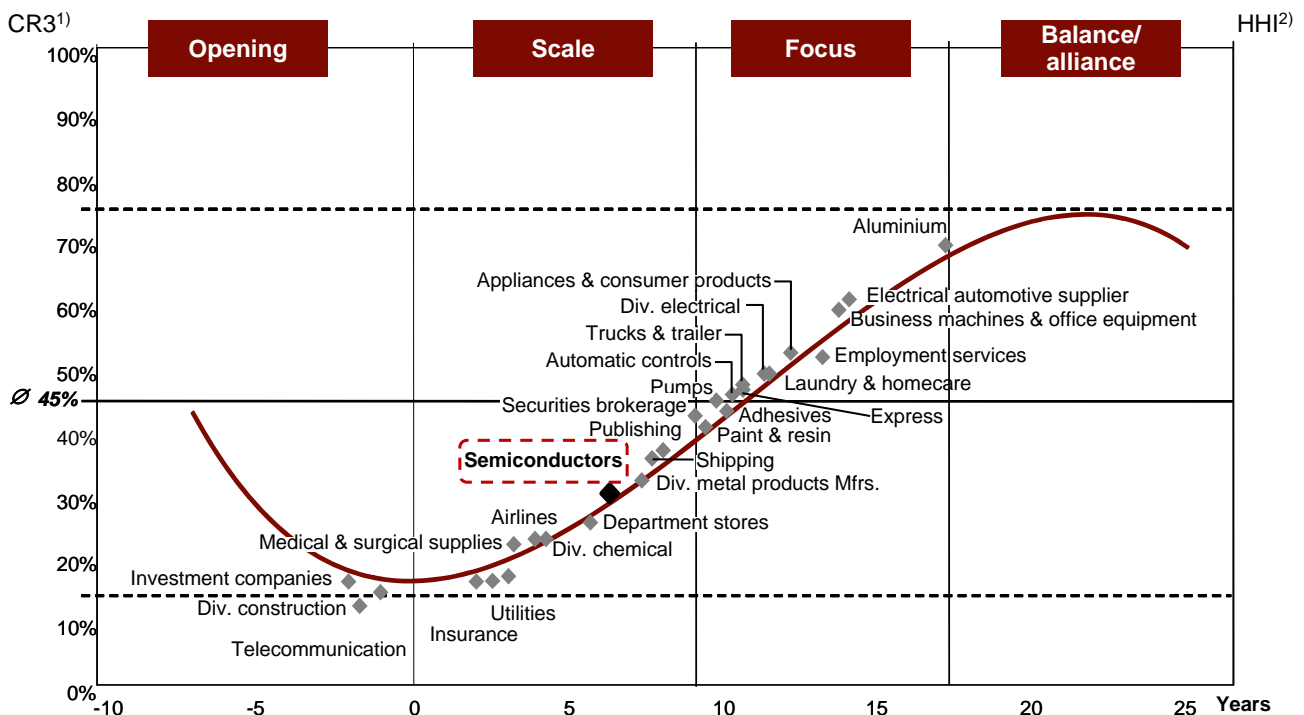
Microelectronics: 2007 – World market by major regions (US\$ mil.)



