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Changes in the German car design and development sector and the challenge of sustainability

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German car industry is constantly under pressure and debated in the public arena:

- **Fierce competition within and from outside Europe to keep and gain market share, build new markets**
- **Pressure on the cost of production, of labour, of R&D**
- **Innovation pressure on**

  Environment

  Safety

  Mobility

  Trade

  Intellectual Property (design protection, anti-dumping)

  Quality of Life and labor conditions

  Tax and Regulation

- **On the way to „national specific“ automotive sector policies in Europe?**

Severe taxes and penalties against cars with high CO-2 emissions

In 2008 the market for SUVs is collapsing in several European countries

The challenge of sustainability

- **Availability and utilisation of energy is a crucial issue, concepts for sustainalbe mobility will play a more important role within the context of social values**
- **About 19 % of European CO2 emissions are attributed to road transportation**
- **High share of Premium Cars and newly dicussed emission reduction level (120g/km CO2 emission in 2012-**
  compared to 2007: 160g/km all German cars (Porsche Cayenne 368 mg,)
- **Need for eco innovations because of**
  - Open up new potential for innovations
  - Make a valuable contribution to climate protection
  - Create new markets for environmental technologies
  - Set incentives for technologies of the future
  - Strengthen competitiveness and improve cost efficiency
  - Secure jobs
  - …

