International Symposium

国 際 シンポジウム

Recent Developments in the Automotive Supplier Industry in Japan and the EU

日本とEUにおける自動車サプライヤー産業の発展

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Greeting Words
開会の挨拶

Presentation to IIC conference
Japan, December 2004

Automotive value chain – chance and challenge for suppliers

McKinsey & Company, Inc.

AGENDA

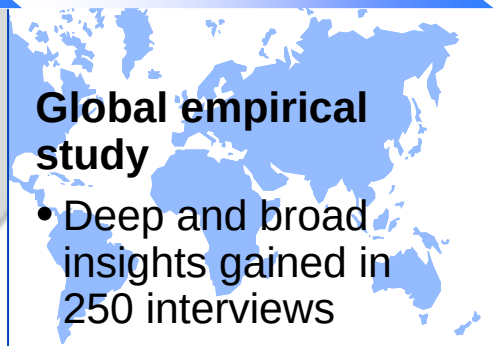
- **Future automotive value chain**
- Challenges for integrators

HAWK PROJECT APPROACH

Issues

- **What impact are innovations having on the value chain architecture in the automotive industry?**
- **What individual strategic approach will secure a company's long-term success?**

Approach



Global empirical study

- Deep and broad insights gained in 250 interviews
- 5,000 end customer surveys
- Quantitative simulation model used
- Conducted by
  - McKinsey&Company
  - PTW/TU Darmstadt

End products

Industry perspective

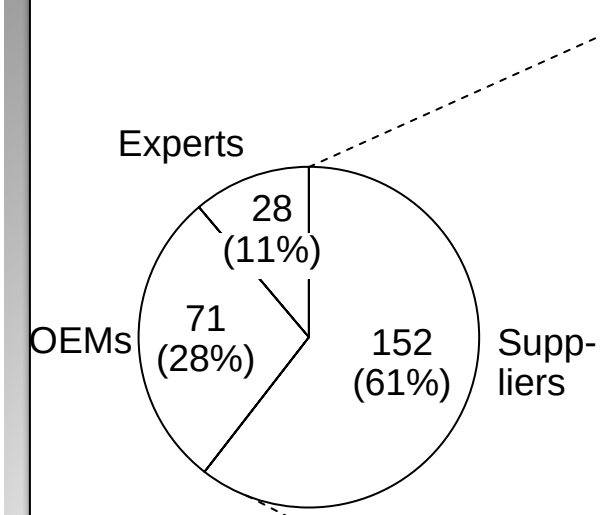
- **Technology roadmap**
- **Best-practice cost structures**
- **Value chain architecture and best-practice competences**
- **Strategies for success**

Company perspective

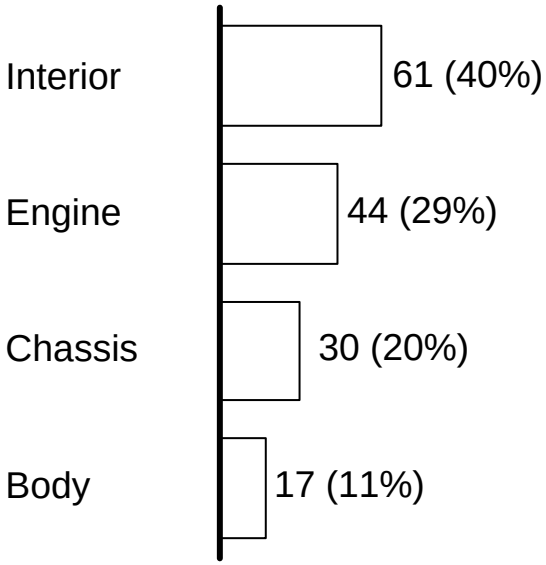
- **Performance improvement**
- **Growth options**

OVERVIEW OF RESPONDENTS

By industry position
Total = 251

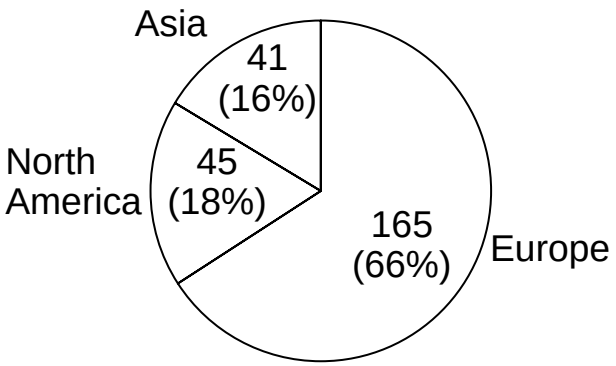


By segment
Number



Respondents from the commercial vehicles sector: 22%

By region
Total = 251

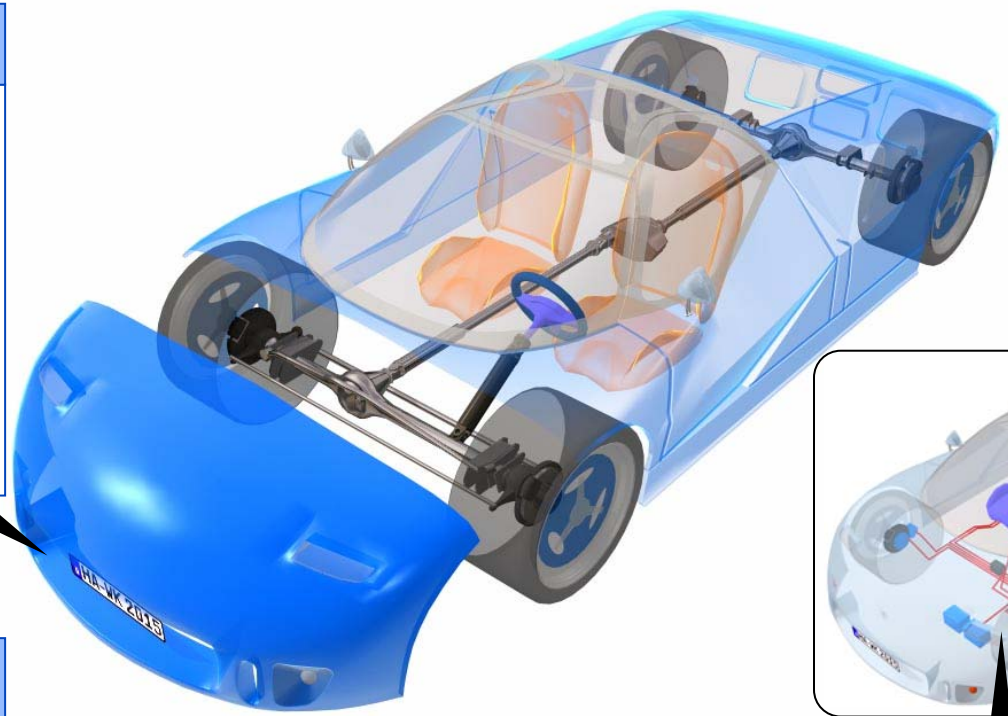


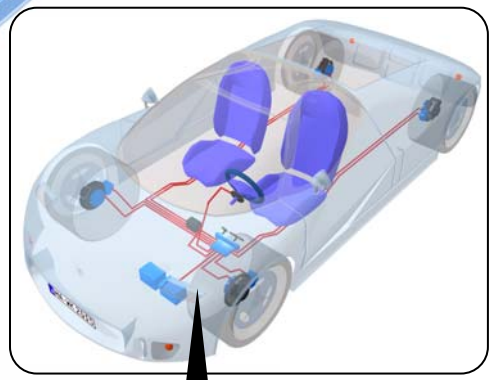
DIFFERENT TYPES OF SYNERGIES

Local synergies

Example: front module

Local synergies through assembly advantage of neighboring, functionally independent components such as radiator, fender and headlamps





Functional synergies

Example: steering column

Mainly function-related synergies through
- Instantaneous transmission
- Crash functionality
- Horizontal and vertical adjustment
- Theft protection