Source: A.T. Kearney analysis

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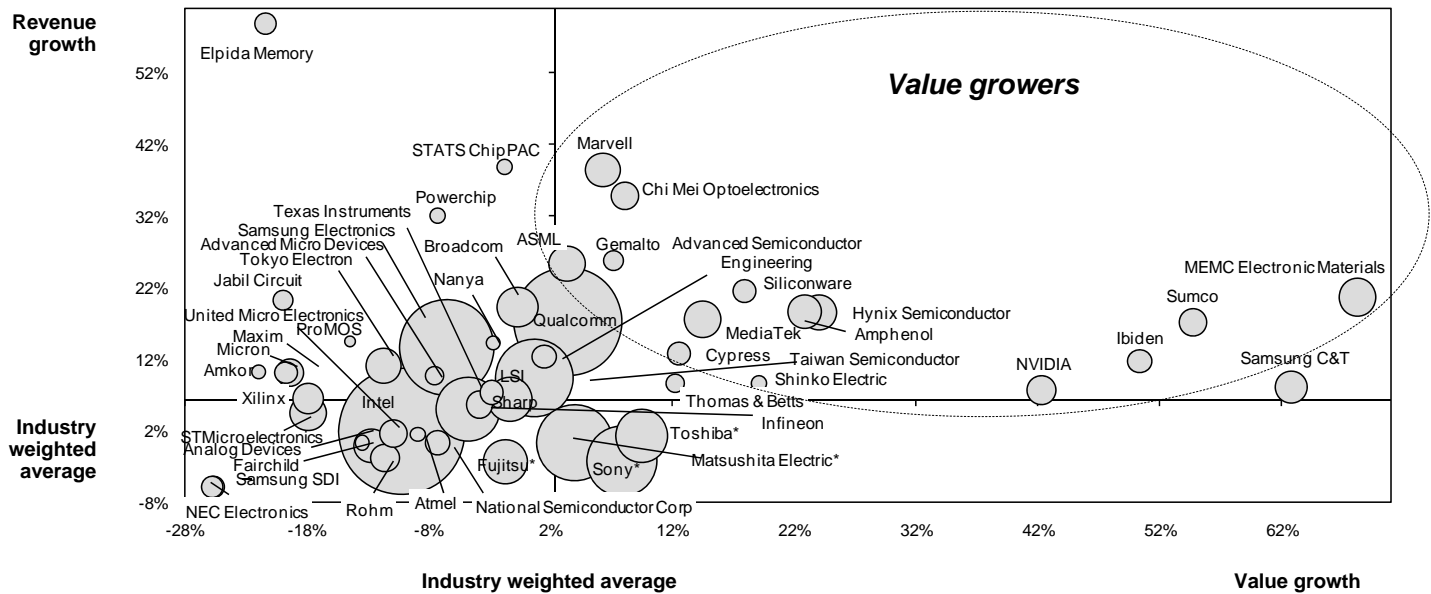
The microelectronics industry is in the start of consolidation – at the end there will be three players



1) CR3: Market share of the three largest companies of the total market based on Value-Building Growth database (34,000 companies)
 2) HHI: Hirschman-Herfindahl Index corresponds to the sum of the squared market shares of all companies, the axis is logarithmically plotted, CR3 and HHI correlate with $r^2 = 0.78$
 Source: Value-Building Growth database; A.T. Kearney analysis

Smaller players from emerging markets enter the market and might be the consolidators

Global semiconductors growth portfolio CAGR 2003-2007



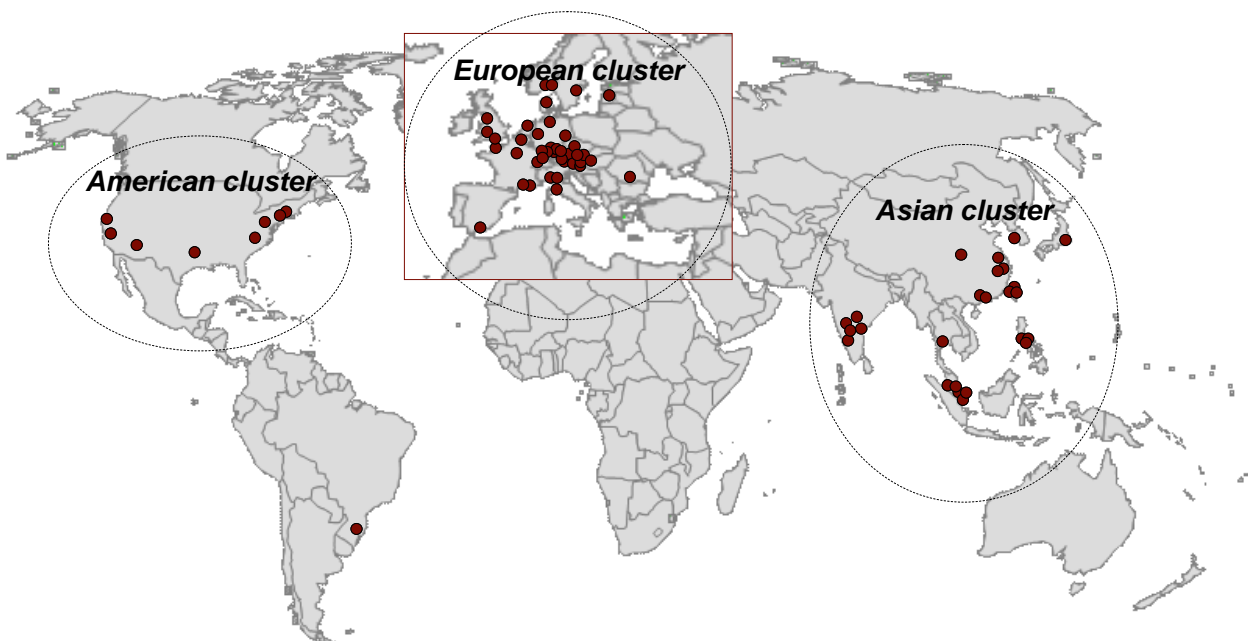
Bubble size = Market Capitalization from 31.07.2008