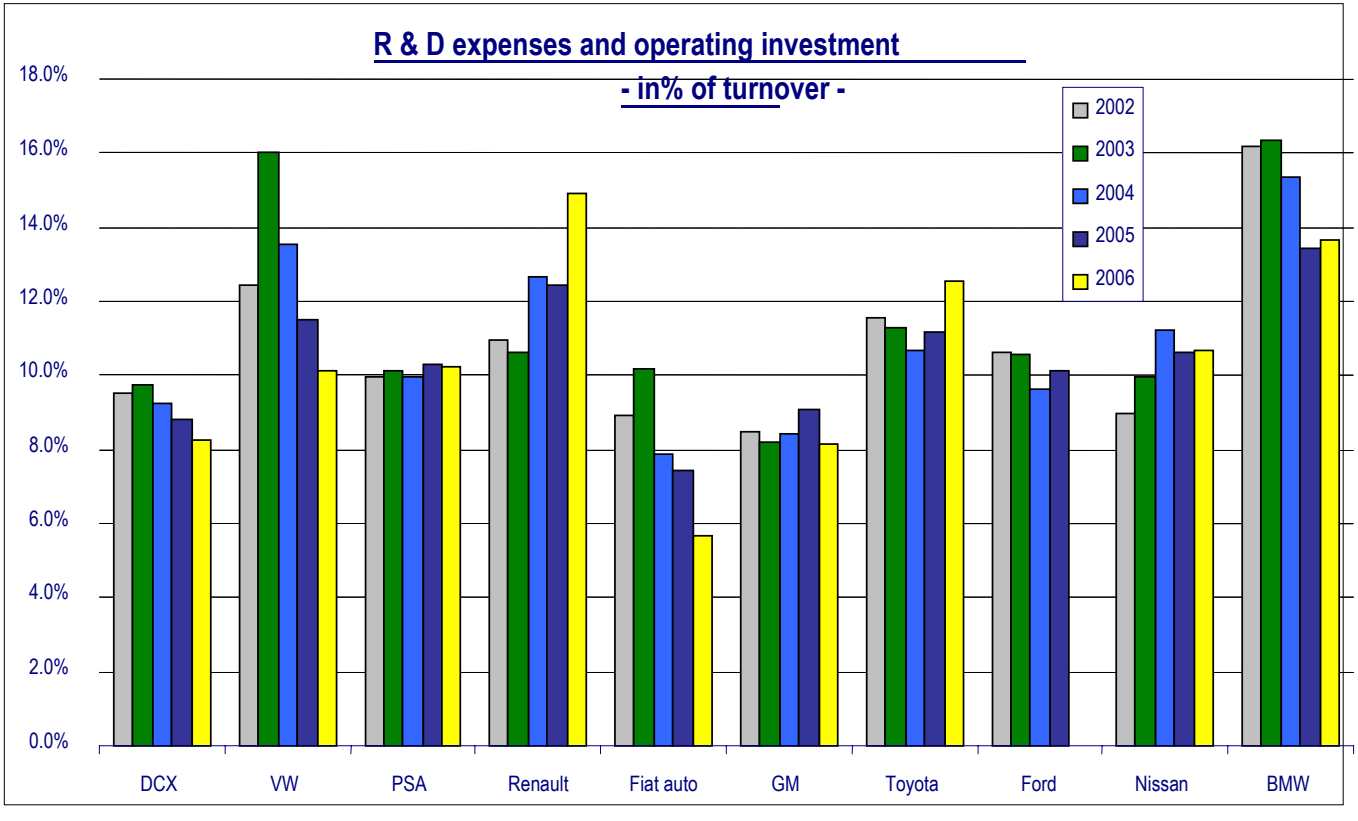
Questions/Focus

- **How have car producers`design, research, and development departments changed?**
- **What role do the automotive engineering firms play that have established themselves since the mid-1990s?**
