

Research & Development and Innovation Management at Siemens

TIM conference, 11th – 12th october 2007, FH Brandenburg

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Siemens at a Glance

Siemens' Innovation Strategy

Overview of Corporate Technology (CT)

Corporate Research and Technologies (CT T)

Corporate Intellectual Property & Functions (CT I)

Pictures of the Future

Opportunities from global megatrends drive the company's long term strategy

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**Energy &
Environmental Care**



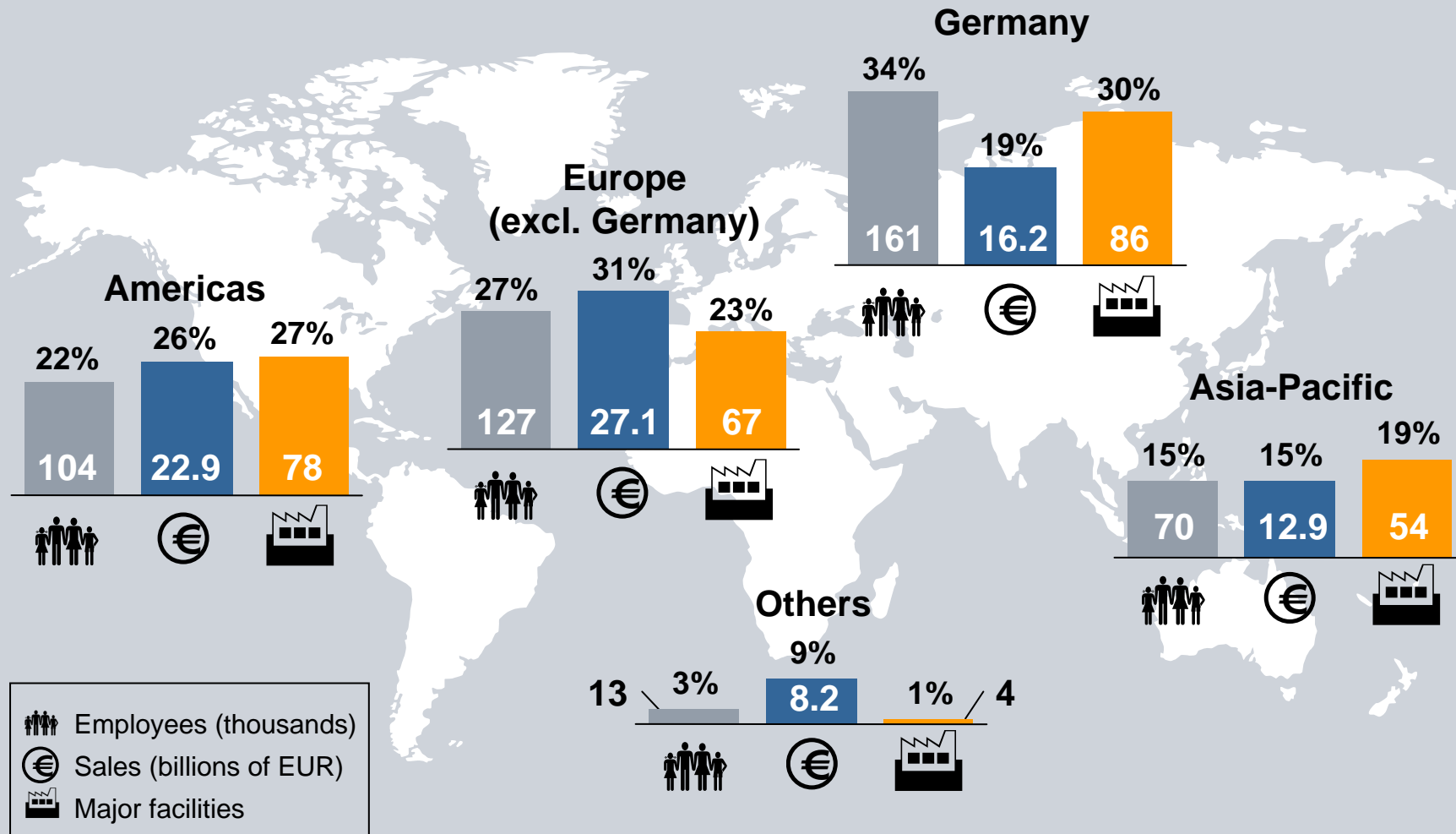
**Automation & Control,
Industrial & Public Infrastructures**



Healthcare



Global presence – basis for competitiveness



As of September 30, 2006

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2007-07-06

Innovation is our lifeblood

Major R&D investments

- 5.7 billion EUR in fiscal 2006*
- 48,900 R&D employees worldwide
- 30,000 software engineers
- 150 R&D locations in over 30 countries around the world
- 10,410 inventions in 2006
- 62,000 active patents



Major innovations

Our patent positions (2006):

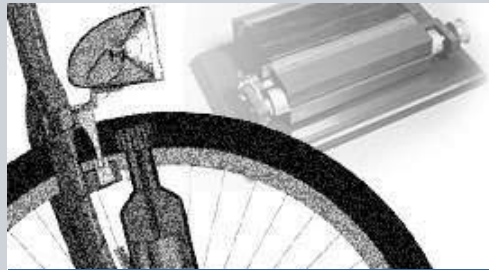
- Germany: No. 1
- Europe: No. 2
- U.S.: No. 11

Recent breakthroughs:

- **Piezo injection**
(Reduces fuel consumption by 20%)
- **Somatom Definition**
(World's first dual source CT)
- **Combined cycle turbine**
(World's largest and most powerful turbine; reduces pollutants: 40,000 tons of CO₂ / year)
- **Velaro E** (Europe's fastest train)

*Including R&D investments related to specific customer requirements, reclassified into cost of sales

Siemens' innovations have changed the world



Energy



From the invention of the dynamo – to the world's most efficient gas turbines



Automation



From the first electronic controls – to fully automated factories



Healthcare



From the first views inside the body – to full-body 3D scans

Siemens' innovations have changed the world



Transportation



From the first electric railway – to 310-mph maglev trains



Information Technology



From the first digital general-purpose computer – to one of the largest software companies

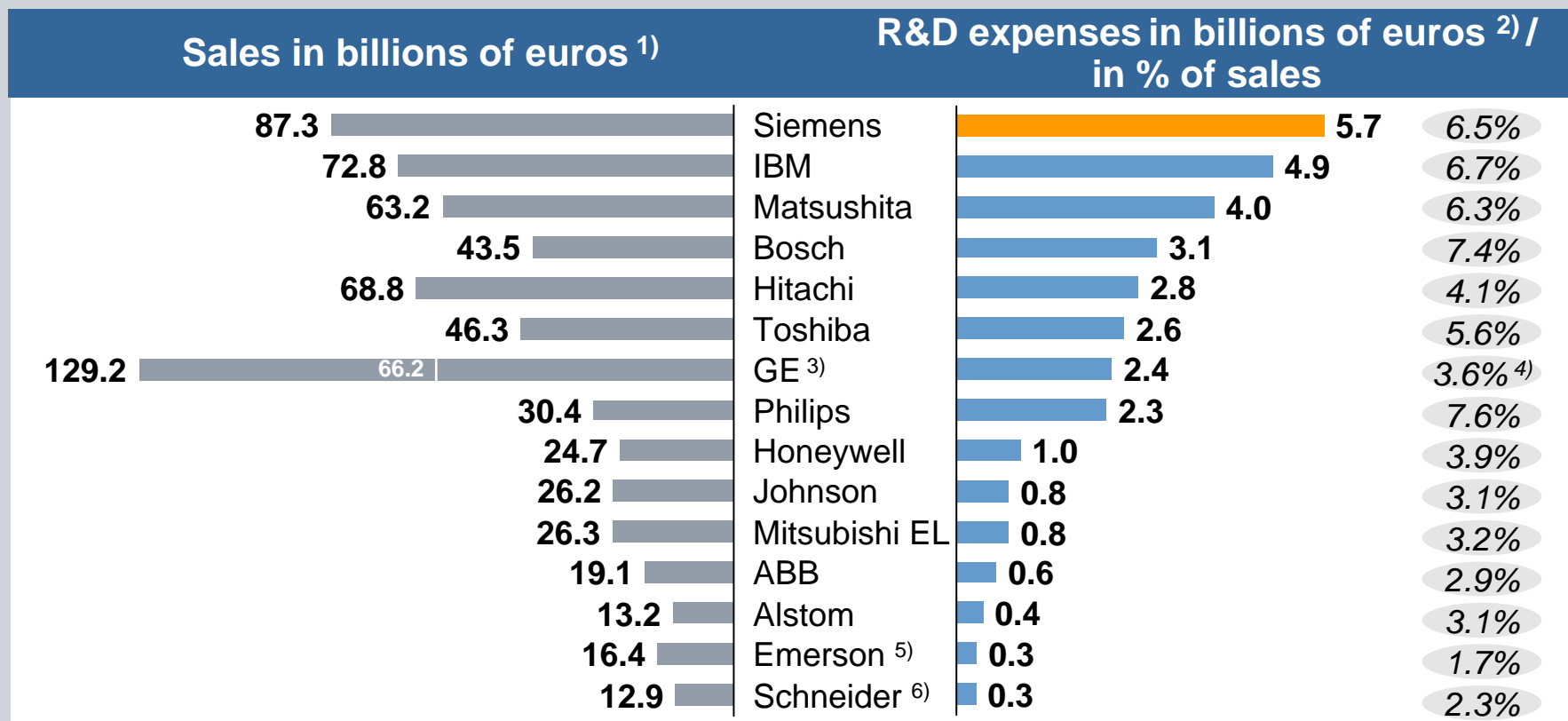


Lighting



From the first commercial metal filament lamp – to high-tech organic LEDs

R&D expenses and sales of important competitors in 2006 ¹⁾



¹⁾ considering competitors only with significant portfolio overlaps with at least two Siemens groups