1) The following business segments were considered: Sony: „Electronics“, Toshiba: „Electronic devices and components“, Fujitsu: „Electronic devices“, Matushita Electric: „Components & devices“. Value growth were calculated on the EBIT growth basis. Market Cap was estimated with industry multiple

Source: Reuters, Annual reports, A.T.Kearney

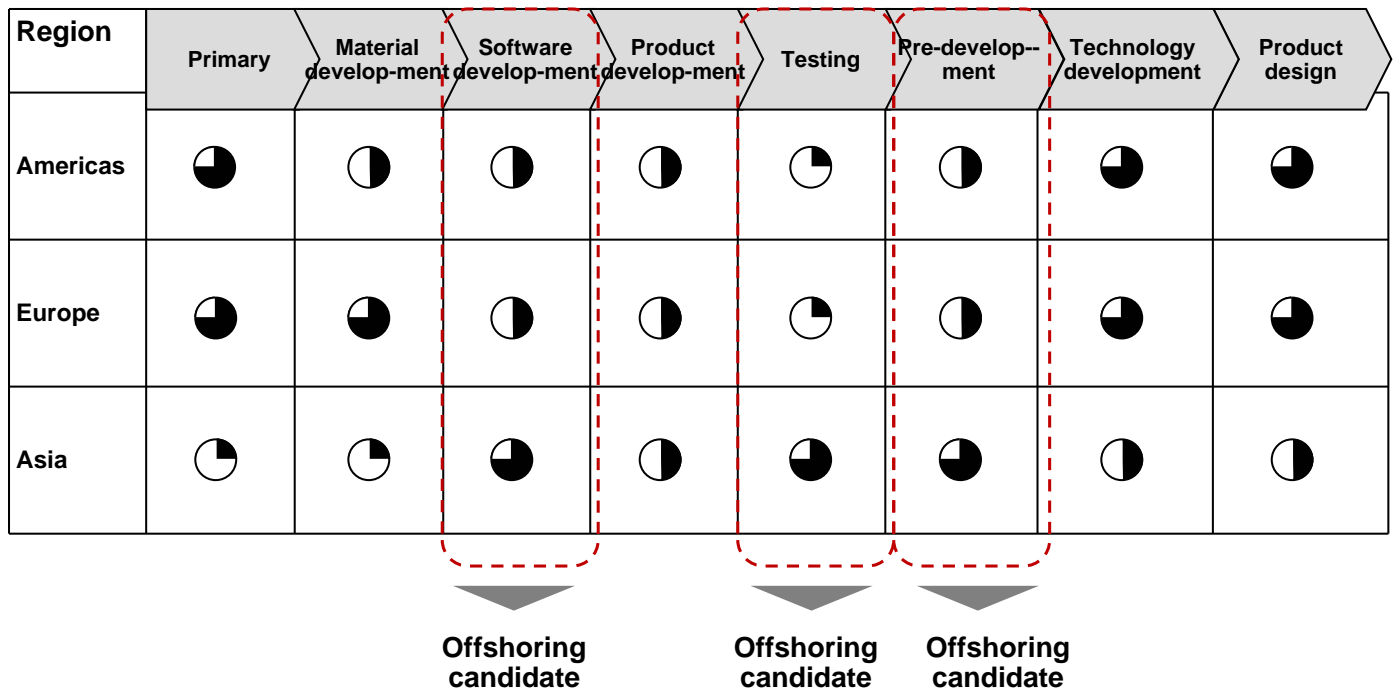
R&D is already today a global function – the tendency is towards the new markets