- **What impact do the changings have on cooperation with universities?**

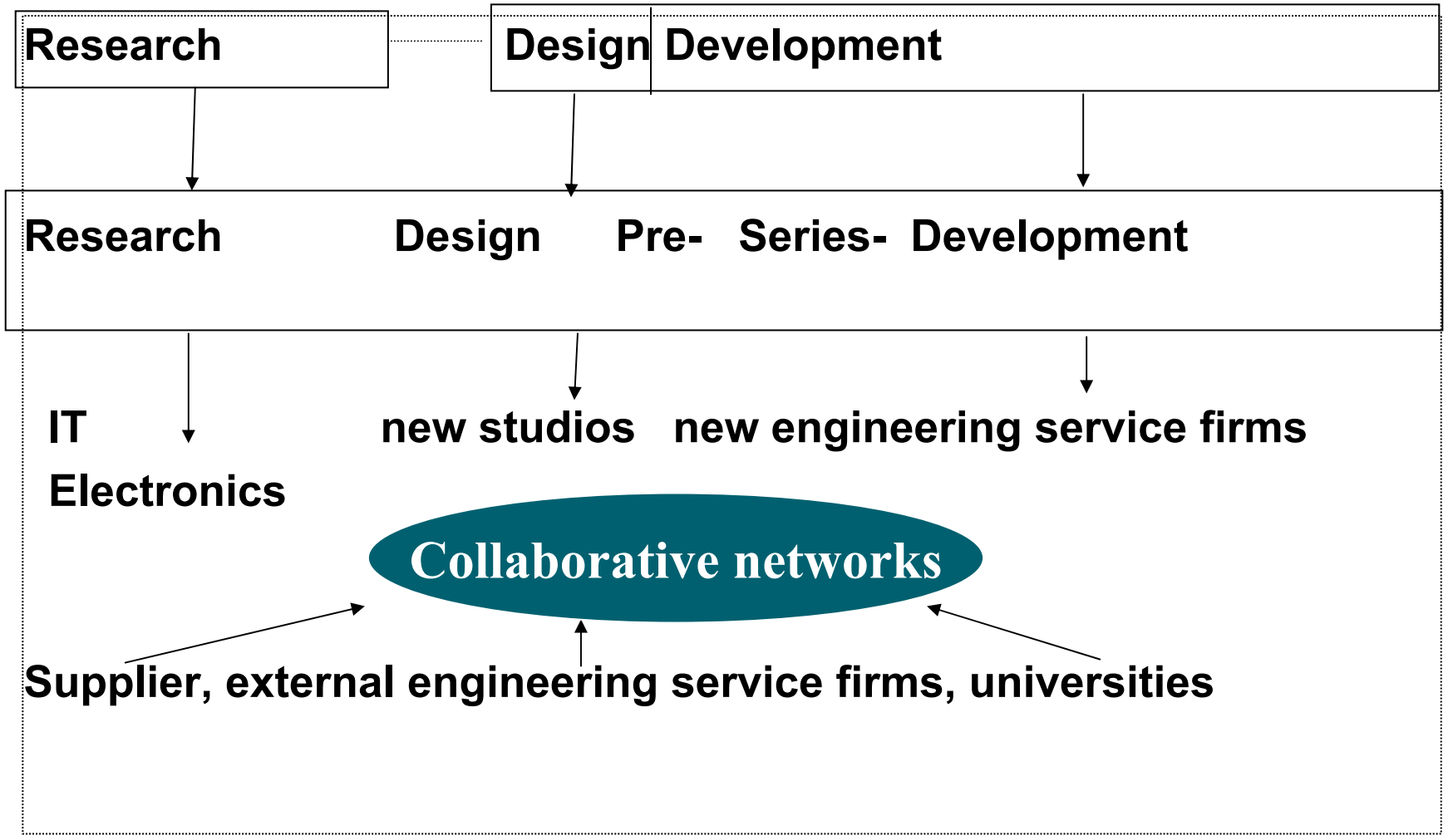
Radical changing in product structure and in organisation of research, design and development processes