Knowledge-based synergies

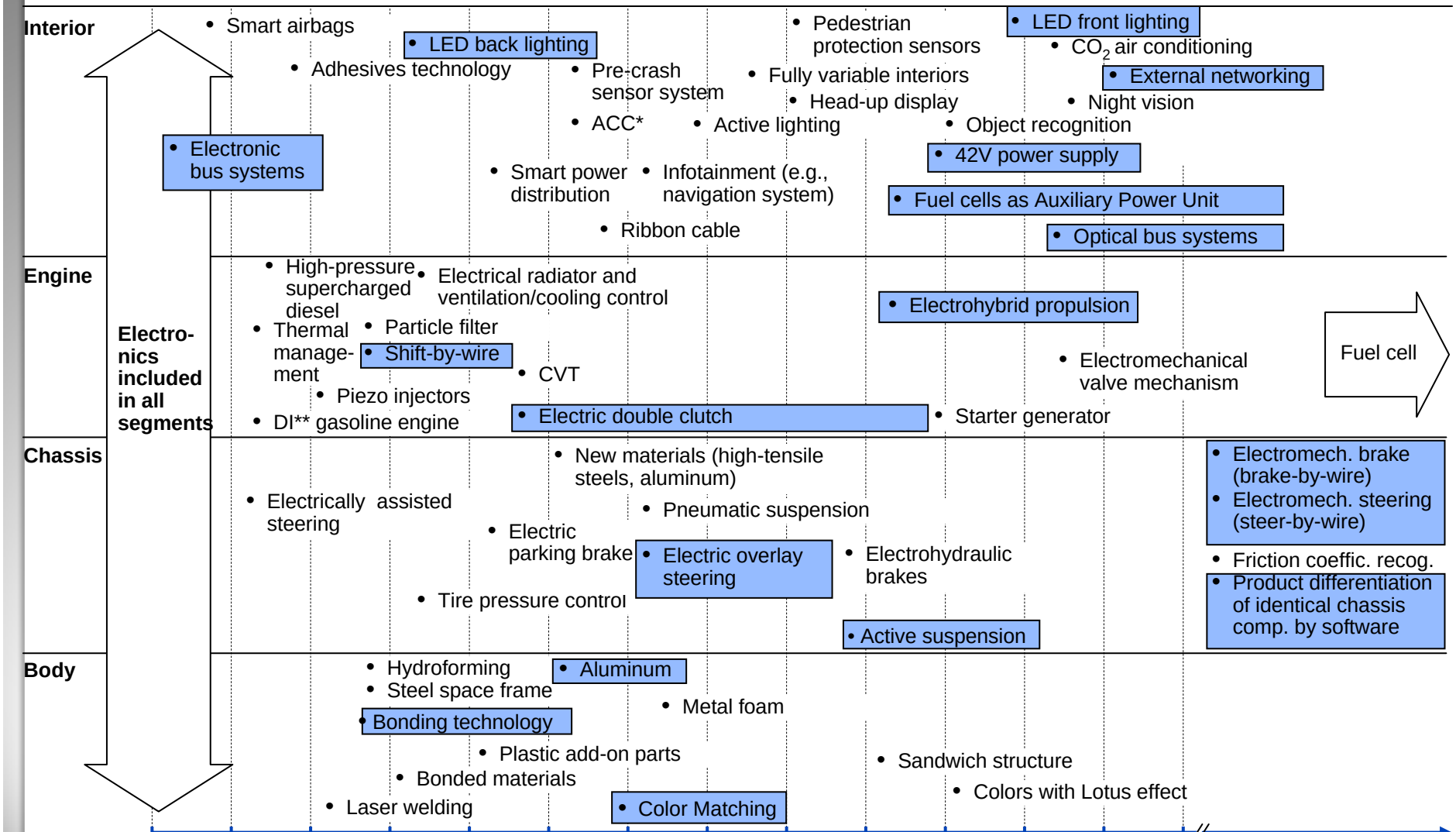
Example: brake system

Mainly concerning
- Dynamics of vehicle movement
- Noise and brake behavior
- Connection with ABS, ESP and engine control

SELECTION

INNOVATION ROADMAP IN THE COMPACT CLASS

Technology changes value chain architecture



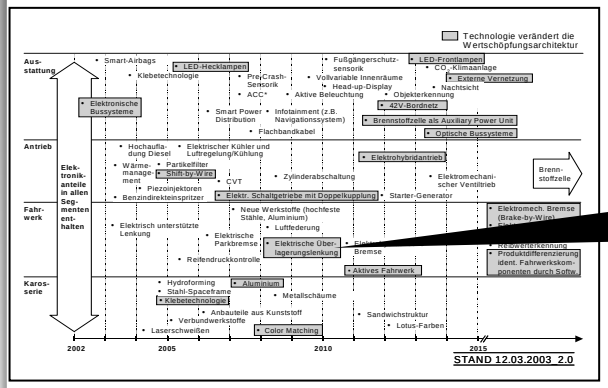
* Adaptive cruise control

** Direct injection

MARCH 12, 2003 2.1

INNOVATIONS FOR ELECTRIC OVERLAY STEERING

Innovation roadmap



Description of electric overlay steering

Electric overlay steering enables the vehicle to actively intervene in the steering without the driver noticing. The steering angle of the wheels can be changed independently of the turning motion of the steering wheel. Steering locks can be increased, decreased or ignored according to the situation. The physical connection between steering wheel and front wheel is not interrupted, so the failure of one or more components does not impact on safety

Value to the customer

- Intervenes in critical situations in conjunction with ABS and ESP. Example: no need to counter-steer when putting brakes full on on different surfaces (γ-split braking)
- Stops the vehicle swerving at high speeds
- Reduces steering locks considerably when parking
- Adjusts the steering properties from direct though to indirect in line with driver‘s wishes (carting)

New components

- Steering angle sensors
- Actuators
- Angle sensor actuator
- Overlay gearbox
- Control unit
- ...

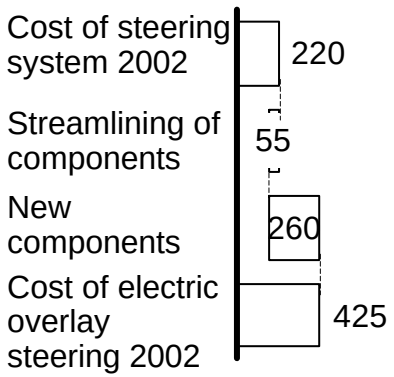
Technical feasibility

- Middle class: 2003
- Compact class: 2008

DETERMINATION OF TIME OF MARKET ENTRY ELECTRIC OVERLAY STEERING

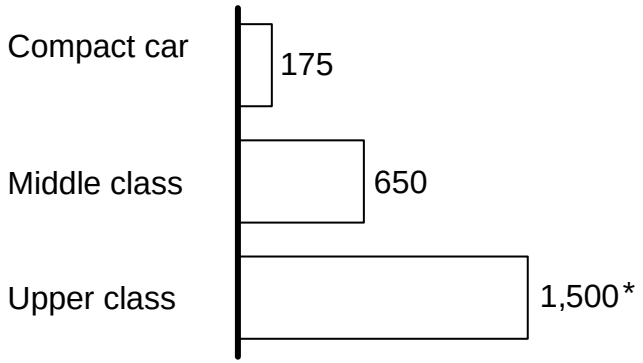
EXAMPLE

Determination of costs at component level
EUR



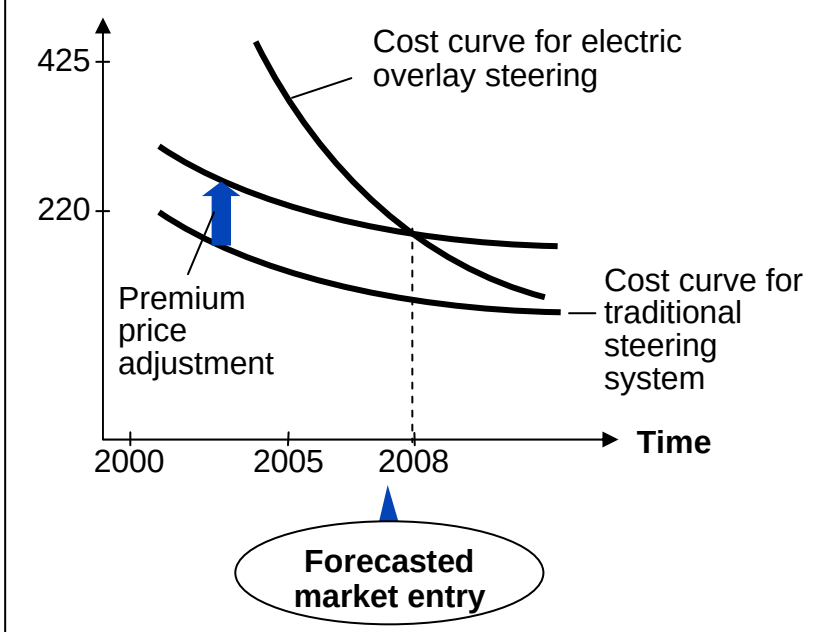
Cost projection by differentiated CIPs at component level

Premiums chargeable for electric overlay steering
EUR



5,000 end customers surveyed

Market entry for electric overlay steering
EUR, manufacturing costs



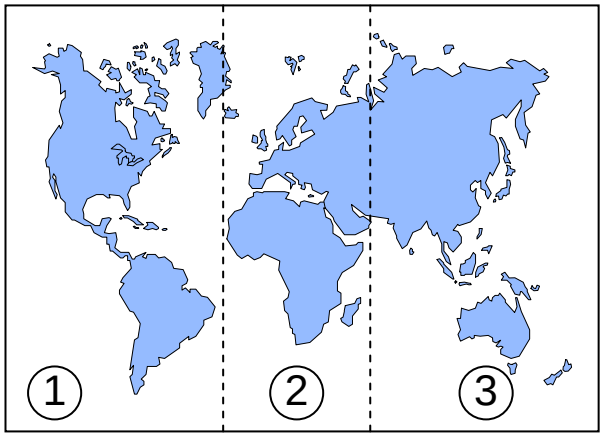
* No statistically significant subset < 20