R&D footprint – Major R&D locations of microelectronics industry



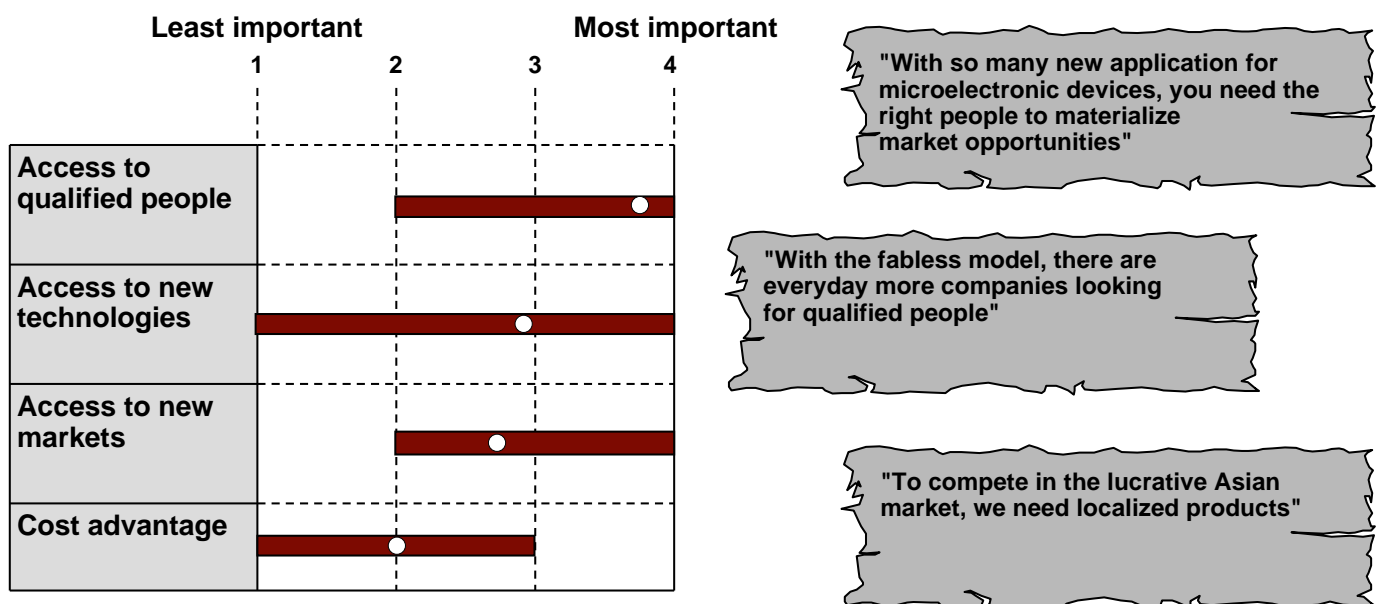
Specially software development, testing and share of pre-development might be located towards offshore regions

Focus of R&D activities



Cost advantage is typically not the major driver for offshoring of R&D

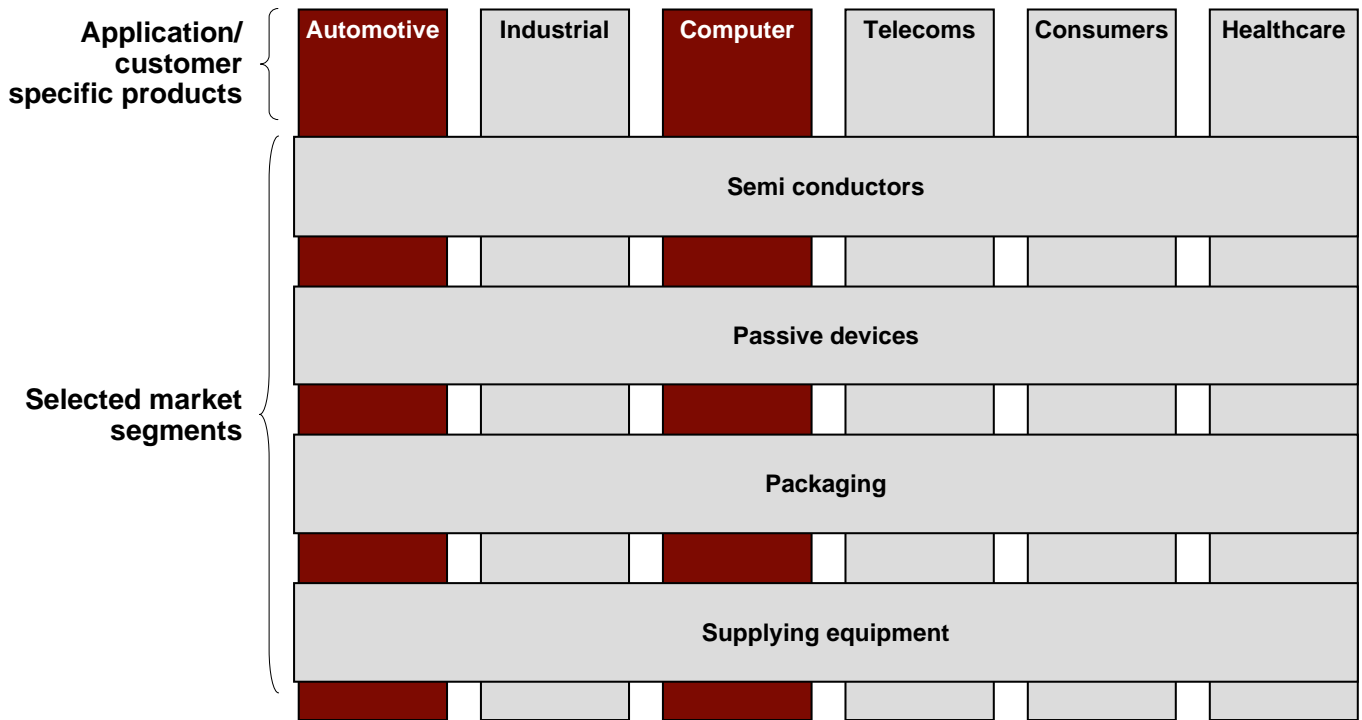
Major drivers for selection of R&D sites