²⁾ based on 4 quarters previous to Sep. 30, 2006; only partially comparable, without external R&D orders and public funding

³⁾ revenues excluding GECS und NBC: €66.156 bn

⁴⁾ related to revenues without GECS and NBC of €66.156 bn

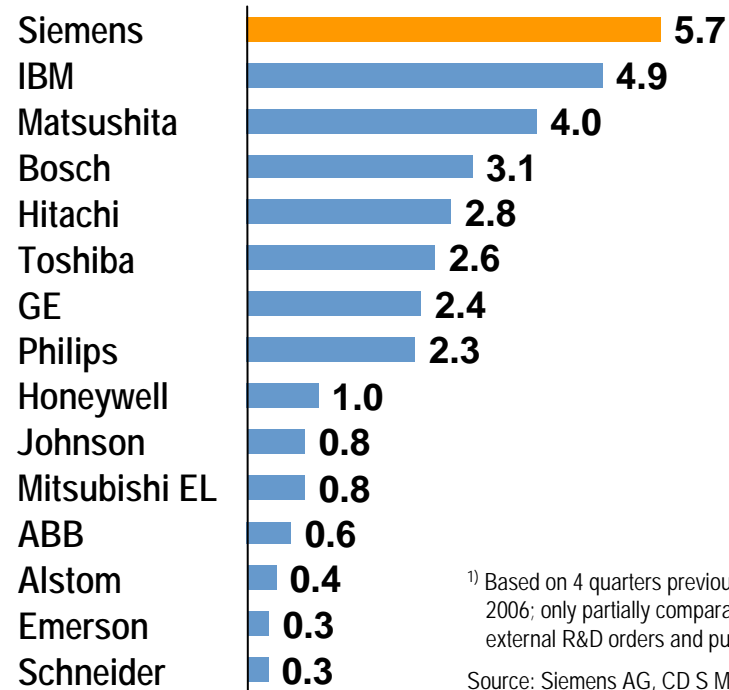
⁵⁾ 600' resp. 3,7% of revenues incl. engineering ⁶⁾ 556' resp. 4,3% of revenues incl. engineering and activated R&D (IFRS)

Source: Siemens AG, CD S MI – 11/06

Siemens – Global Network of Innovation

R&D expenditures of competitors

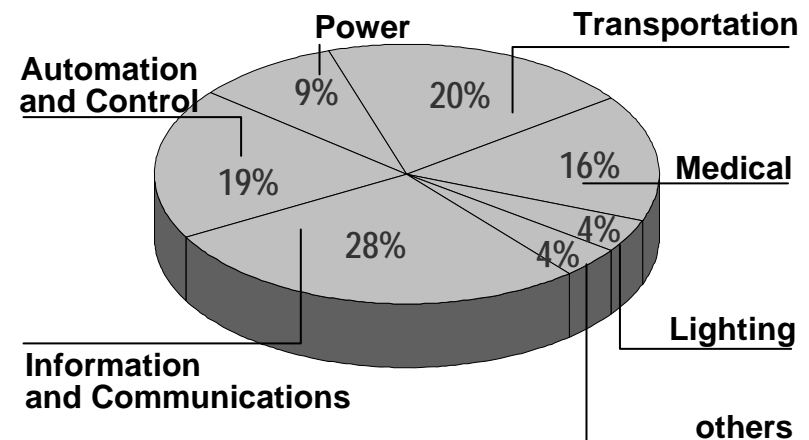
R&D expenditures in billions of euros¹⁾



¹⁾ Based on 4 quarters previous to Sep. 30, 2006; only partially comparable, without external R&D orders and public funding

Source: Siemens AG, CD S MI – 12/06

R&D expenditures of Business Areas



**More than 50% of R&D for software –
about 30,000 software engineers worldwide**

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Research and innovation are complementary

Research is the transformation
of money to knowledge

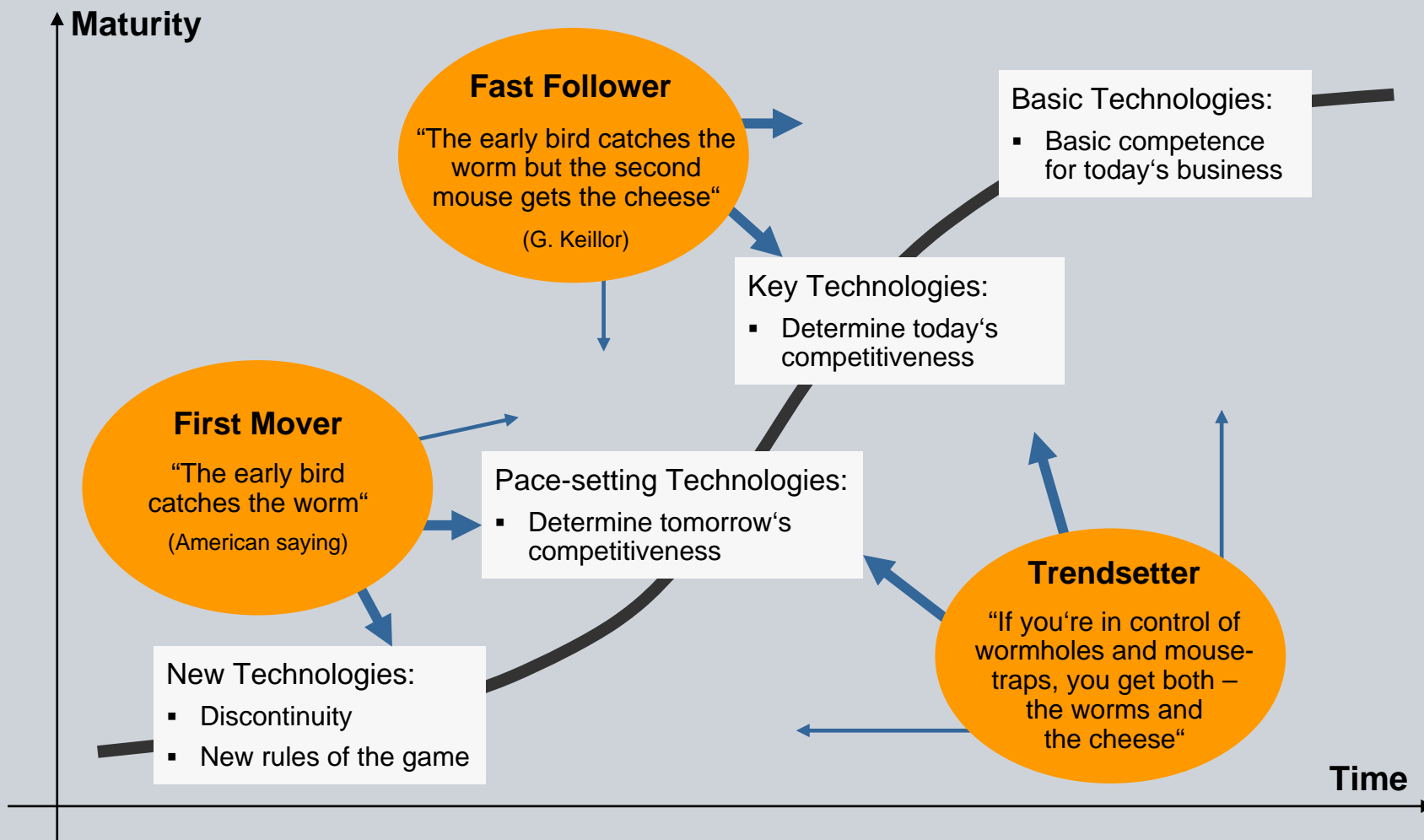


Innovation is the transformation
of knowledge to money

Consequences:

- Research is a necessary but not a sufficient condition for innovation
- Economic value is only created by successful innovations
- Business strategy drives R&D strategy

The most important innovation strategies and their positioning along the technology lifecycle