- Shorter product cycles, variety of models
- Platform concepts, non-varible parts and components
- Digital/Virtual Reality New Product development processes (Rapid prototyping)
- Global development networks with high concentration on a few headquarter
- Target costing (management by objectives)
- Colloborative developement networks (OEMs, supplier, ESF and other KIBS)
- (Simultaneous Engineeering, System-house-Integration)

High R&D investment



Inhouse: Research - Design - Development



Example: BMW

Change from component orientation towards function orientation – close cross-linking of all function fields

- System orientation for all electric and electronic components and software (40 % proportion of value-added
- Vehicle electrical system as complete system E/E archtitecture
- Jont pocess development with suppliers (since 2005)
- Building blocks (multi-model basic components in different cars
- Backbone (standardized basic archtitecture for several car projects)
- Standardizing (Autosar, FlexRAy consortium)
- Development partnerships with suppliers and engineering firms

Example: BMW Group Research and Technology

5 departments

- **Vehicle Technology**
- **CleanEnergy**
- **EfficientDynamics**
- **ConnectedDrive**
- **ITDrive**

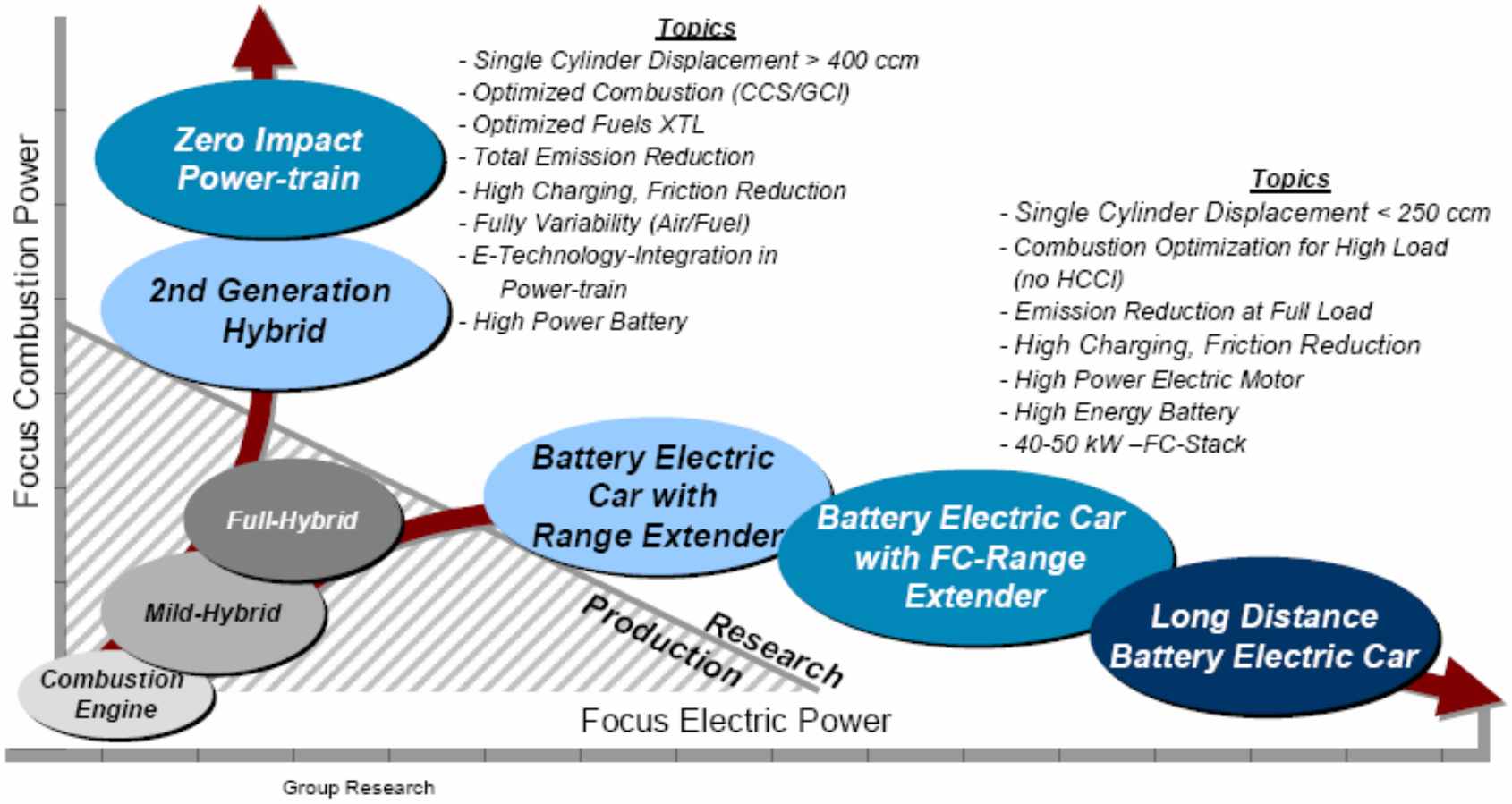
Integrationg knowledlegde from different fields – entertainment electronics, software development, aviation, materials, health care management industry