Legend - Min Average Max

For microelectronics, Automotive and Green IT offer significant opportunities

Segmentation of the microelectronics industry





Source: A.T. Kearney analysis


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Opportunity 1 – Automotive: Alternative powertrain solutions is a key issue at the moment


CEO quotes on powertrain

 **Martin Winterkorn, CEO Volkswagen** (06/2008)
 "The future belongs to the electric vehicle – using electricity from the power plug."

 **Klaus Draeger, Head of R&D BMW** (06/2008)
 "In the long run, hydrogen will be the solution."

 **Rick Wagoner, CEO General Motors** (03/2008)
 "All of us are under enormous pressure. GM has a clearly defined goal: we want to launch the Volt in 2010 for a price of less than 30 000 dollar."

 **Takeo Fukui, CEO Honda Europa** (03/2008)
 "There are many technologies for reducing CO2 emissions. The best solution from our perspective is the fuel cell. Until a mass market production is possible, hybrid motors as well as clean diesel aggregates, biofuels and battery driven powertrains will be used."

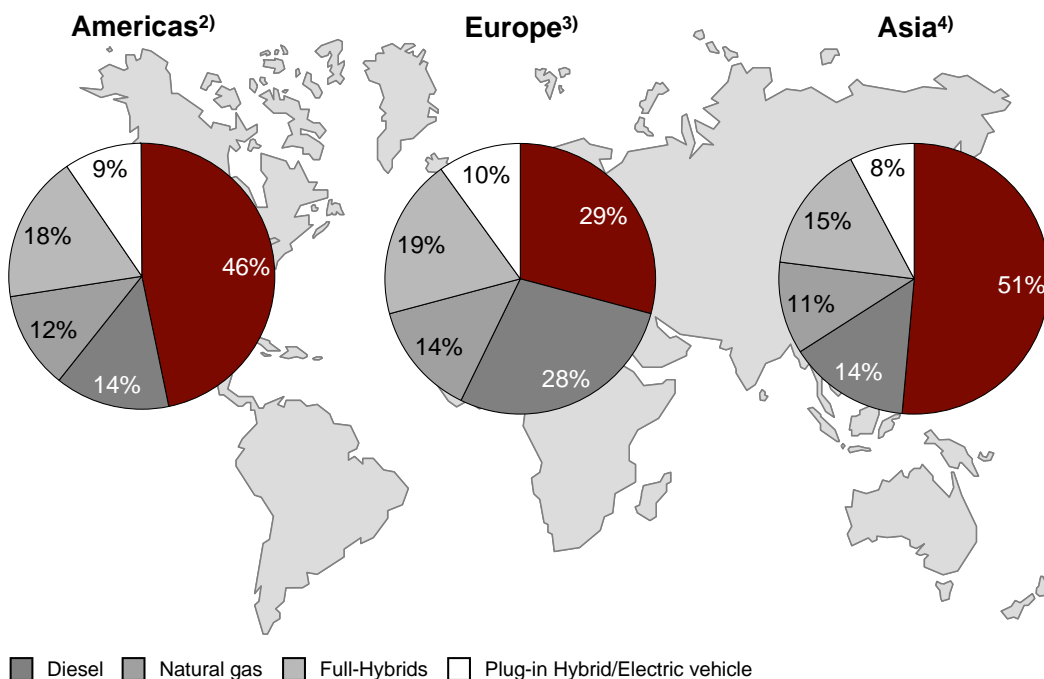
 **Dieter Zetsche, CEO Daimler AG** (03/2008)
 "The powertrain of the last 120 years will have to give way to something that is emission free... The decision between electric vehicle and fuel cell has not been taken yet."