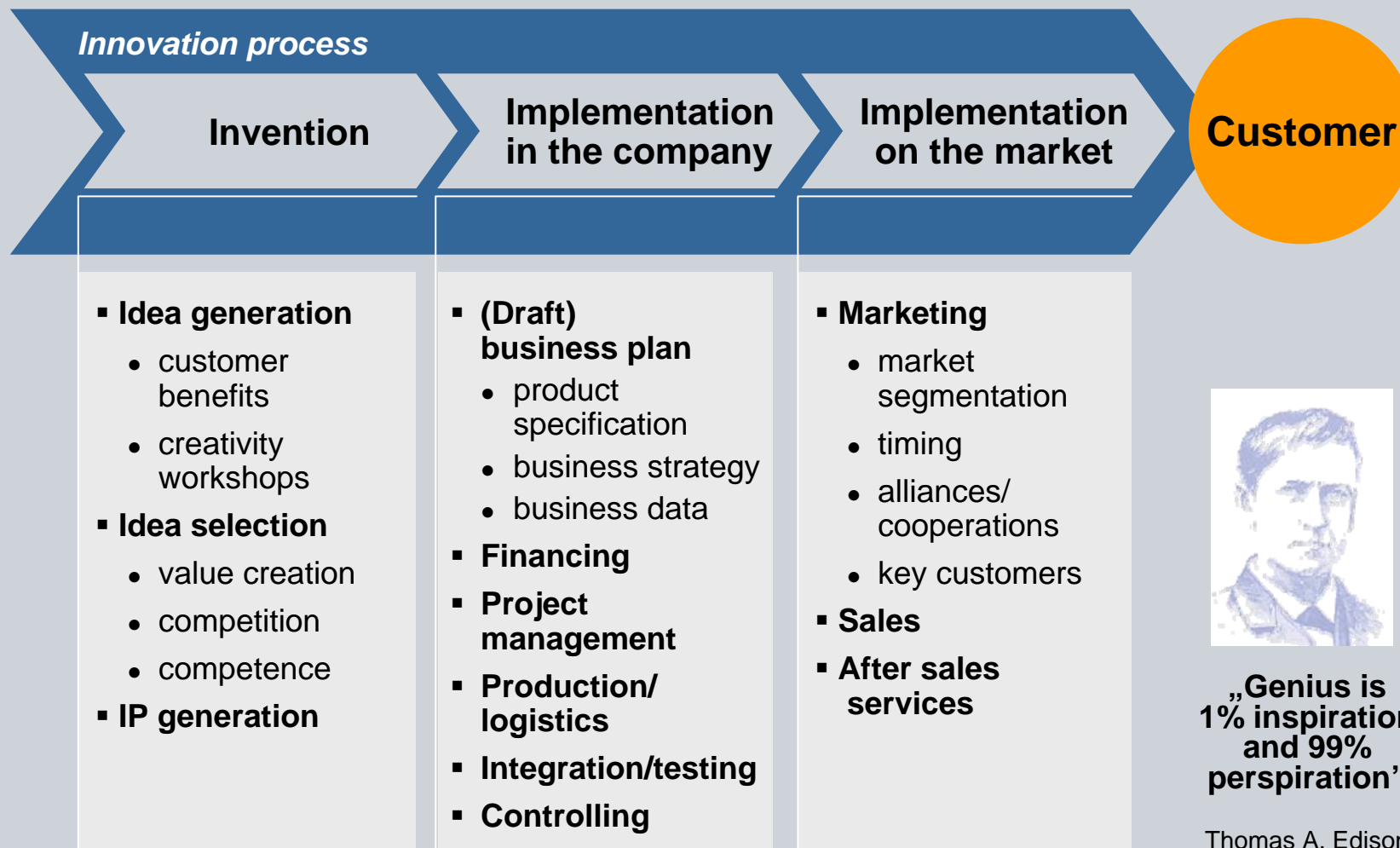


Siemens' innovation strategy:
Be a trendsetter in our businesses

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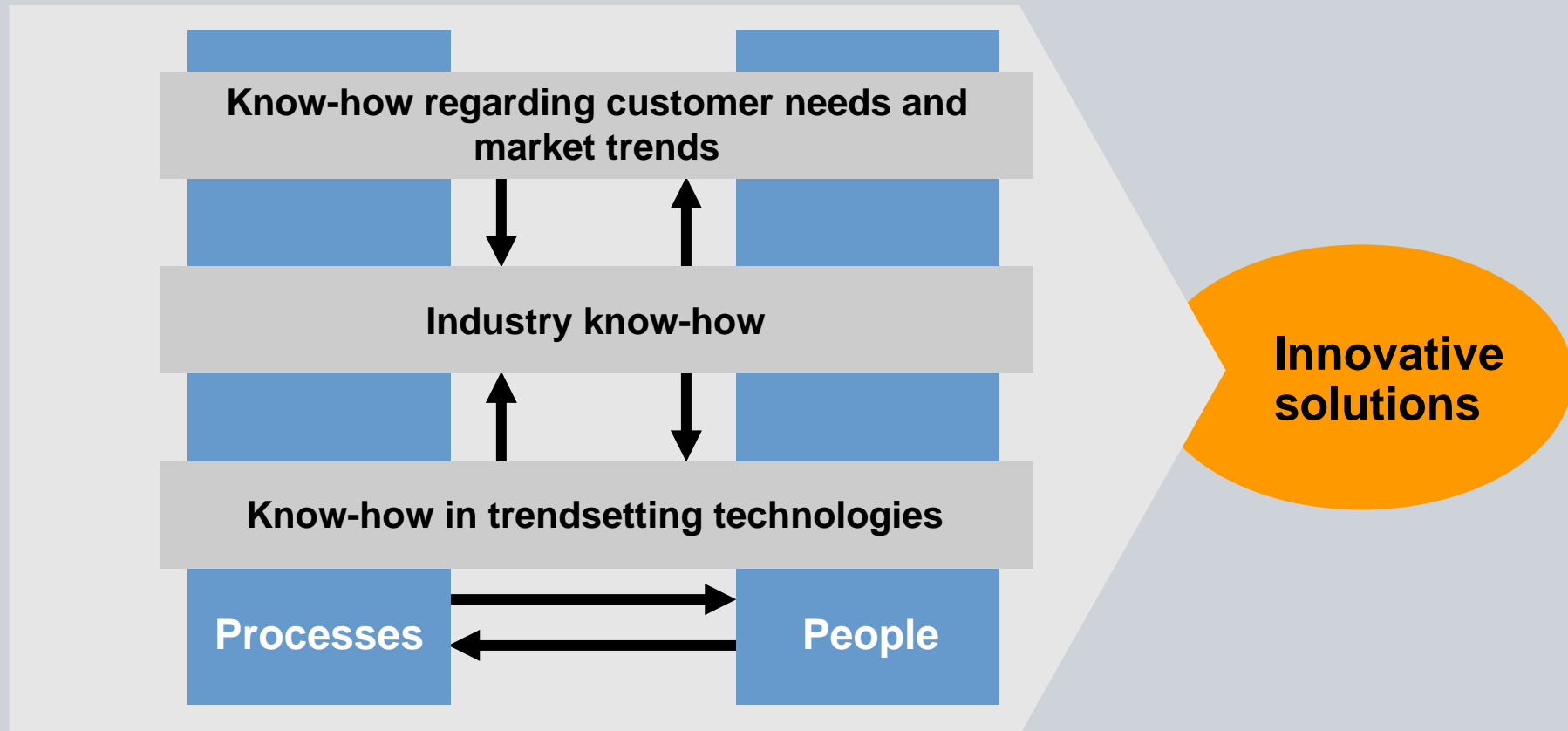
- Comprehensive visions: “Pictures of the Future”
- Deep knowledge about our customers' businesses and processes
- Technological leadership
- Strong patent portfolio / strong player in standards
- Use of synergy / platforms
- R&D presence in leading markets
- Optimized innovation processes
- Cooperation with top notch universities
- Strong innovation culture, network of excellent people

Any innovation process starts and ends with the customer



People and processes are the key elements for innovation success

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Elements of a strong innovation culture

Customer orientation	<ul style="list-style-type: none"> ▪ Help the customer make more money! ▪ Strive for quality: get the customer to return, not the product!
Management attention	<ul style="list-style-type: none"> ▪ Target setting, controlling ▪ Assignment of responsibilities, empowerment ▪ Motivation, recognition of achievements
Innovation climate	<ul style="list-style-type: none"> ▪ Willingness to take risks ▪ Make it differently, not only better! ▪ Trust, incentives
Excellence	<ul style="list-style-type: none"> ▪ Innovation benchmarking ▪ Education, training, technical career ladder ▪ Winner teams

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Corporate Technology increases the company's innovativeness in many ways...

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... as innovator

- **Product innovation**
- **Process innovation**
- **System innovation**
- **Innovative applications**