Organizing idea pools (universities, research groups etc.)

BMW EfficientDynamics

- **High precision injection**
- **Auto start stop – micro hybrid as standard**
- **Brake energy regeneration**
- **Electric Power Steering**
- **Air vent control**
- **Gear shift indicator**
- **Reduced rolling resistance tyres**

Roadmap "Universal Powertrain"



Source: Volkswagen AG 2007

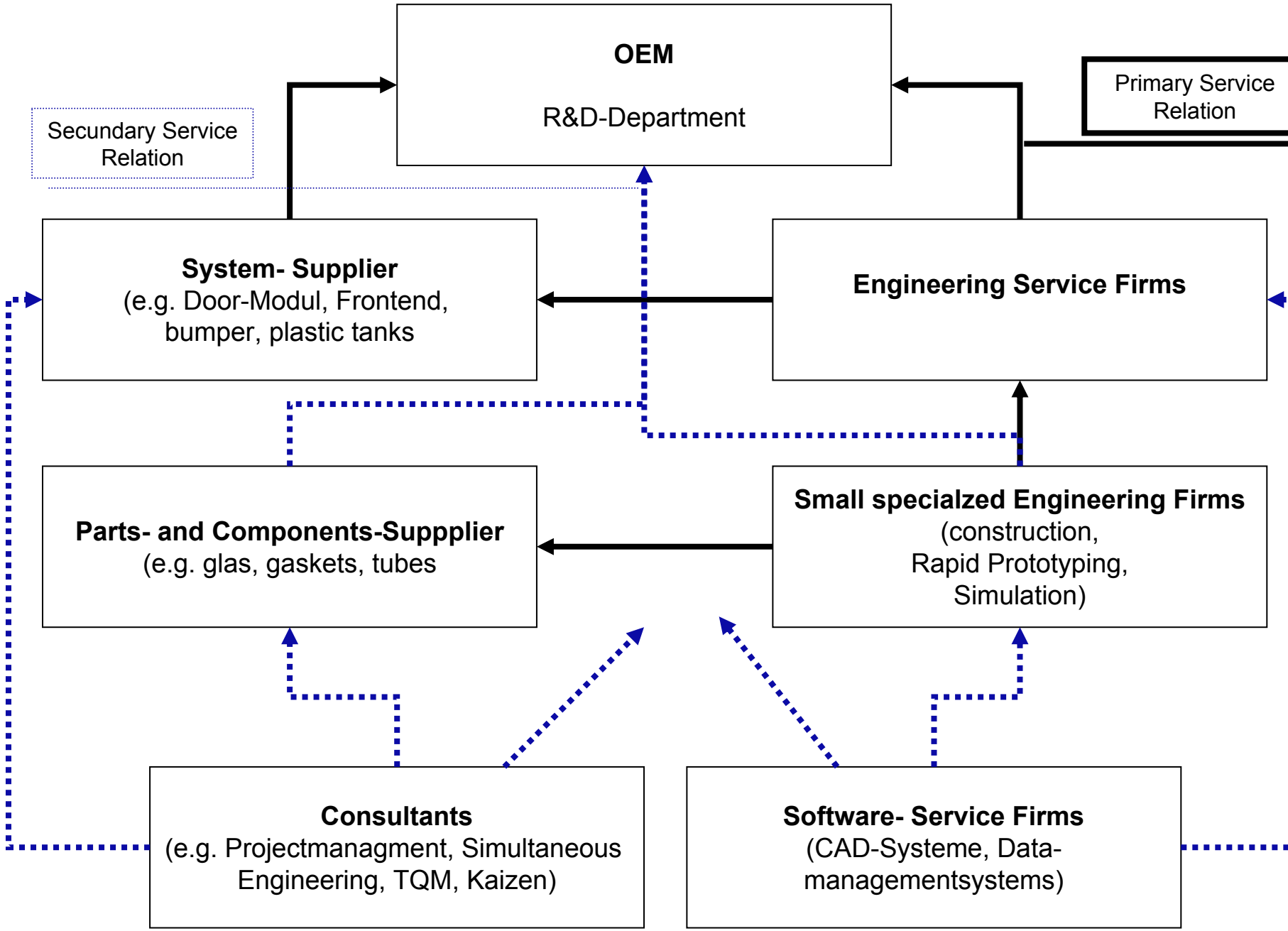
VW Blue Motion

- **1.4L TDI improvements** (VGT, improved exhaust and catalytic converter)
- **5-speed manual gearbox with longer ratios**
- **Aerodynamics** (revisted front-end contributing to improved aerodynamics with lower air resistance, rear spoiler to smooth airflow, smaller door mirrors
- **Miscellaneous weight savings and energy measures** (light alloy wheels fitted with low roll-resistance tyres as standard, notincluded air conditioning, eletric door mirrros, remote control locking

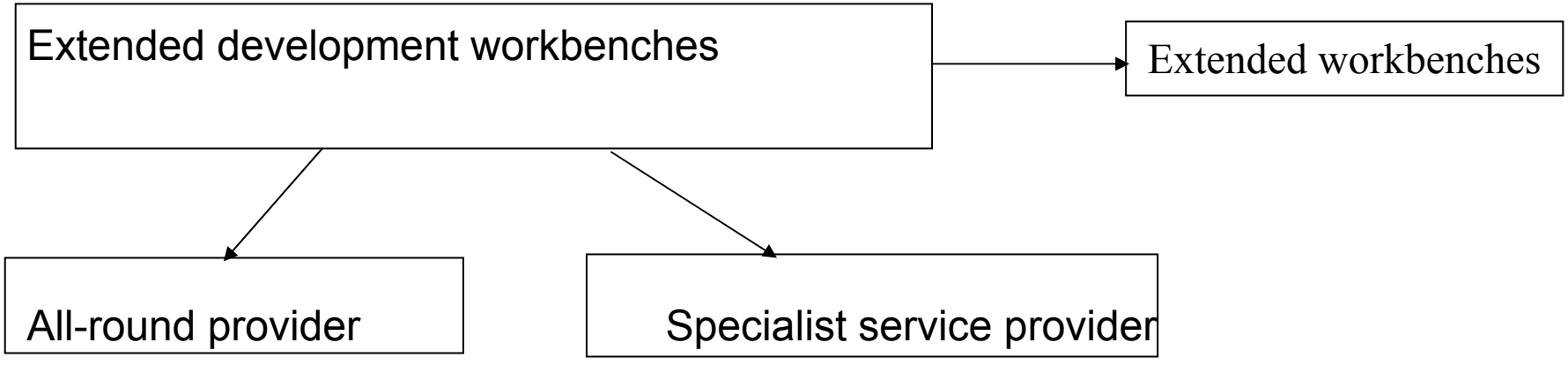
Character of knowledge dynamics

- **multi-technology industry: with no specific analytical base/scientific discipline as a point of departure. Specific to the auto industry are the requirements and capabilities of technological integration.**

- **multi-actor industry, composed of a multitude of specialists and with a strong, ongoing trend towards further specialization (new business models**
- **multitude of interfaces**
  - Interfaces between academic disciplines. Differences in the methods and mindsets of people with a background in mechanics and electrics/electronics have recently been playing an increasingly important role (not least as a source of problems).
  - Interfaces between functional organizations within firms. The classical interface is that between product development and production.
  - Interfaces between firms and other external actors involved in processes of various sorts.
  - Interfaces between hierarchical levels and between planners and executors of work (as exemplified by the classical Taylorist divide).
- **New important role of non-automotive knowledge (e.g. from the health sector or from aerospace)**
- **Many contradictory goals and interests**