REGIONAL DIFFERENCES

① **Innovation drivers, NAFTA**

- Legal requirements
- Comfort features
- Cost reduction potential

- Suppliers continue to be component specialists, rarely system integrators



② **Innovation drivers, Europe**

- Safety
- Comfort
- Prestige
- Environment-friendliness

- Product innovations are the key to profitable growth

③ **Innovation drivers, Japan/ Asia**

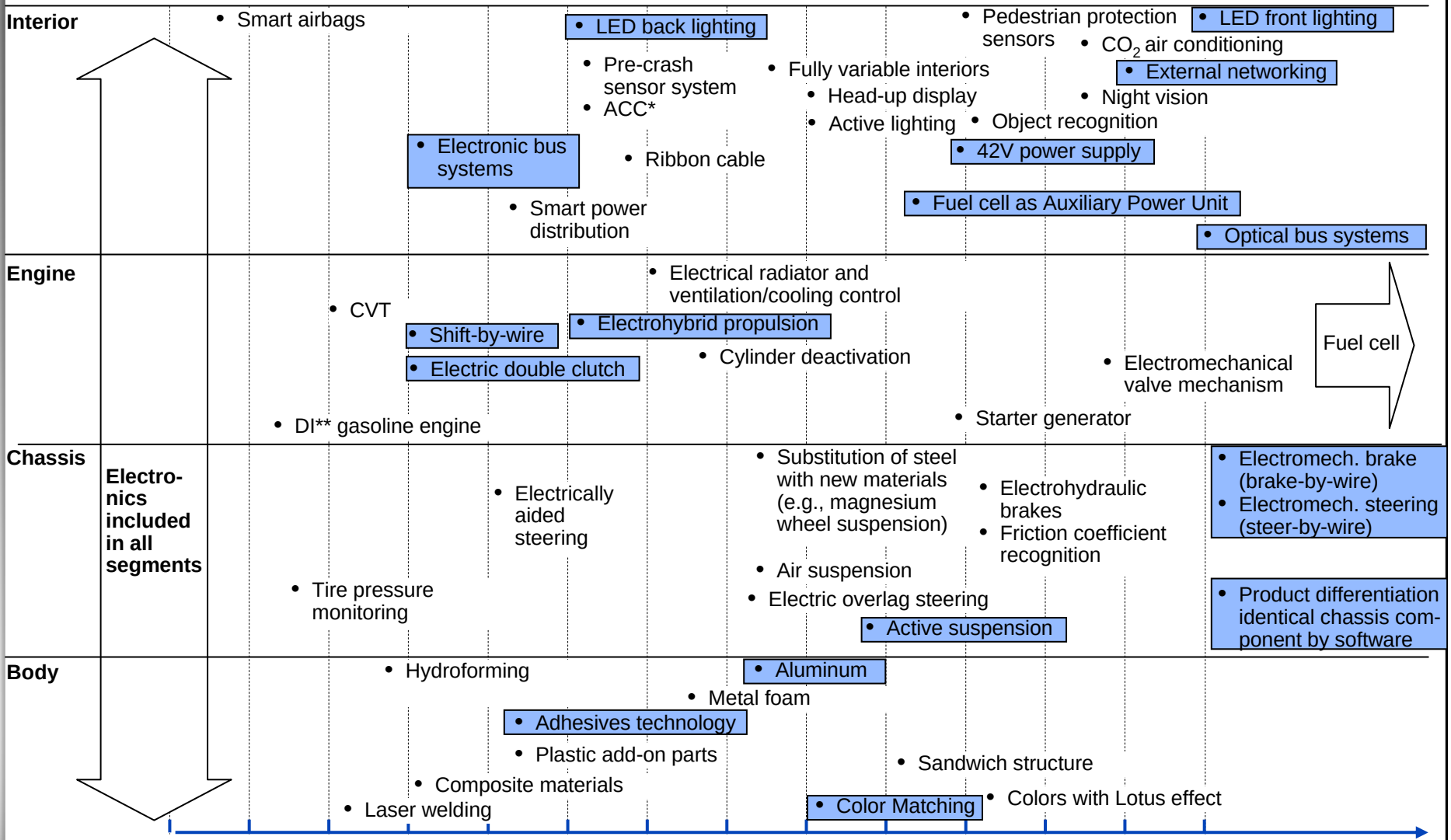
- Individual satisfaction of customer requirements

- Individually tailored solutions for customers lead to new innovations
- Standardized interfaces will determine the industry

SELECTION

ROADMAP OF INNOVATION USA (COMPACT CLASS)

Technology changes value chain architecture



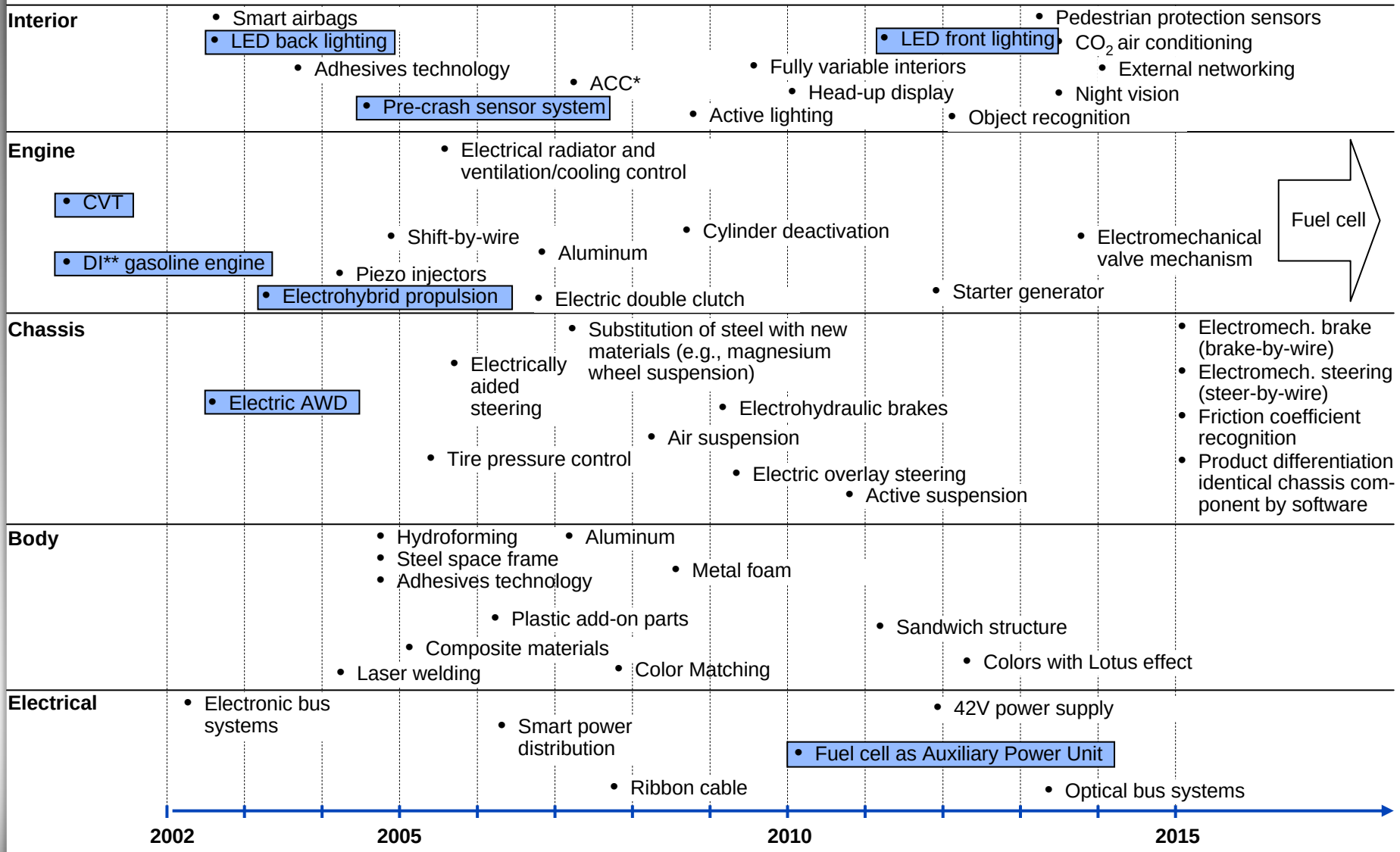
* Adaptive cruise control

** Direct injection

ROADMAP OF INNOVATION JAPAN (COMPACT CLASS)