... as technology provider

- **Tailored solutions**
- **Consulting**
- **Services**
- **Task Forces**

... across Siemens

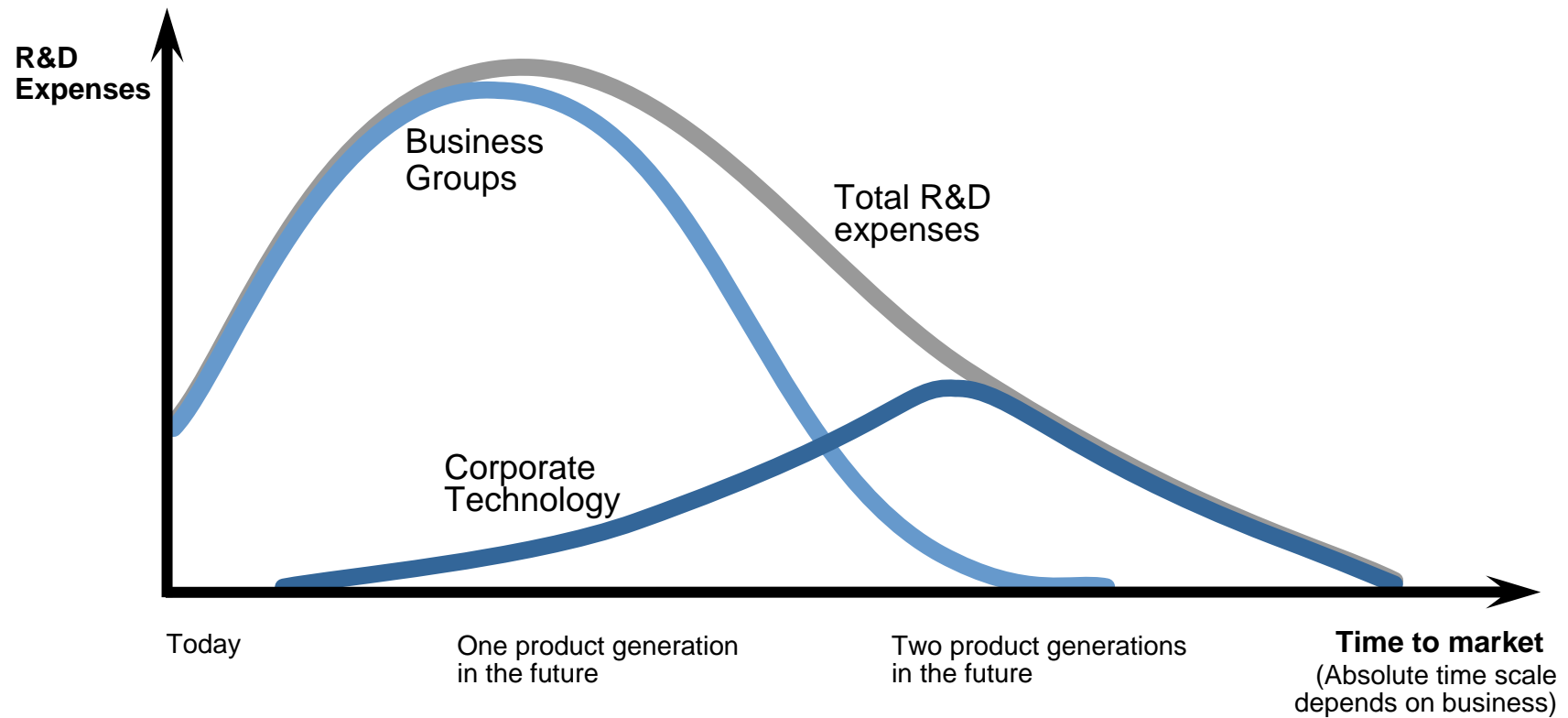
- **Long-term vision: Pictures of the Future**
- **Best Practice Sharing**
- **Accelerators**
- **Patents**

Based on...

- ▶ ... a future-oriented portfolio of competencies
- ▶ ... a flexible and customer oriented range of services
- ▶ ... efficiency through multiple usage
- ▶ ... professional service providers (single source)

Time horizons of the R&D activities of the business groups and Corporate Technology

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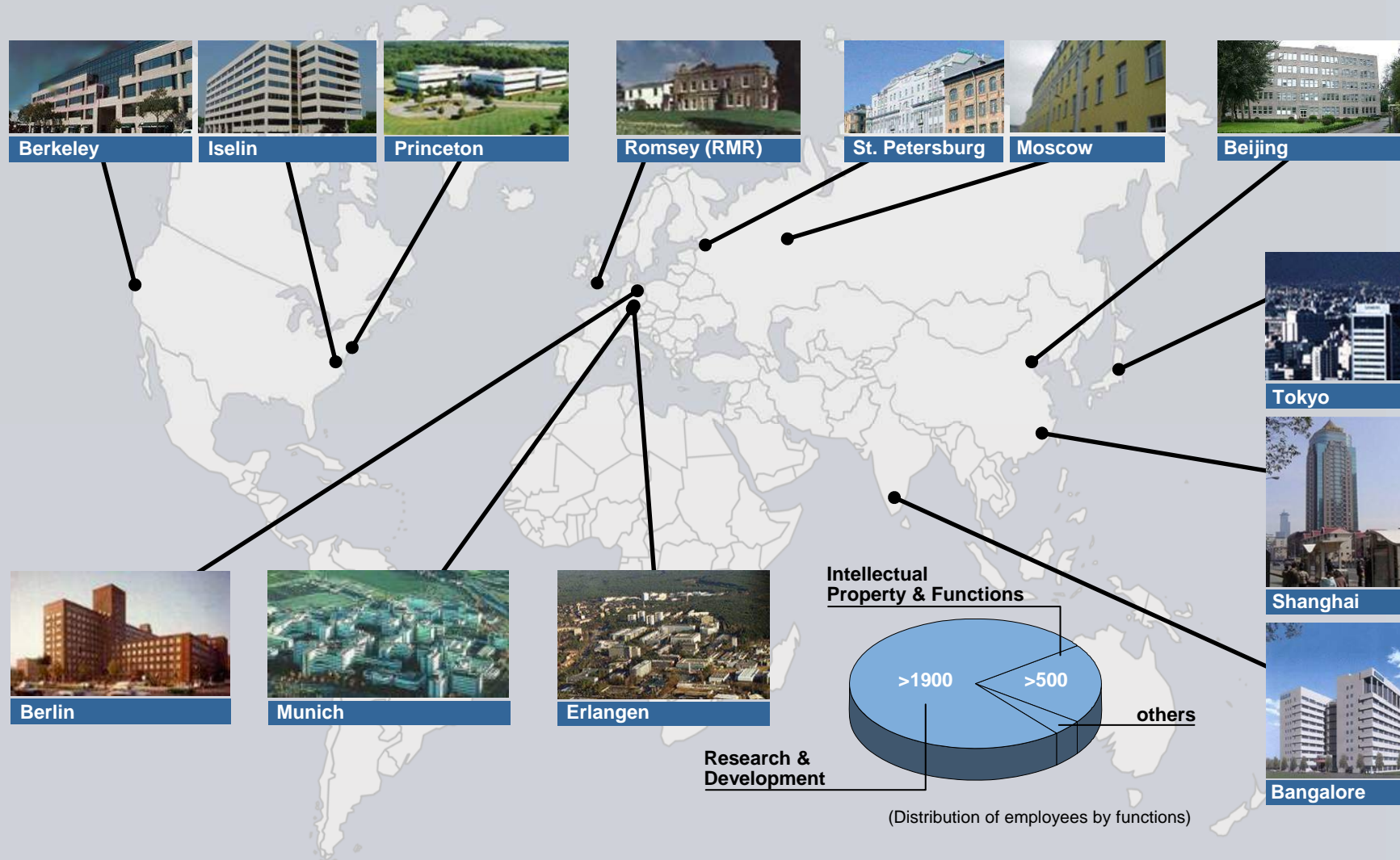


▶ A seamless transition from R&D in Corporate Technology to the Business Groups is crucial for our success

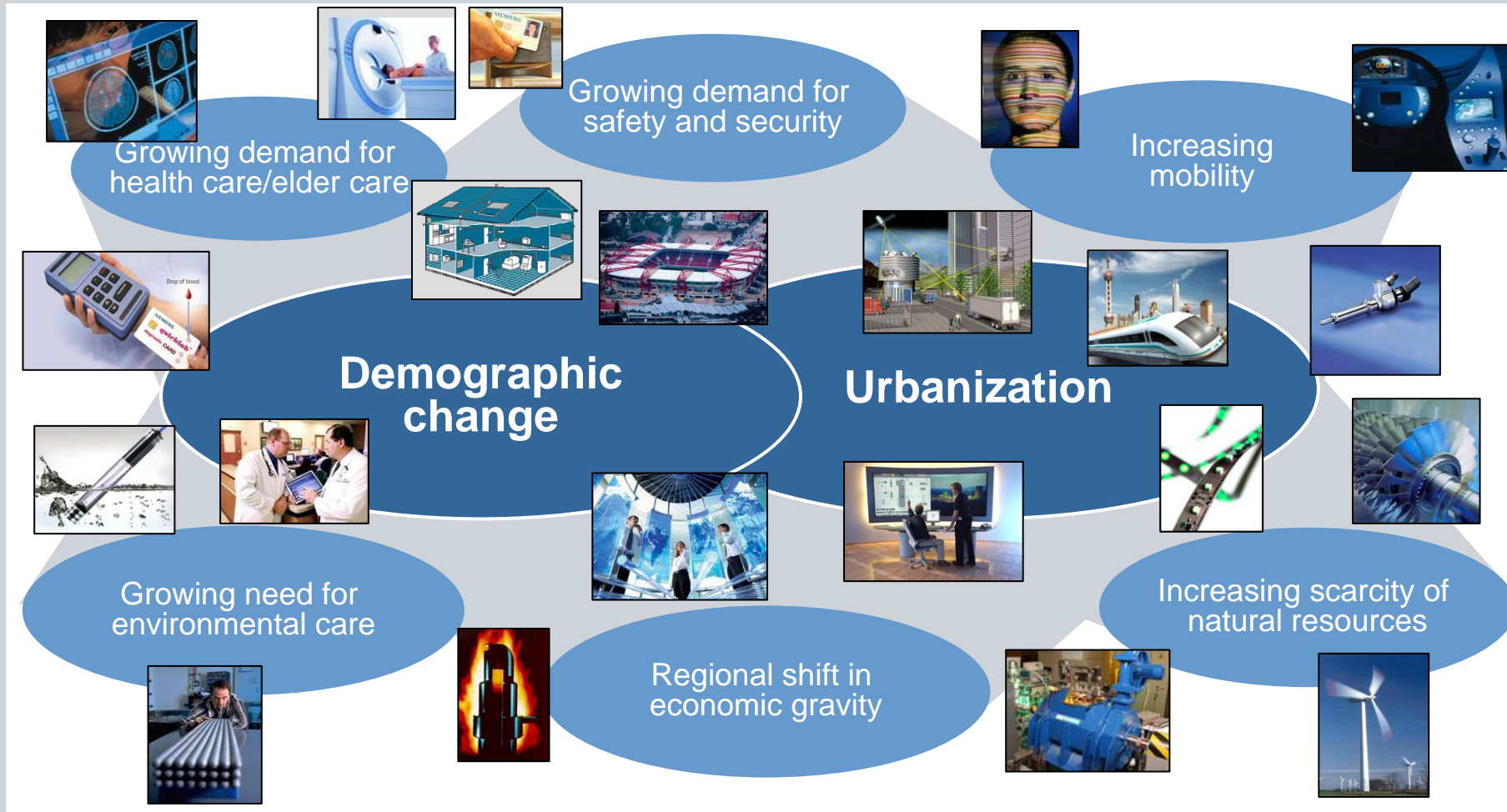
Corporate Technology



Present in all leading markets and technology hot spots



The consequences of megatrends require innovative and comprehensive solutions



CT Accelerators in Berkeley, Shanghai and Munich 22 Spin-offs and 13 Spin-ins through January 2007