Source: CEO press statements

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Opportunity 1 – Automotive: We expect Electric vehicle to increase up to 10% in market share until 2020

Powertrain landscape 2020¹⁾



■ Gasoline ■ Diesel ■ Natural gas ■ Full-Hybrids □ Plug-in Hybrid/Electric vehicle

1) "Moderate drive for change" scenario; 2) North- and South America; 3) EU-27 4) China, India, Japan; All shares are related to vehicles produced in 2020. Sums may vary from 100% due to rounding. Source: A.T. Kearney

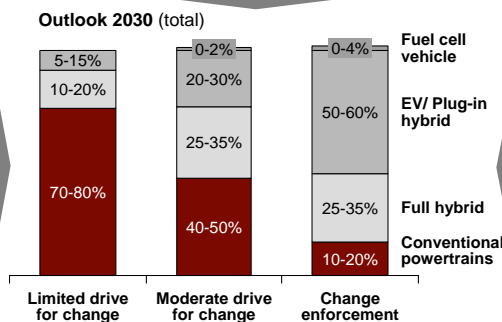
Opportunity 1 – Automotive: Until 2030, electricity powered vehicles might make up to 60% of total vehicles

Customer perspective

- Continued rise in oil prices will further weaken positioning of conventional powertrains
- Decrease of battery unit costs will further improve TCO of electricity powered vehicles
- Electricity powered vehicles might become "standard" from a customer perspective and hinder Fuel Cell Vehicle breakthrough

OEM perspective

- OEMs will continue efforts to build up portfolio with alternative powertrains
- Budget and capacity alignment as well as broadening of know-how will build the basis for strong shares of alternative powertrains
- Focus on electricity powered vehicles might hinder Fuel Cell Vehicle breakthrough



Technology perspective

- Reliability and durability of alternative powertrains will reach level of conventional powertrains
- Breakthroughs in electricity storage technologies could further boost demand for electricity powered vehicles
- Lack of customer demand could limit efforts to install a H₂ infrastructure