SELECTION

Technology changes faster in Japan

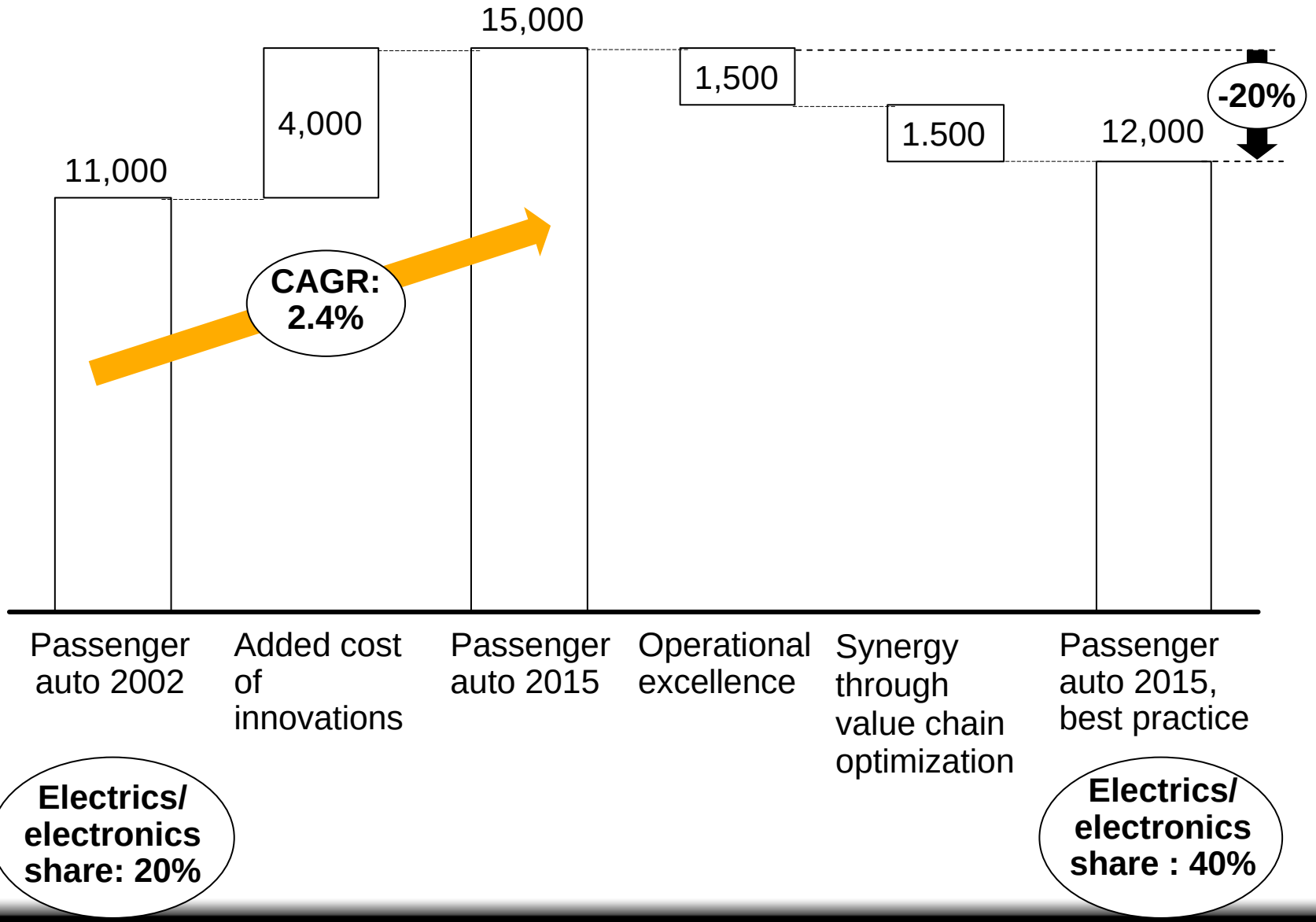


* Adaptive cruise control

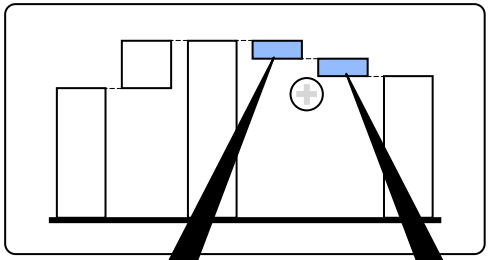
** Direct injection

COST STRUCTURE OF COMPACT CLASS AUTOS IN EUROPE

EUR/unit, not adjusted for inflation

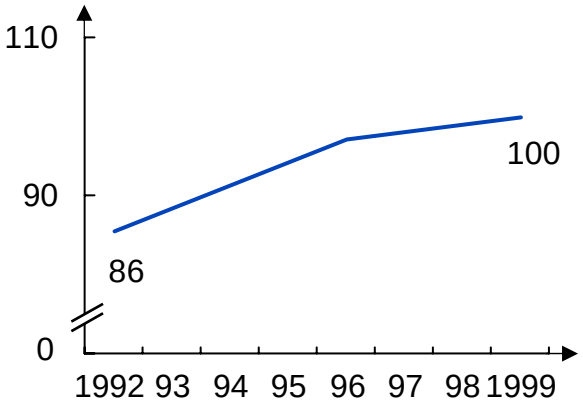


PRODUCTIVITY IMPROVEMENT LEVERS



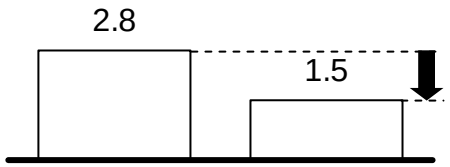
Operational excellence

Real labor productivity in Germany
Index 1999 = 100



CIP rates are leveling off in Germany

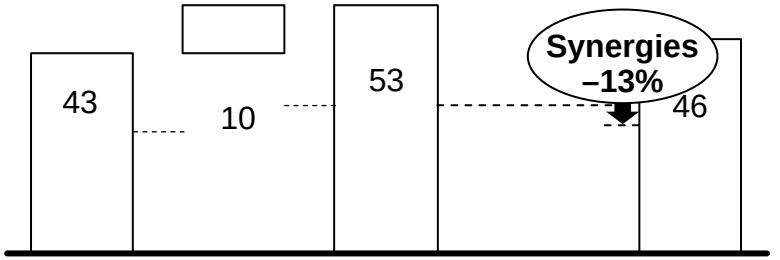
CAGR

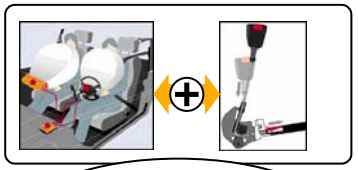


Synergies through use of shared competence in safety systems

EXAMPLE

EUR





Airbag and belt tightener use the same motive agent

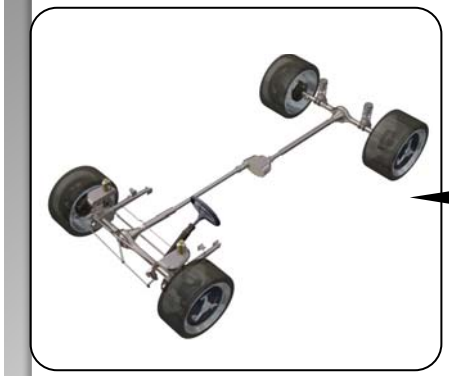
Synergies through use of joint competences for pyrotechnics and purchasing

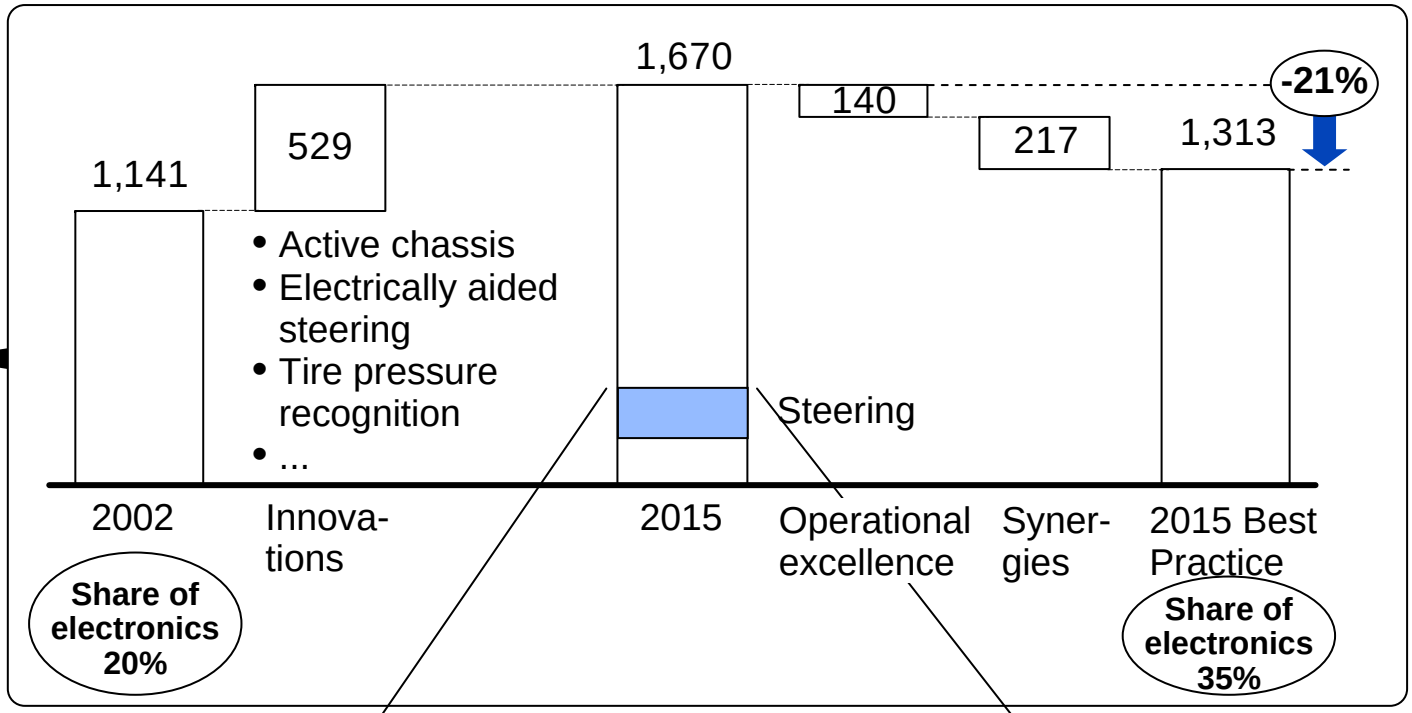
* Years: 1992, 1996 and 1999 interpolated

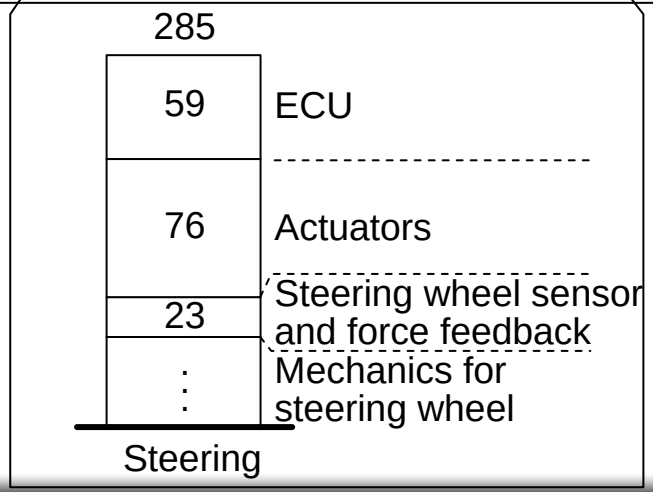
CHASSIS COST STRUCTURE

EUR

Cost of chassis for compact class auto





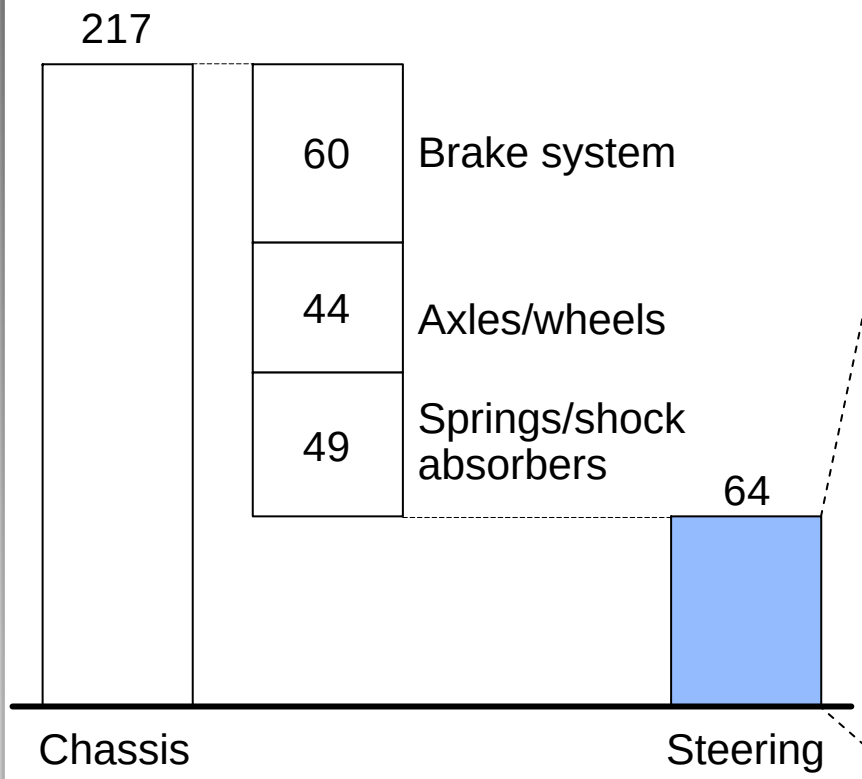


* Years: 1992, 1996 and 1999 interpolated

SYNERGY POTENTIAL FOR EACH COMPONENT

EUR

Synergies



Development

- Use of competences in development of control electronics
- Synergies through transfer of actuators from other areas of application
- Joint software development with other chassis systems