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Technology-to-Business Centers in Berkeley (since 1999) and Shanghai (since 2005)

TIB



Selected Spin-ins and Spin-Outs:

- **SCALANCE-W** Real-time guarantees for industrial WLAN
- **TD200C family** Novel touch-sensor allows OEM customizable control panels
- **Sensys Networks** Wireless traffic monitoring sensors

Siemens Technology Accelerator in Munich (since 2001)

sta»siemens
technology
accelerator



Selected Spin-offs:

- **EnOcean GmbH** Battery-less sensors
- **PolyIC** Printable low cost polymer electronics (e.g. for RFID)
- **Panoratio GmbH** Data analytics software

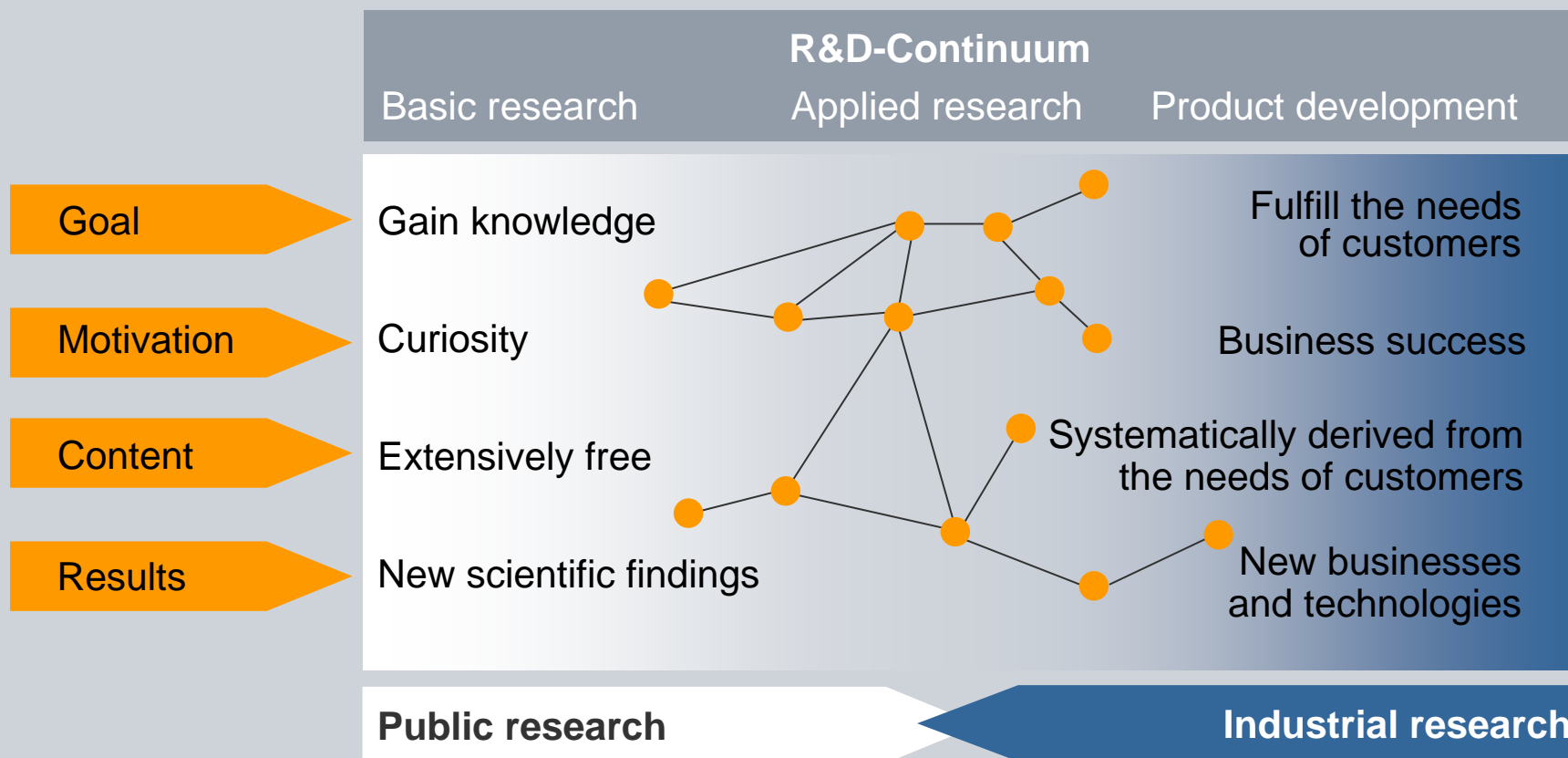
Mission and objectives

- Drive innovative ideas and technologies
- Generate new business:
 - embedded in existing Siemens structures
 - as start-up
- Provide support and seed funding
- Combine technology and business orientation
- Impact on innovation and entrepreneurial culture

Networking between public research and industry



Deriving benefit from different motivations



Organizational structure

Status: October 2006



Corporate Technology

Corporate Research and Technologies

Materials & Microsystems

Production Processes

Power & Sensor Systems

Software & Engineering

Information & Communications

Siemens Corporate Research (USA) ²⁾

CT China ³⁾

CT India

CT Russia

CT Office Japan

Roke Manor Research¹⁾

Strategic Marketing

Executive Office

Corp. Intellectual Property and Functions

Intellectual Property Services

Licensing & Transactions

Intellectual Property Support

Corporate issues & Consultancies

Strategy & Communication

Company Name & Trademark Law

Regional Intellectual Property Departments

Standardization & Regulation

Environmental Affairs & Technical Safety

Information Research Center

Business Administration and Controlling

Siemens Technology Accelerator

Technology to Business Centers

Strategic Planning

Human Resources

Chief Information Office

¹⁾ functional reporting to Corporate Technology

²⁾ Separate Legal Entity; Part of Separate Legal Entity

³⁾ including Technology-to-Business Center Shanghai

CT SE4: Innovation- and Project Management

We are a group of international consultants

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- Specialized to bridge the gap between
 - technology and business

Technology

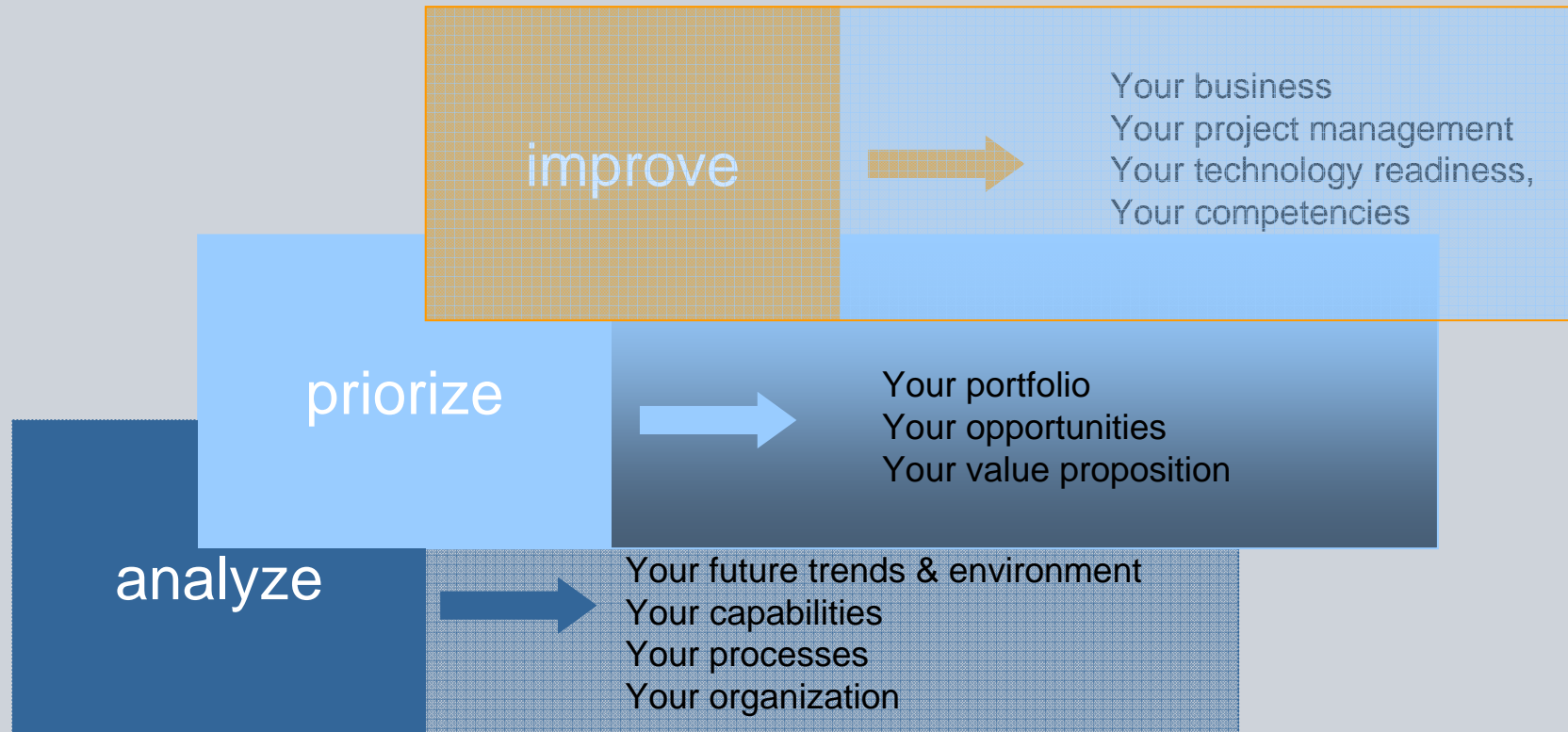


Business

Our offerings are structured in 3 competence fields

- Innovation Management
 - Project Management
 - Capability Management

We act in three areas to support your business



We secure the future of business by deriving the maximum competitive advantage from innovations.