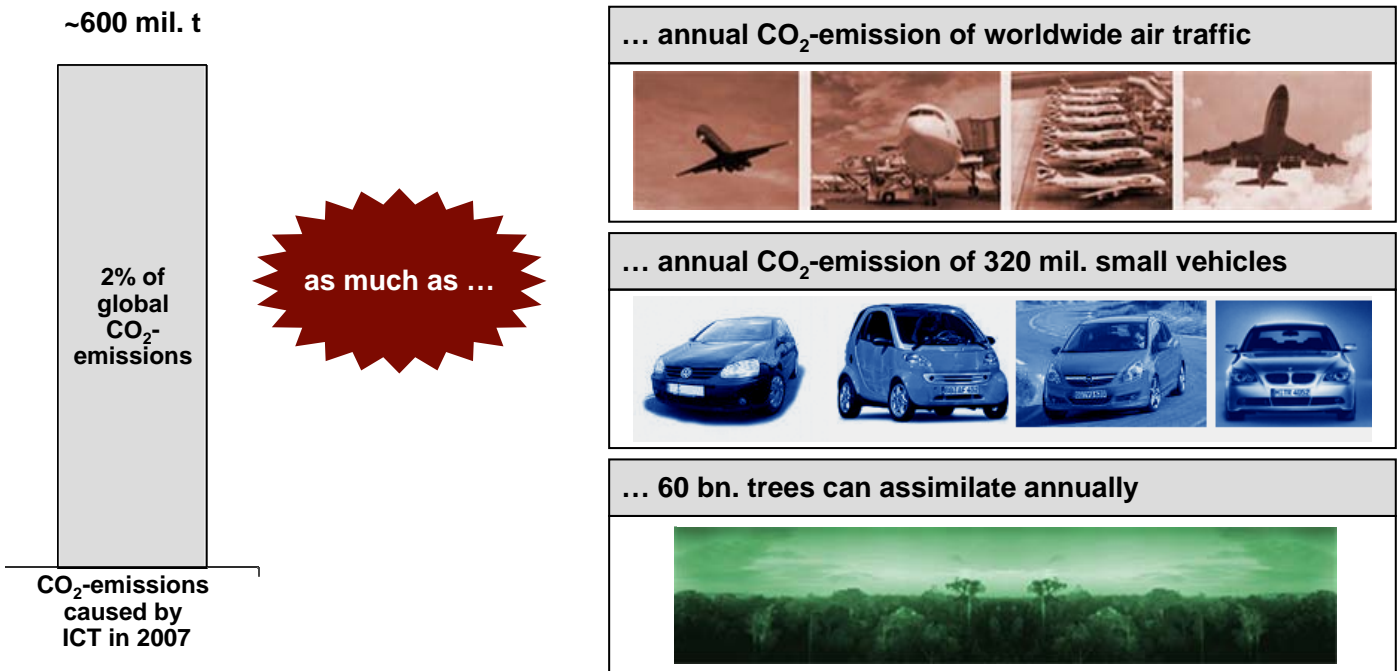
Regulation perspective

- Close-to-zero CO₂ limits in Triad markets might enforce usage of alternative powertrains
- Further support of regulation by tax incentives expected

Opportunity 2 – IT: ICT is a key driver of the worldwide CO₂-emission – on a par with air traffic!

Estimated worldwide ICT – induced CO₂-emission¹⁾

Global

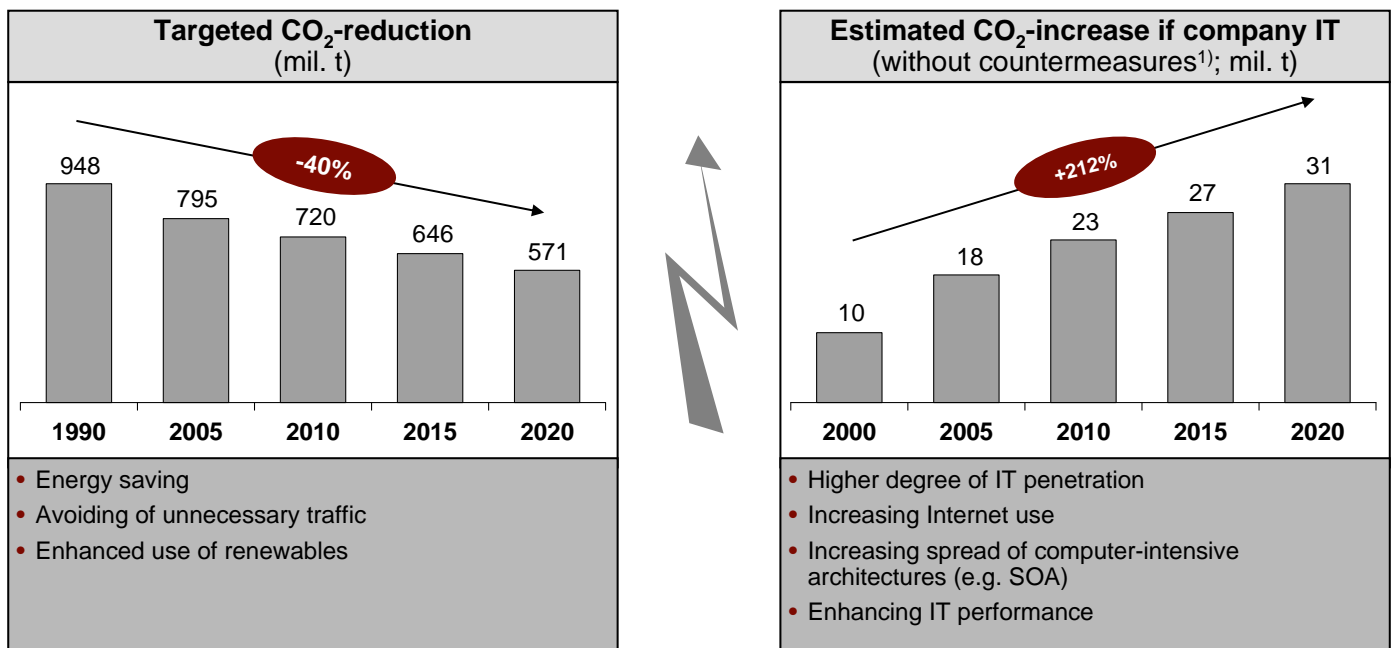


1) ICT indirectly contributes to CO₂-emission due to consuming power for hardware operation and cooling ICT = Information and communications technology
 Source: Gartner; Robinwood; UNFCCC; A.T. Kearney Analysis