Production

- Combination of precision engineering with electric sub-systems
- Use of scale effects through re-use of identical components (e.g., actuators)

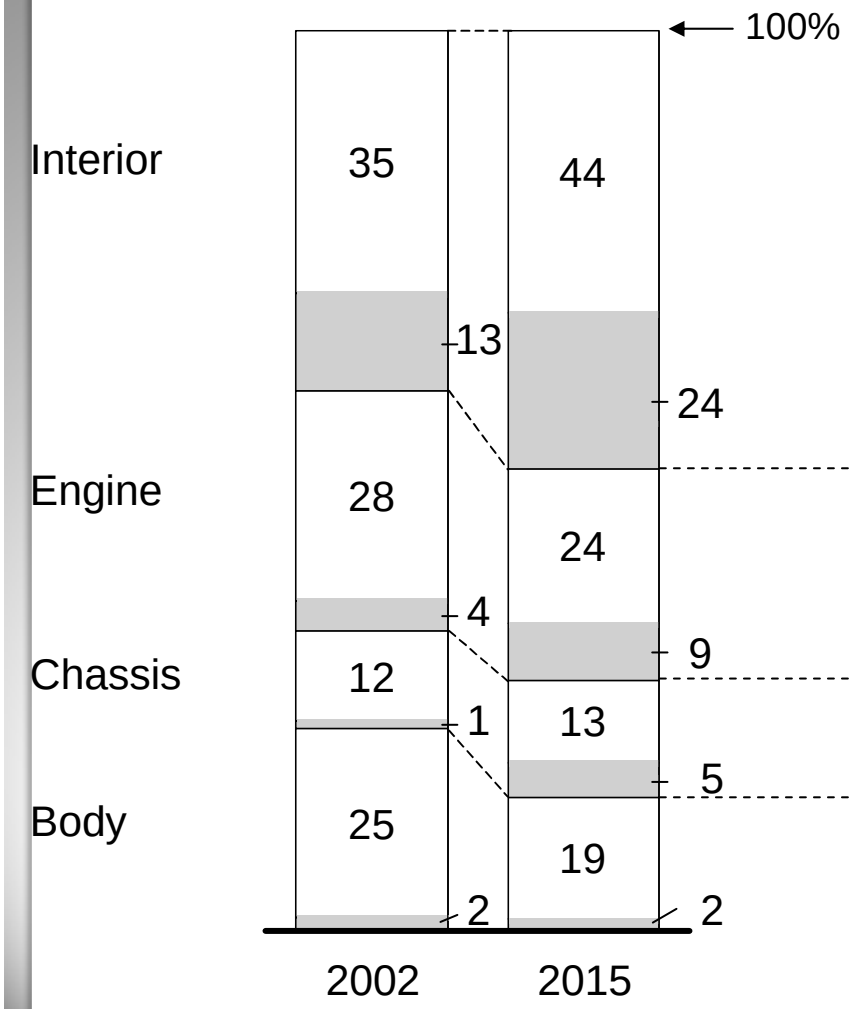
Transaction

- Realization of scale effects in purchasing

COST STRUCTURE IN THE COMPACT CLASS

Share of electrics/ electronics

Percent

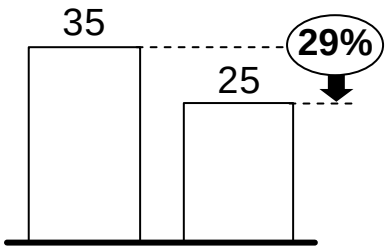


Segment cost	Key changes
↑	New interior comfort features drive up share of electrics/electronics and total cost
↘	Economies of scale can be tapped with a cross-OEM engine. End customer differentiation is ensured by software
→	X-by-wire technologies will drive down costs
↓	Traditional mechanical components will be under very severe cost pressure

DEVELOPMENT OF OEMs' VERTICAL INTEGRATION

2002 2015*

OEMs' share of value added
Percent



Increasing outsourcing of

- Integration work for total systems/modules to suppliers
- Development of systems with increasing need for specific know-how

Segment	OEMs' share of value added Percent of manuf. cost	Examples of modules outsourced by OEMs
Interior	17 / 12	• System integration** of interior • Integration** of inside door system • Development and integration** of air conditioning system • Development and integration* of in-board network
Engine	24 / 9	• Engine assembly • Engine development (on cross-OEM platform) • Manufacture of prefab engine block • Manufacture of prefab cylinder head
Chassis	31 / 13	• Integration** of steering system, springs/shock absorbers and axle/wheel suspension • Axle manufacture
Body	72 / 66	• Integration** of front end • Manufacture of aluminum and plastic add-on pieces

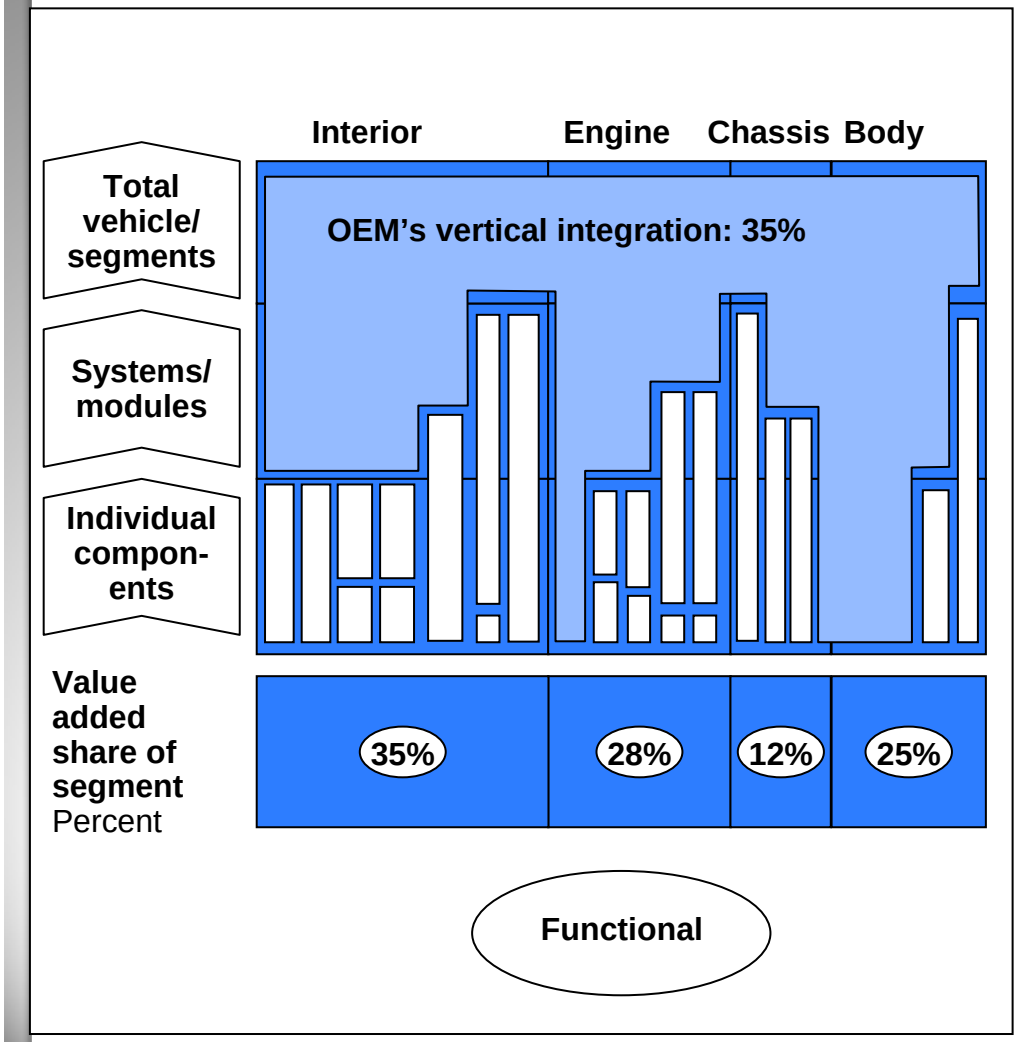
* Model forecast ** Interface management, assembly, inspection, and warranty