We are a team of experienced professionals

- **Founded in 2004**
- **40 consultants**
- **250 successfully completed engagements around the globe**
- **Locations: US, Germany, and China**

▪ Consultant Team Highlights:

- 90% hold a graduate university degree
- 50% have over 10 years consulting experience
- 90% have international and intercultural experience
- 75% have experience in Siemens Groups
- 50% have experience outside of Siemens



**We have specialists worldwide
operating from three locations**

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Munich, Germany



Beijing, China



Princeton, USA

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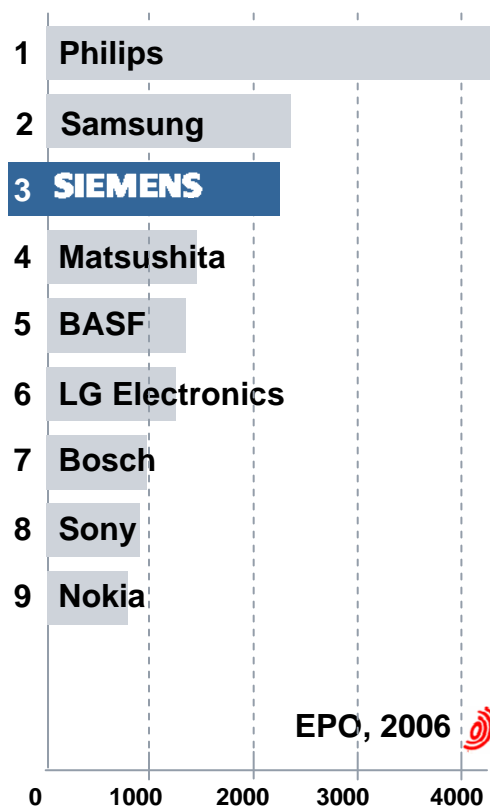
Siemens' leading position in patents is the proof of our innovative strength



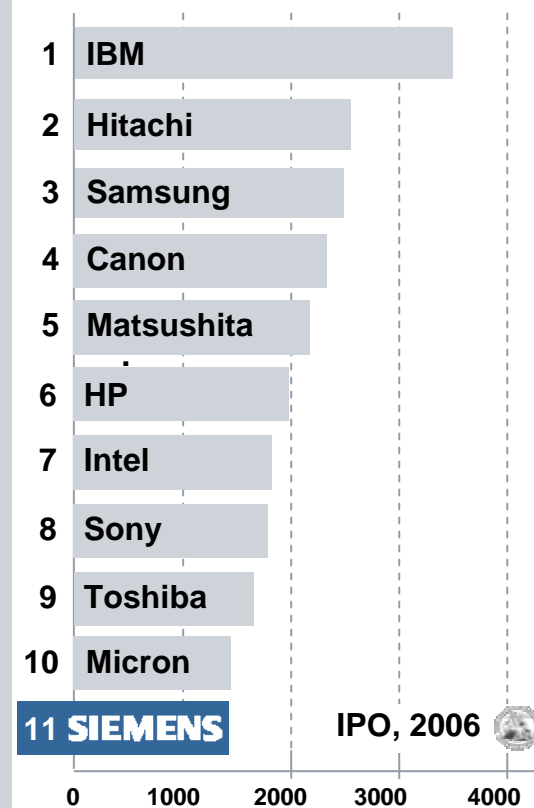
Published applications
at the German Patent
and Trademark Office



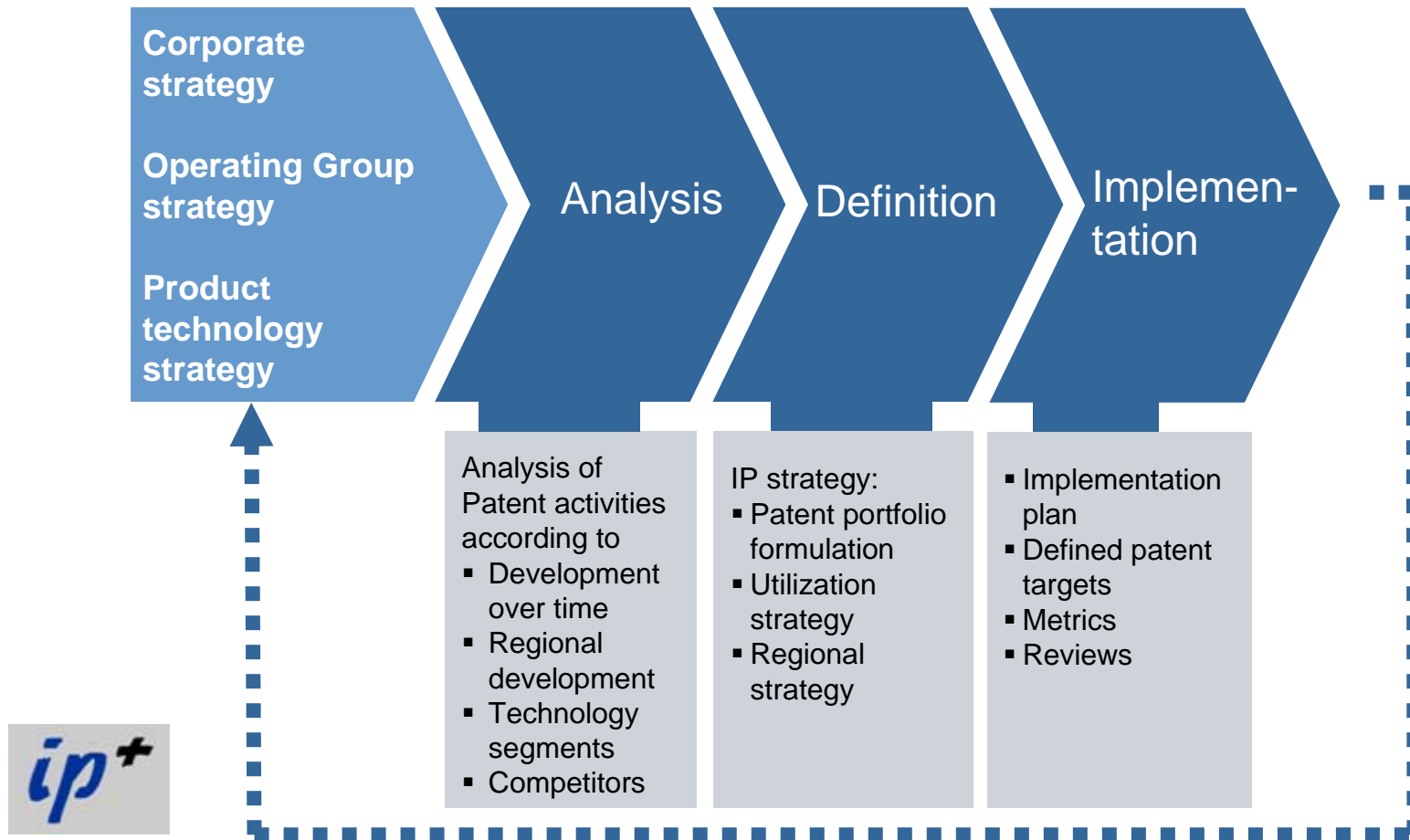
Patent applications
at the European Patent
Office