Opportunity 2 – IT: An increase of IT-induced volumes is expected despite the overall target to reduce emissions

Estimated IT-induced CO₂-emission

Germany

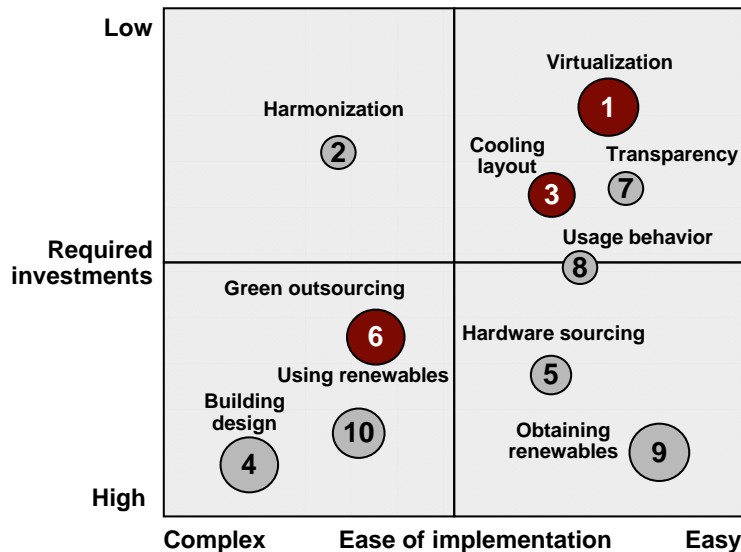


1) Expected trend in particular based on increased server-induced power consumption
 Source: Federal Environmental Agency; Gartner; A.T. Kearney Analysis

Opportunity 2 – IT: Energy-efficient solutions are important measures to reduce CO₂-reduction in IT

Ten measures to reduce IT-induced CO₂-emission

Illustrative



Server consolidation

1. Reduction of physical servers through virtualization
2. Reduction of physical servers through application harmonization

Energy-efficient cooling solutions

3. Energy-efficient cooling layout – existing system
4. Energy-efficient cooling layout – new building design (“passive - datacenter”)

Green IT (Out-)sourcing

5. Sourcing of energy-efficient hardware
6. Green Outsourcing of hardware and operation to energy-efficient service provider

Energy-efficient usage behavior

7. Energy metering and energy transparency in IT-usage for sensitization/ benchmarking
8. Energy-saving use of hardware (shut down, power management)

Renewables

9. Obtaining renewables for IT-power supply
10. Using renewables e.g. solar system on roof of datacenter

CO₂-savings lever
 CO₂: CO₂-Equivalent

Companies in the microelectronics industry should take actions driven by those trends

Summary

Trends	Impact on microelectronic-R&D-footprint
Consolidation	<ul style="list-style-type: none"> • Consolidation will boost R&D offshoring • Globally, this will cause a decentralized network of research centers. Research departments will be operated even in new markets (Indonesia, Africa, ...) although facing major difficulties (IP, personnel, ...). • Fundamental research will stay in Europe
Offshoring of selected R&D activities	<ul style="list-style-type: none"> • Separation of research activities and fabrication facilities • Fundamental research will stay in Europe • Cost-wise, this will direct more capital towards intelligence/knowledge-creation and less towards prototyping
Growth opportunity: Automotive	<ul style="list-style-type: none"> • Tight collaboration of the strong Austrian automotive supplier industry and domestic microelectronics R&D • This trend may foster the position of automotive suppliers as much as the position of the R&D facilities • Excellence prevents the impact of crises
Growth opportunity: IT	<ul style="list-style-type: none"> • Focus on CO₂-neutrality rather than performance • Chances for R&D in micro-/ nanoelectronics industry

**Thank you for your attention.
I would be glad to answer your
questions.**

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