COMPACT CLASS AUTO

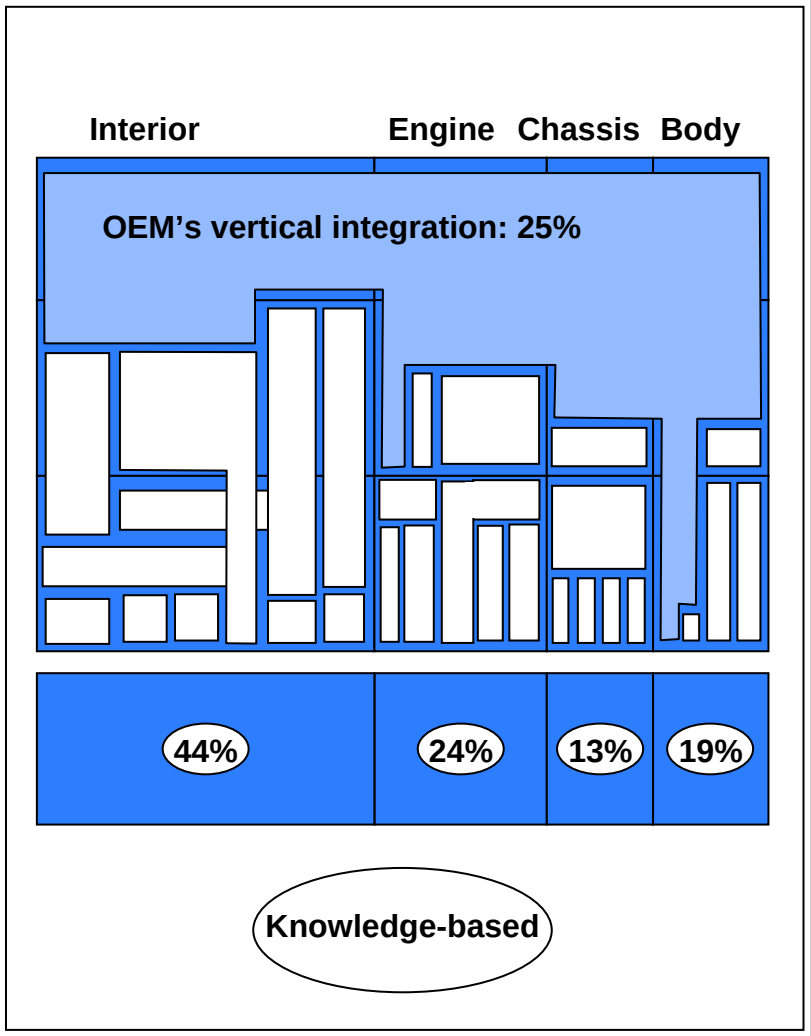
DEVELOPMENT OF VALUE CHAIN ARCHITECTURE

Supplier
OEM

Value chain architecture today



Best practice value chain architecture 2015

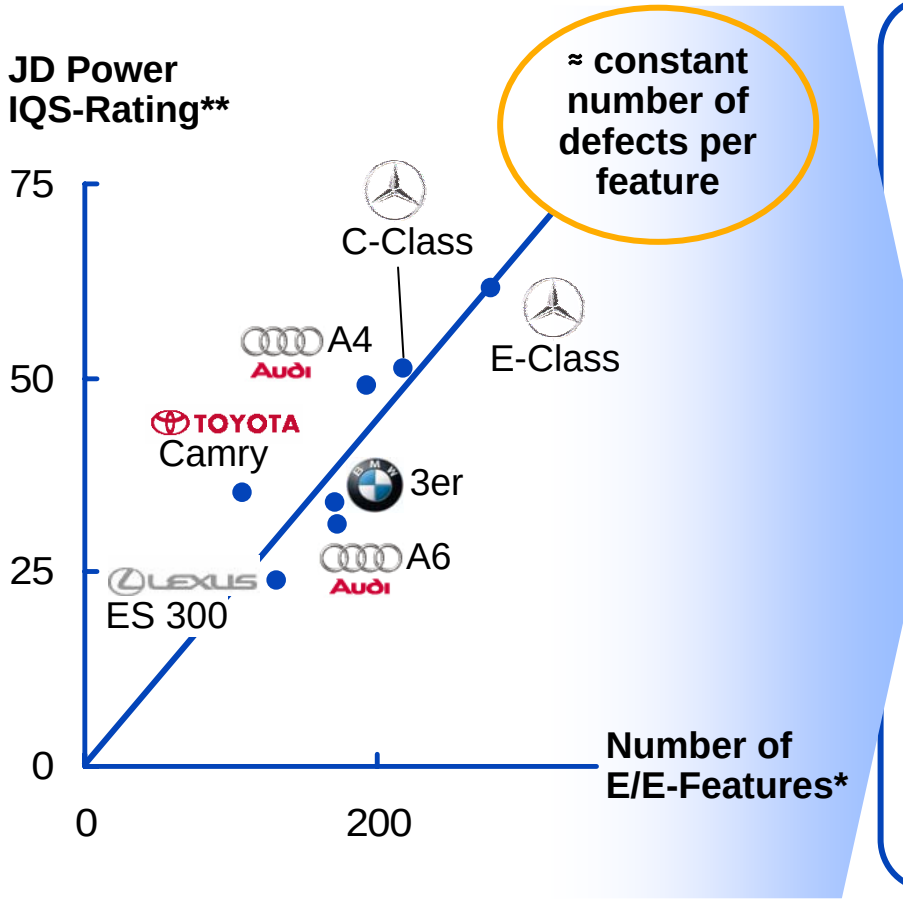


AGENDA

- Future automotive value chain
- **Electronics challenges for integrators**

The automotive electronics value chain becomes more dynamic due to the OEM's urge to handle exploding complexity

DRIVERS OF VALUE CHAIN DYNAMICS



OEMs looking for ways to handle the increasing complexity

- New architecture needs time to implement and to practice
- Standardization is hard to implement and best done on an industry level
- Modularization disaggregates the problem but does not fix it on the module level

Supplier partners are to handle quality and cost problems

- Joint innovation in focus areas
- Development *and* production of integrated modules instead of isolated components
- High level integration in development networks (tier 0.5 model)
- Design-to-cost on a system level

Rise of more active supplier roles creates high dynamics in most AE value chains

* Interior and body features

** Defects per 100 vehicles, October 2003, sum of "Features and Controls", Sound System und HVAC

Source: JD Power

Even in the existing value chains there are a number of roles to choose

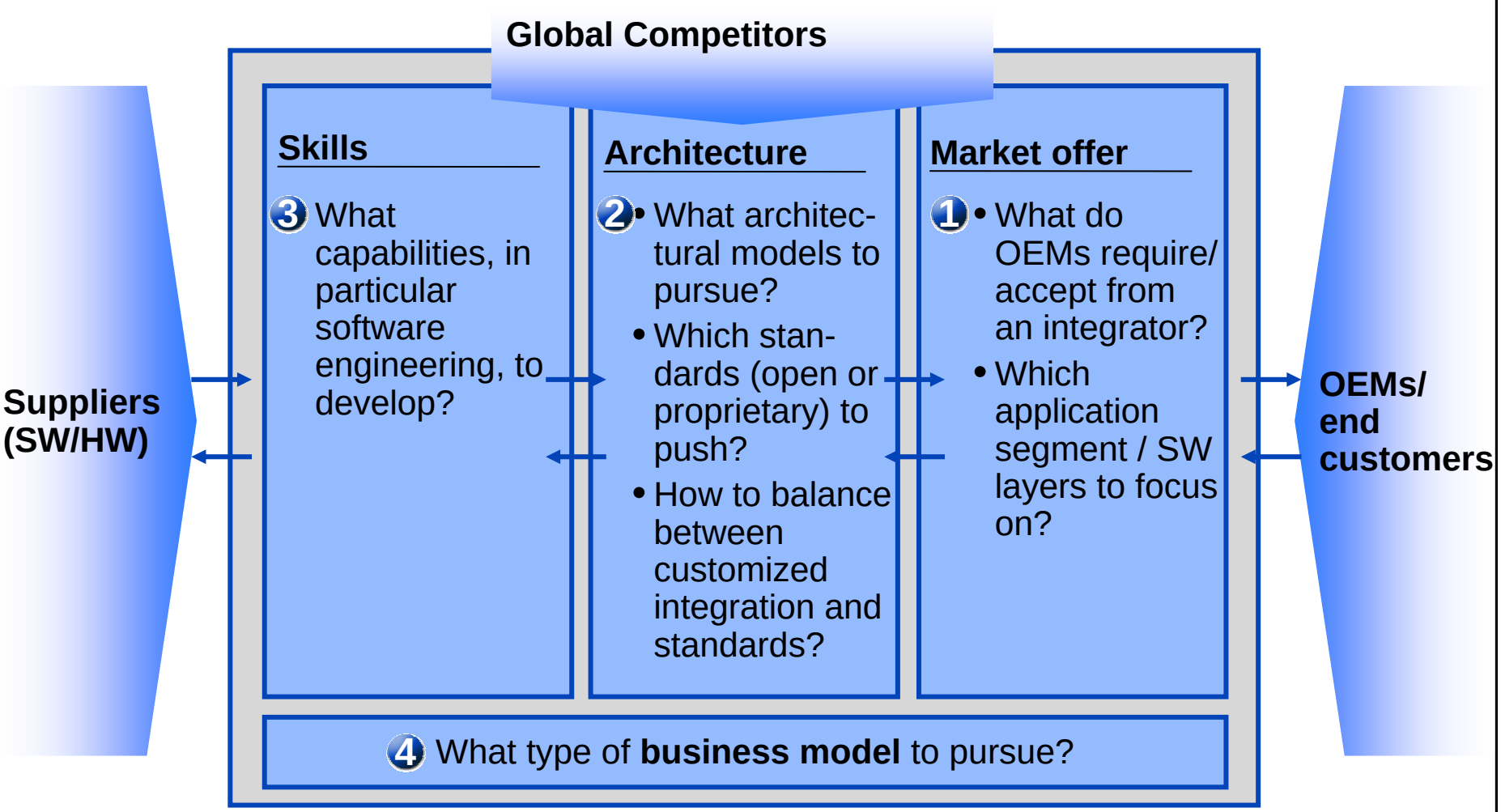
DEFINITION OF ROLES ALONG VALUE CHAIN

Role	Core competency	Examples
OEM	Develop and build cars, brand management	DaimlerChrysler, BMW
System integrator	Specify and integrate complex system (passive restraint system, infotainment break system suspension, etc.)	Autoliv, Bosch, Continental, S-VDO
Complex Component Supplier	Manufacture and integrate complex components and modules (door module, side airbag, HVAC)	Brose, Delphi, Bosch, Denso
Engineering Services Provider (ESP)	Take over well-defined development tasks, support R&D and specification process	PGAM, Rückert, Porsche Engineering Services, Bertrandt, Bosch Engineering
Semicon Supplier	Design-to-specification and manufacture of standard and non-standard semiconductors	IFX, Motorola, STM
Software Provider	Develop complex software with a highly reliable process, assess feasibility and resource/time needs with high reliability	Wipro, AVL, EDS
Electronics Manufacturing Supplier (EMS)	Price-efficient manufacturing of electronic components designed by other players	Flextronics, Solectron