Granted patents
at the US Patent and
Trademark Office



The IP Strategy Process



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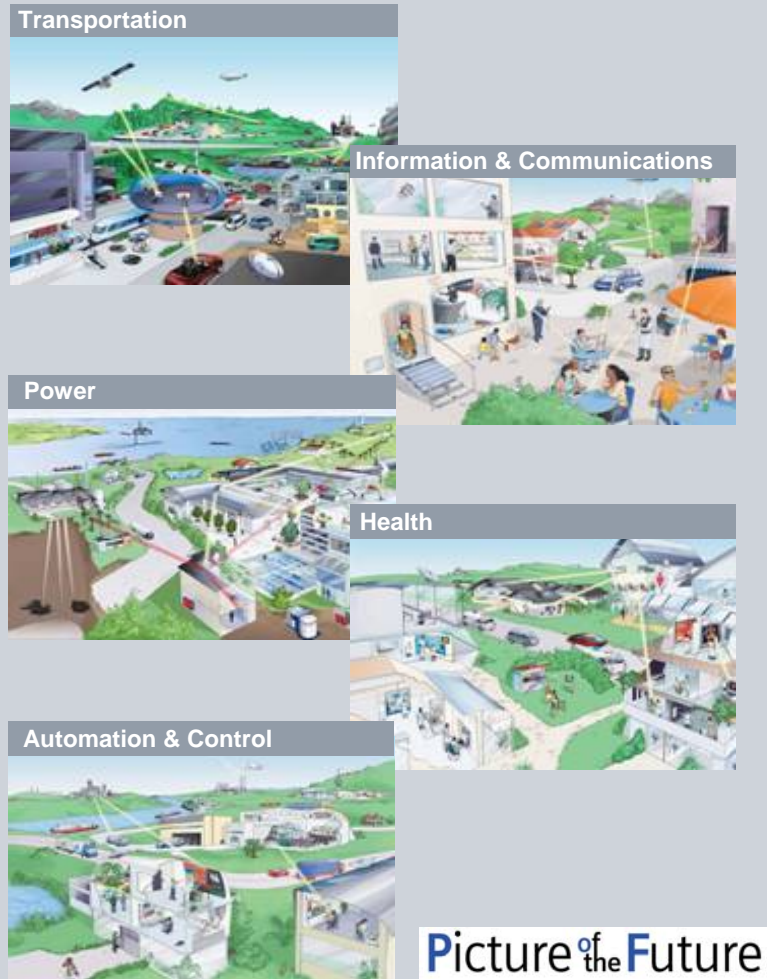
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Pictures of the Future

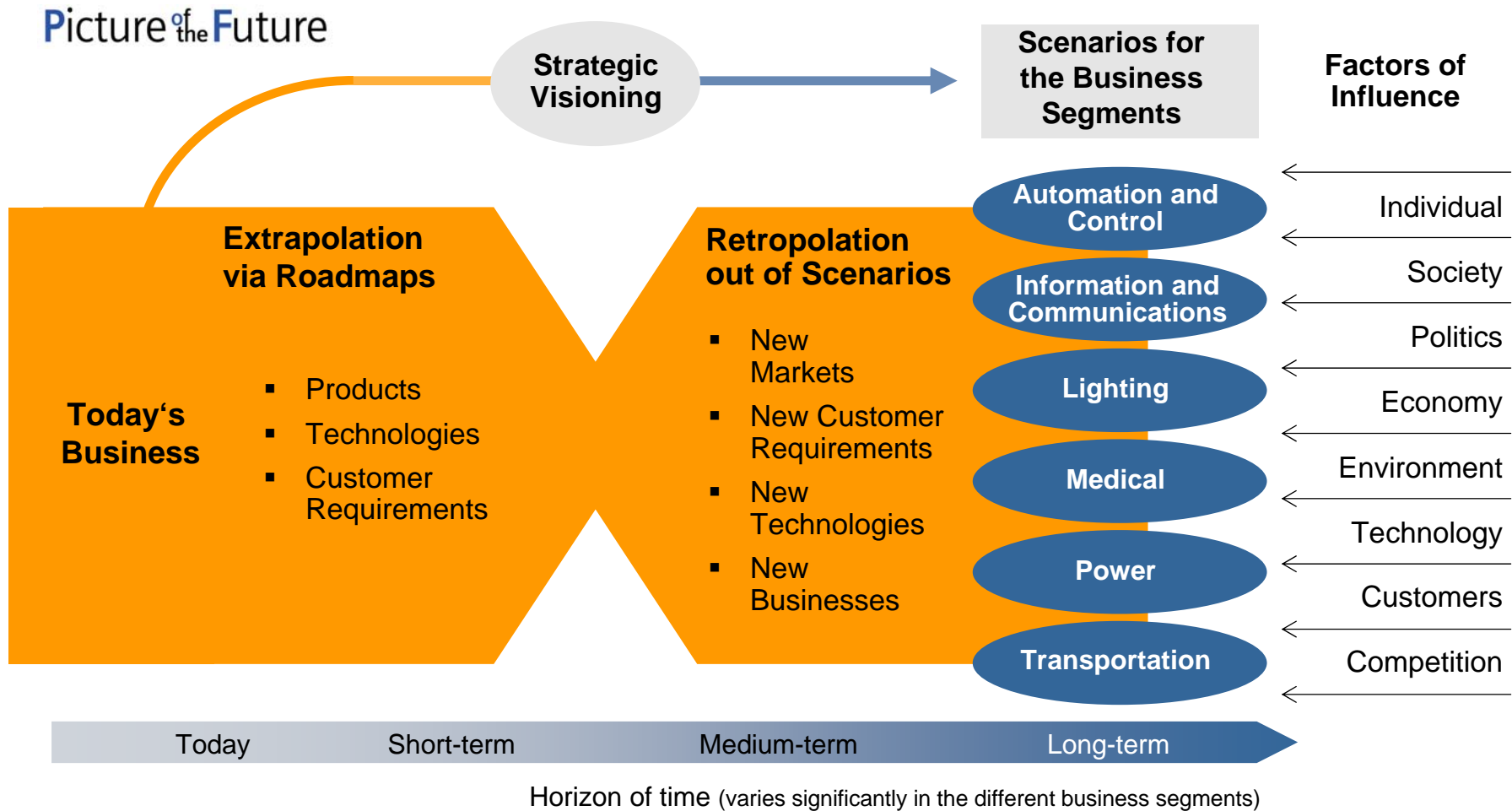
The Pictures of the Future are comprehensive future scenarios for our Business Areas

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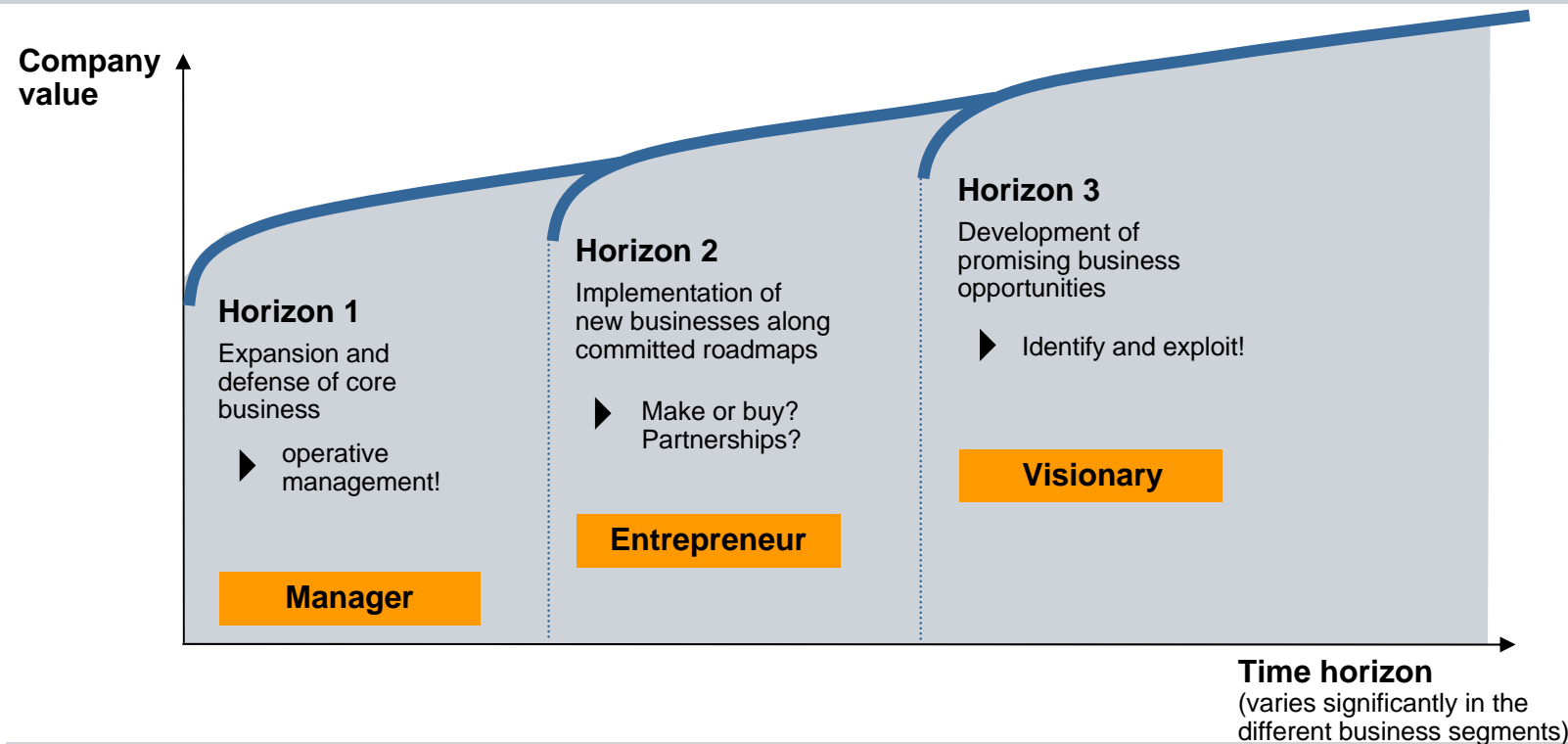


- **Trends**
 - socio-economic
 - customers
 - structural
 - technological
- **Technologies**
 - growth technologies
 - multiple impact
 - disruptive
- **Markets**
 - size
 - Growth
 - regional development
- **New businesses**
 - economic value
 - synergies

Strategic planning: the combination of extrapolation and retropolation leads to the Pictures of the Future



Controlling time horizons in innovation management demands different leadership cultures



Tools for innovation planning

Roadmaps of the Business Groups

Pictures of the Future

Source: Mehrdad Baghai, Steven Coley, David White: "The Alchemy of Growth – Practical Insights for Building the Enduring Enterprise", Perseus Books, 1999

Picture of the Future Example (1) Energy

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Picture of the Future

Picture of the Future

Example (1) Energy

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In the decades to come, power will be supplied by a well-balanced mix of central, distributed and renewable-resources power plants. With fossil-fired power plants, a cost-effective way to cut carbon-dioxide emissions is to increase efficiency - and over the long term, the separation and storage of CO₂ offers another approach. Highly efficient, low-emission and fault-tolerant gas and steam turbines will remain the central components of these power plants. Power generation processes and syngas based processes within the oil and gas sector are converging, while the operation of electrical networks is becoming more global, flexible and focused on distributed components. Market mechanisms and a real-time impact on processes are becoming the forces that dominate liberalized markets.