OEM
R&D-Department
Primary Service Relation
Secundary Service Relation
System- Supplier
(e.g. Door-Modul, Frontend, bumper, plastic tanks
Engineering Service Firms
Parts- and Components-Suppplier
(e.g. glas, gaskets, tubes
Small specialzed Engineering Firms
(construction, Rapid Prototyping, Simulation)
Consultants
(e.g. Projectmanagment, Simultaneous Engineering, TQM, Kaizen)
Software- Service Firms
(CAD-Systeme, Data-managementsystems)

Changing role of engineering service firms



Current trends

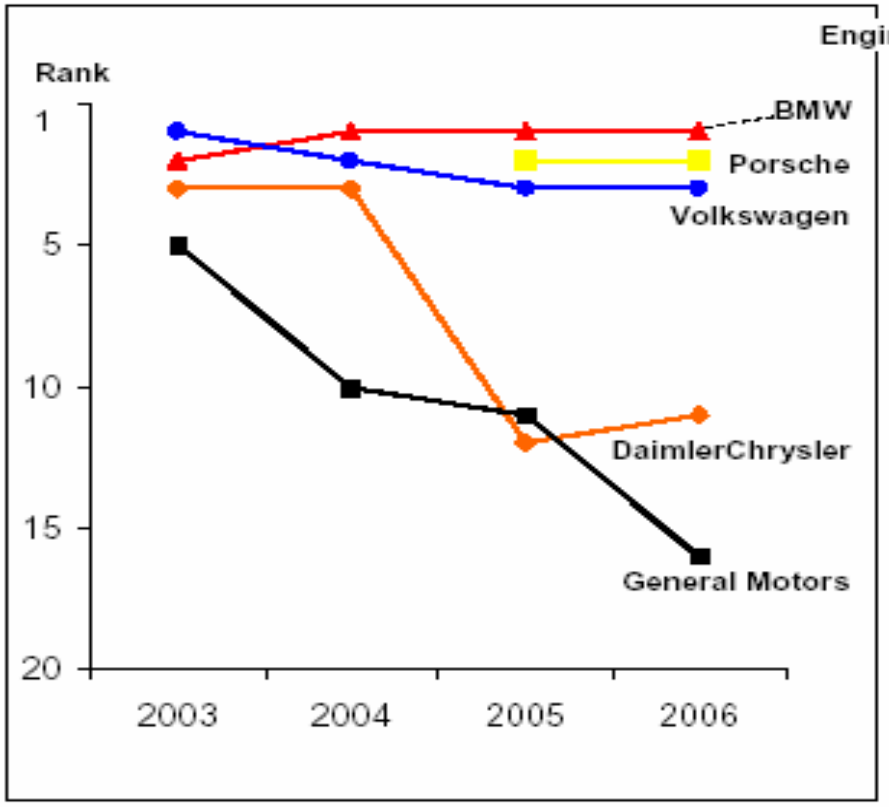
Independent firms (Karmann, Volke) as market loser

Independent firms (Bertrandt, Rücker, Edag) as market winner

Dependent firms in which the OEMs hold an interest as new market winner

Role of universities: new organisational innovations

Employer Attractiveness for University Graduates in Europe



Rank	Co	2006	2005
1	BMW	29.3	29.5
2	Porsche	20.4	20.0
3	Volkswagen Group	17.8	19.4
4	Boeing	14.7	12.7
5	Siemens	13.6	14.2
…			
8	Renault	10.1	10.0
…			
11	DaimlerChrysler	9.4	10.7
12	Toyota	9.3	8.5
13	Volvo	9.1	13.4
…			
16	General Motors	8.5	12.0
…			
19	Fiat	8.0	6.2
20	Ford	8.0	9.5
…			
29	PSA	5.9	7.7

Source: trendence

Volkswagen AG

Innovation Alliances in Germany

Multi-level governance alliances

A) national

- Lithium-Ionen-battery
- Car electronic

B) regional

VW e.G Center of Car Techology Braunschweig
(VW, AutoUni VW, Federal state of lower saxony, TU Braunschweig)

BMW: CAR@TUM (Munich Center of Automotive Research)

C) Firm

e.g.

Mercedes- Ballard, Audi – Samsung, VW – Sanyo, VW and Apple (Online-Tuning)