Sources: McKinsey

Positioning as an integrator requires the answer to a set of key questions around technology and business model

KEY QUESTIONS FOR AUTOMOTIVE SUPPLIER



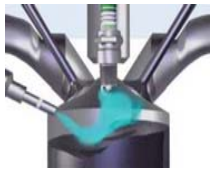
Sources: McKinsey

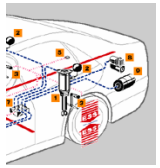
1 Suppliers should position themselves as competent supporters of the OEM's strategy

SUPPLIER ROLES ON THE AUTOMOTIVE SOFTWARE GAMEBOARD

Application segment

SW layer	Drive and ride management	Safety	Driver assistance, comfort	External communication	Entertainment
Application	A Help OEMs to develop brand defining applications			B Provide best-in-class solution development	
Operating system					
Communication					
Driver		C Support full abstraction in own development			

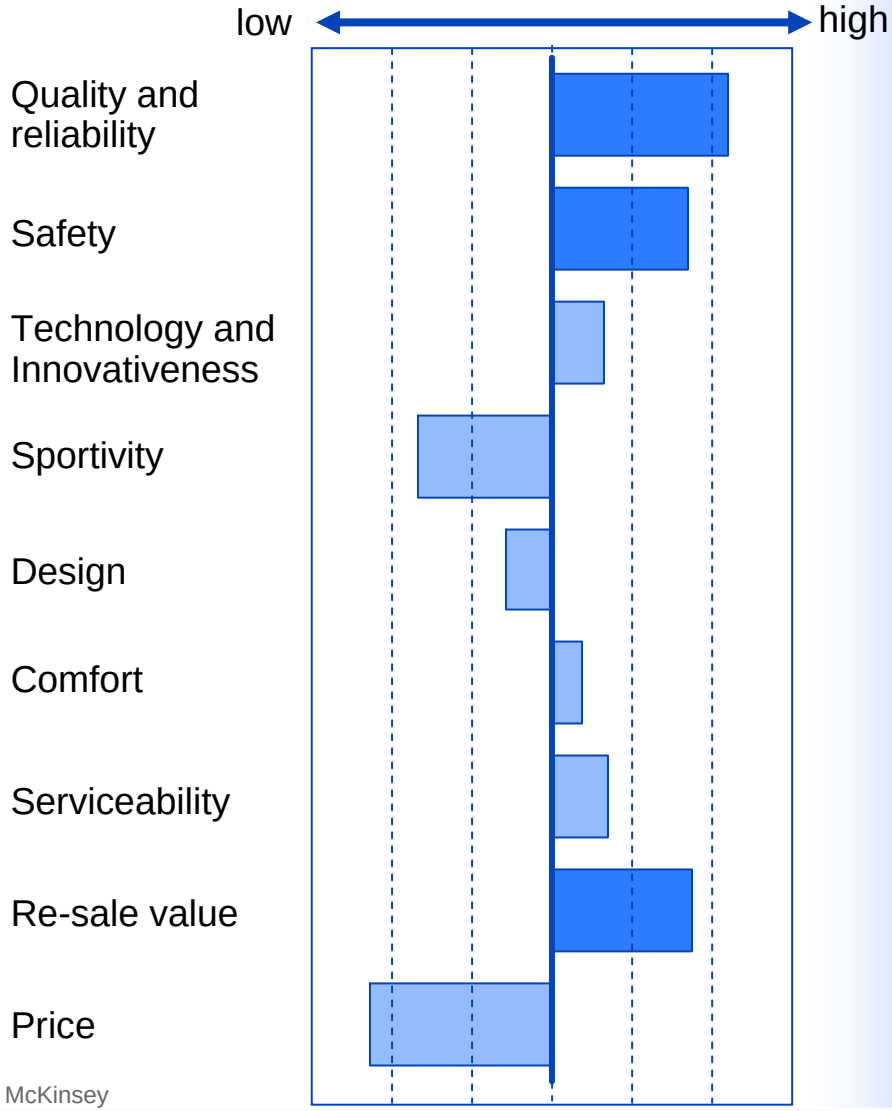




Source: McKinsey

1 OEMs will drive electronics innovations increasingly from a brand image view

BRAND IMAGE COMPARED TO PEERS



Source: McKinsey

Recommended AE strategy

- Focus on safety and drive & ride management applications, e.g.,
  - Collision avoidance
  - E911
  - Remote engine diagnosis
- Provide basic professional feature sets instead of playful gadgets
- Emphasize particular importance of reliability of electronics
- Ensure modular architecture to facilitate updates and keep re-sale value high

Also for an integrator, understanding the end customers helps to develop the right specifications

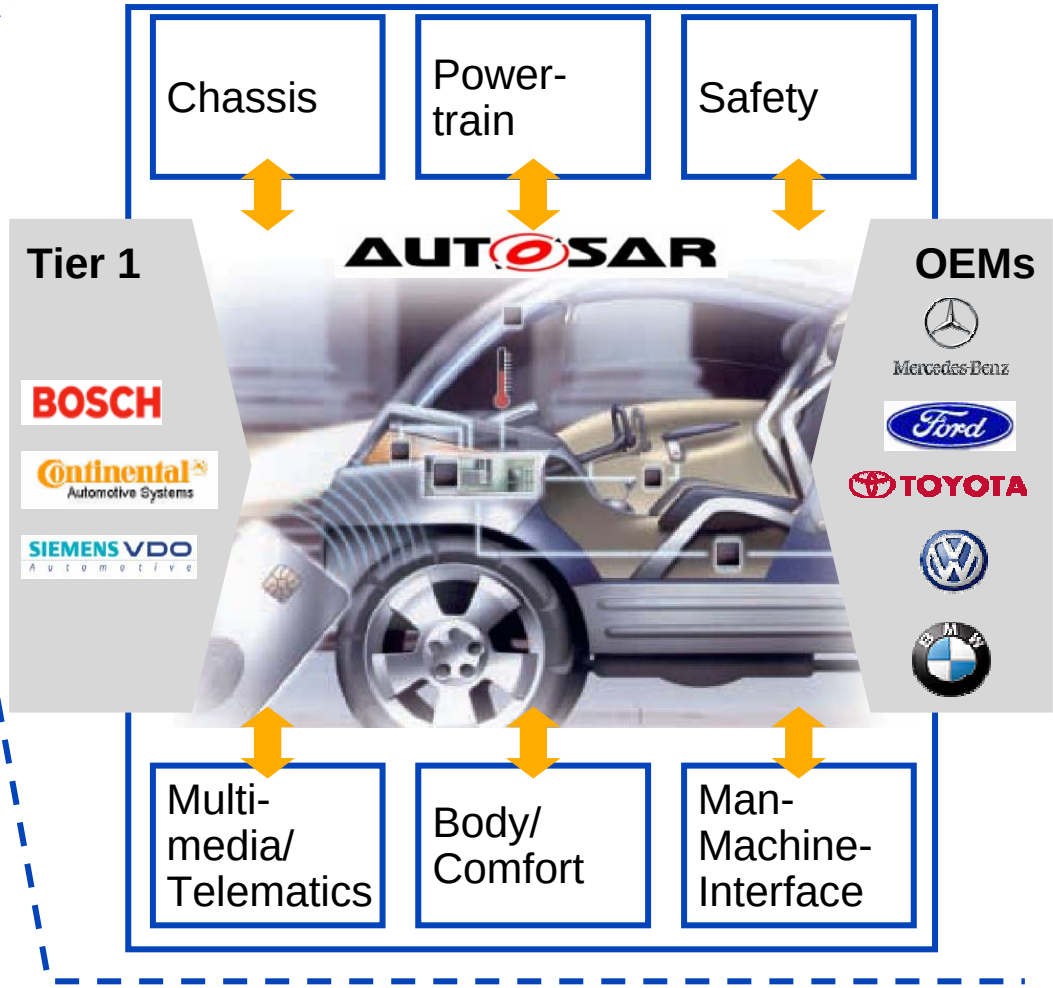
2 AUTOSAR, as a first step, defines functional domains in which integration and standardization need to happen

AUTOSAR BASIC ARCHITECTURE

Strategy "Divide and Conquer"

- Segment automotive electronics in manageable pieces with more focused requirements
- Learn from other industries how the specific complexities can be managed in the development process
- Build a development network with specialized players to develop and manage tailored best practices