New methods of gas and oil production

- (1) In the future, natural gas from remote gas fields will be converted into synthetic liquid fuels (using gas-to-liquid processes, GTL).
- (2)-(3) The highly pure "synfuel" will be shipped to the consuming countries and mixed there with conventionally produced diesel fuel. This can be used to fuel highly efficient and extremely low-emission combustion engines (3).
- (4)-(5) In larger remote gas fields, the gas will be liquefied (liquefied natural gas, LNG) and carried by tanker ship (5) to consumers around the world.
- (6)-(7) The future production of oil will employ non-conventional methods, such as production from oil sand (6) or the largely automated extraction of oil and gas from deep-sea deposits (7).

Climate-friendly electricity production

- (8) Alongside highly efficient generation of electricity in gas-fired power plants (18), coal-fired plants will play an important role in the future. Those with integrated coal gasification in particular (8) can cut emissions drastically. The syngas produced there is used both to generate electricity (in a combined gas and steam turbine process) and to produce synthetic fuels or hydrogen.
- (9)-(10) The carbon dioxide created by the coal gasification is separated and stored underground (10). The greenhouse gas thus does not escape into the atmosphere.
- (11) The gas and steam turbine process at the power plant employs highly efficient gas turbines that allow flexible use of fuels, steam turbines and superconducting generators.

- (12)-(15) The proportion of applied renewable energy sources is on the increase: Large offshore windparks (12) feed electricity into the network according to wind fluctuations - thereby posing a major challenge regarding the flexibility of power-plant and grid operation. Tidal power plants (13) produce precisely plannable electricity from tidal flows. In southern regions, solar power from solar-thermal (15) and upwind power plants (14) is used.

Interlacing of data and energy networks

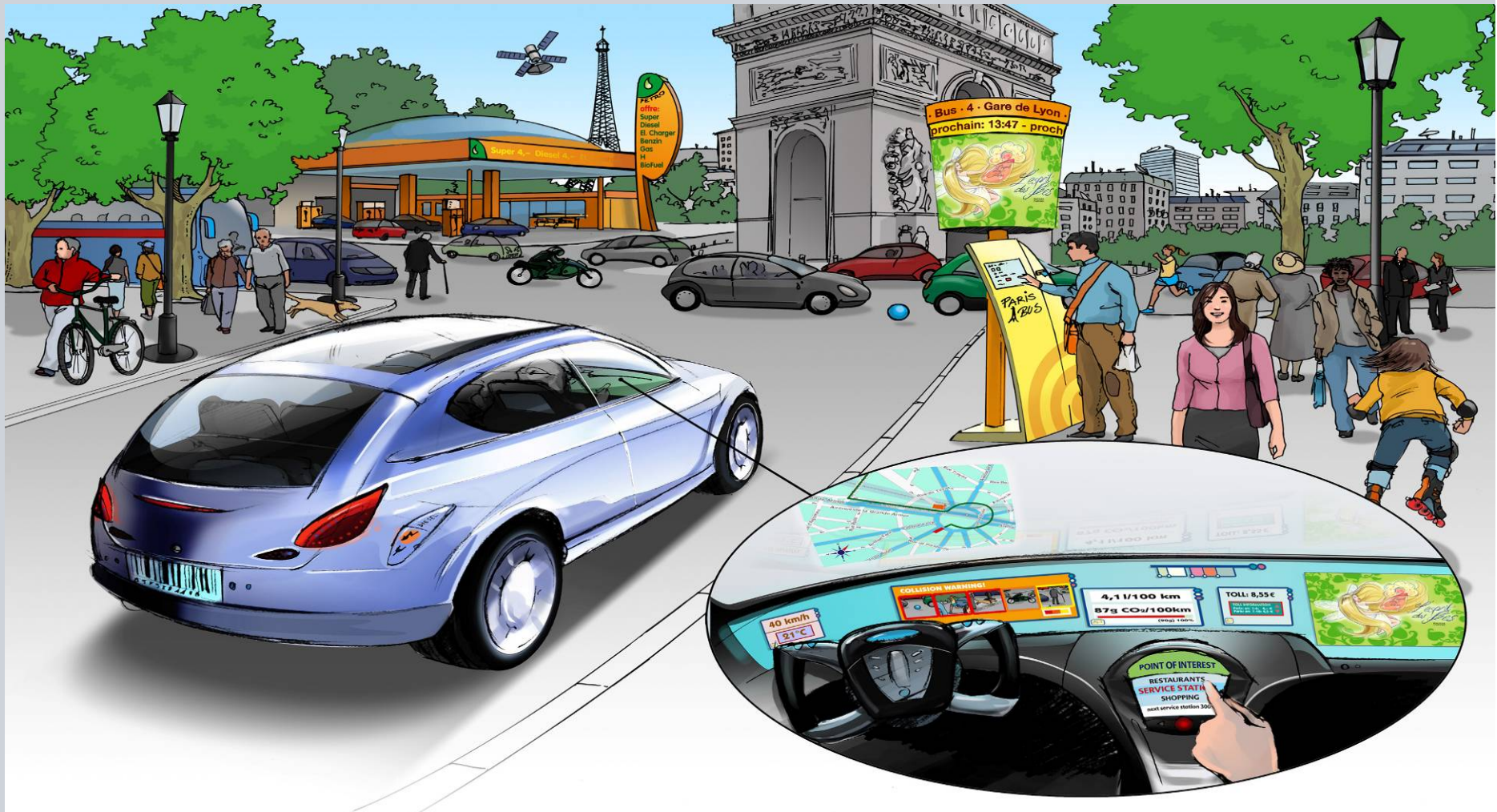
A wide range of communication networks forms the basis for the flexible operation of a power network: Energy trading (yellow), plant monitoring (red) and load management (green) are handled over them.

Great flexibility in the trading and distribution of energy

- (16)-(17) The power exchange (16) serves as a forum for energy trading. Here, large energy providers, large consumers (25) and municipal plants (22) buy and sell on different markets (17) with various time scales.
- (18) Using performance-based service contracts, old power plants are brought up to the latest standards in terms of flexibility, efficiency and environmental friendliness.
- (19)-(21) The grids are utilized up to their physical limit. This can be done with equipment such as sensors that monitor the temperature and the condition of the above-ground transmission lines (21) - or by actively influencing load flow (FACTS, flexible AC transmission systems, 19). The necessary modifications to protect the network are made online (20).
- (22)-(24) The share of distributed power generation using such means as high-temperature fuel cells (SOFC, solid oxide fuel cell, 23) is growing. Directly at the customer, service providers - including municipal utilities (22), for example - operate small fuel cells (PEM, polymer electrolyte membrane, 24) in cogeneration. These various distributed generators are combined into virtual power plants, enabling peak loads to be counterbalanced.
- (25)-(27) Major consumers, also known as load aggregators (25), bundle switchable loads - for such facilities as factories (26) or public buildings (27) - and trade in "real time" on the markets of the energy exchange (17).

Example (2) Future of Automotive (in cooperation with Siemens VDO)

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Future of Automotive - Key automotive specific trends **SIEMENS**

(in cooperation with Siemens VDO)

Sustainable Mobility (Vision: „Zero Emission“)

- Internal combustion engines (ICE) will dominate (world)
- Combustion processes of gasoline and diesel engines will become more alike (world)
- Market share of hydrogen combustion engines and fuel cells will be small (world)
- Increasing demand for mild and full hybrids (Japan, EU, US, China)

Increasing Safety & Comfort (Vision: “Zero Accidents“)

- Number of accidents increases (world)
- Shrinking number of fatalities (death) (Japan, EU)
- High growth of fatalities (death) (China, India)
- Growing market importance of vehicle and driver safety supporting systems (world)
- Personalized comfort and wellness functions will increase (world)

Seamless Connectivity (Vision: “Always On“)

- Mobile devices with navigation and other functions will complement in-vehicle equipment (world)
- Growth in seamless networked systems for communication and services (world)
- Content via World Wide Web will be increasingly offered (world)

Managed Complexity (Vision: “Always Easy“)

- More and more vehicle functions are connected to each other (world)
- Development of an open and flexible E/E vehicle architecture (world)
- Trend to standardization and integration of vehicle intern platforms (world)
- Increasing importance of intelligent HMI solutions (world)

Thank you!



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