AUTOSAR functional domain structure



Source: AutoSAR, McKinsey

2 Establishing standards and platforms is key in development of mobile phones

EVOLVEMENT OF MOBILE PHONE ARCHITECTURE

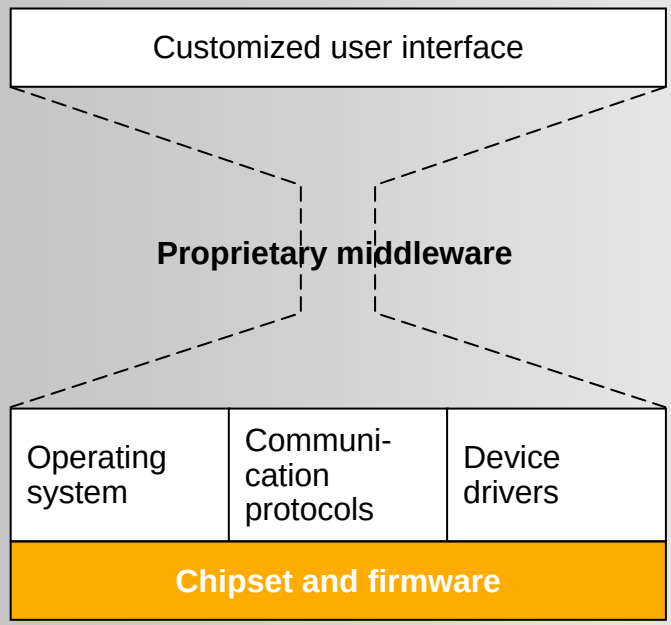
DISGUISED NUMBERS

MOBILE PHONE SYSTEM

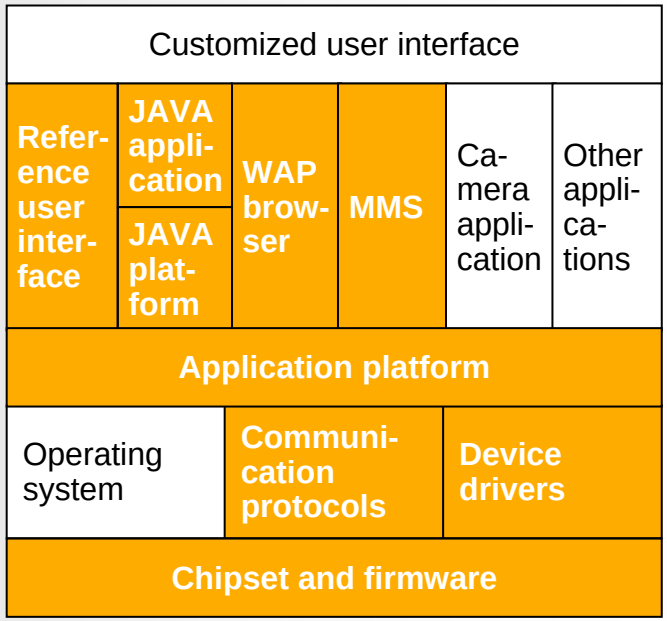
Value creation in responsibility…
- … of semiconductor player
- … of ODM/OEM

Market trends
- Increased system and software complexity due to higher portion of value created in software
- Forward integration required by semiconductor players since OEMs focus on final system integration and branding

1999



2003



Total lines of code*	**0.3 mil.**	→	**1.6 mil.**
Max. team size	**20**	→	**150**
Effort (Man-years)	**20**	→	**90**
Locations	**2**	→	**8**
Third parties managed	**–**	→	**5**

Sources: McKinsey

2 To define the right integration focus, it is essentially to understand the principal challenge of automotive electronics

REQUIREMENTS ON AUTOMOTIVE ELECTRONICS

AE requirements		High tech example
• Safety critical	←	Avionics
+		
• Highly available	←	Public switching
+		
• Feature-rich	←	Consumer electronics
+		
• Easily useable	←	Mobile phones
+		
• Under high cost pressure	←	Personal computers

The combination of complexities is unique and can't be solved by taking a standard approach from any other industry

Source: McKinsey

3 Concerning process maturity the Automotive supplier industry is lacking 10 years behind the SW industry

TESTIMONIALS FOR NEED OF MORE SOPHISTICATED SOFTWARE SKILLS

Audi

"Regarding electronics problems in the development process, the share caused by SW increased from 57% for the A2 to 75% for the A4" *Willibert Schleuter*

BMW

"Due to a software problem BMW had to call back 49,500 M3 models in the USA"
Reuters

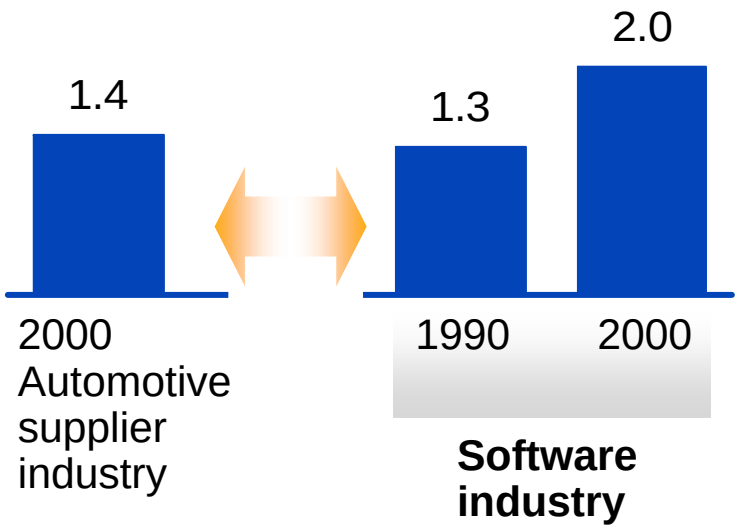
Mercedes-Benz

"The current quality issues will become CEO agenda"
Jürgen Hubbert

auto motor und sport

"About 80% of all black boxes that are replaced by service shops do not have any malfunctions."

Situation of process maturity CMM level



All European automotive OEMs are level 1

Source: Volkswagen, BMW, Audi, Mercedes-Benz, SEI, Interviews, McKinsey

3 In software development, OEMs suffer from lack of process maturity needed for distributed development

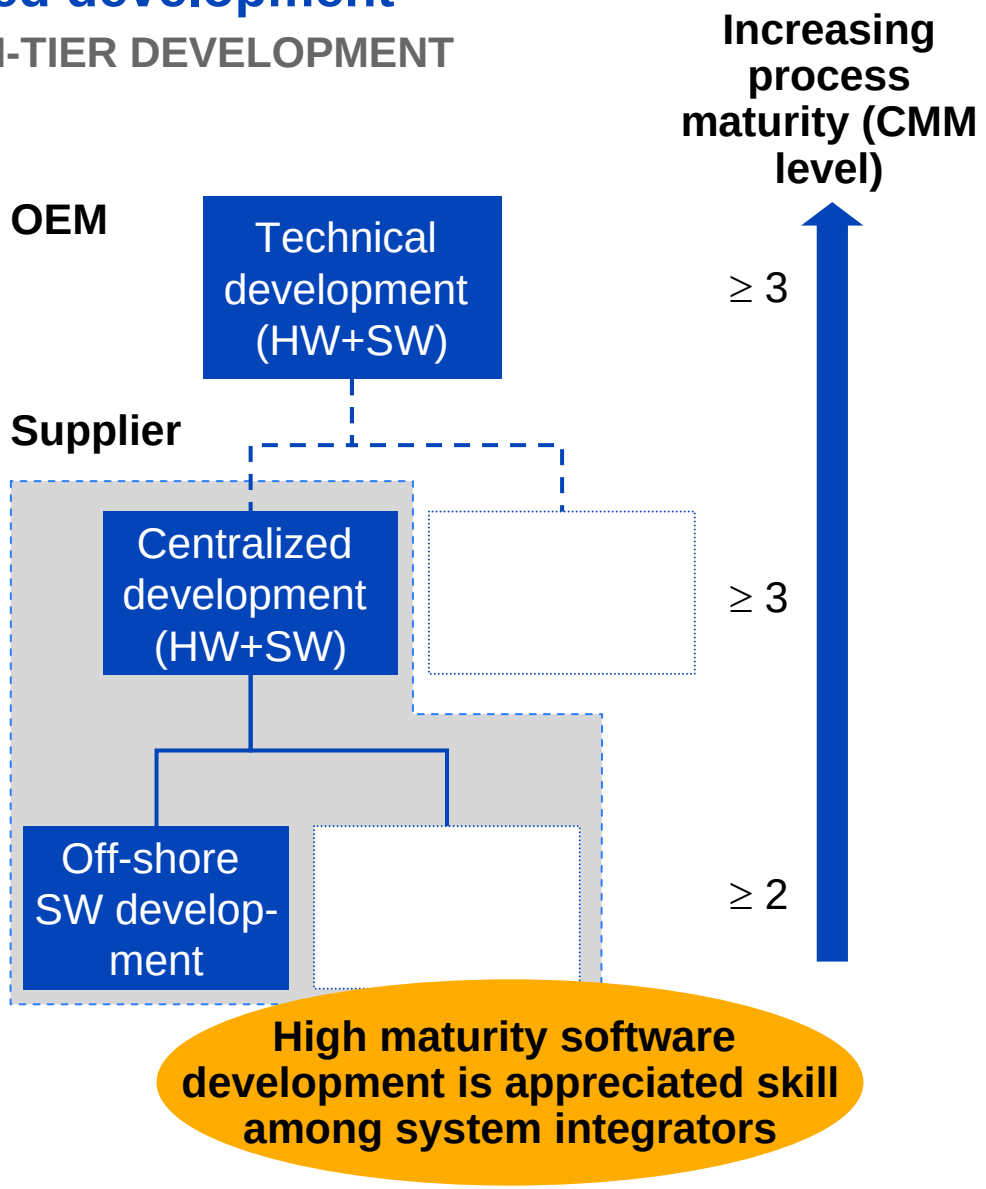
ROLE OF PROCESS MATURITY IN MULTI-TIER DEVELOPMENT

CMM level below 3 implies

- No stable management process for subcontractors
- No reliable traceability of requirements
- In case of level 1, even lack of formalized requirement management

CMM level lower than subcontractors implies

- Inefficient work sharing
- Improper hand-down of requirements
- Wrong and/or inflexible architecture
- Bad project planning

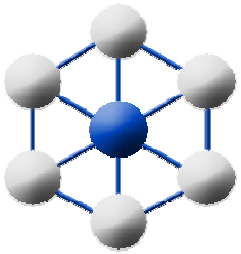


Source: Expert interview

4 In general, the right OEM-supplier relationship model depends on application maturity

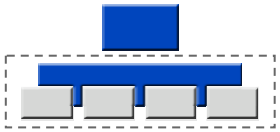
TYPICAL COOPERATION MODELS

Network



- Increasing supplier competence
- Decreasing customer differentiation

Tier 0.5



- Stabilization of interfaces
- Standardi-zation

Disintegration

- OEM shaping product and integrating SW suppliers

Success factors for suppliers

- **Prove integration capabilities to position yourself as future integrator**
- Manage autonomous system specification and interfaces to diverse partners

- Dominant supplier taking over SW integration task

- **Drive innovations with landmark proprietary technology**
- Define interfaces and break-down specification to Tier-2 suppliers

- Disaggregation of product into independent components, no value added by integration

- **Develop industry standard for HW and SW components**
- Focus on scale and process excellence to drive down cost curve in commodity markets

Product maturity

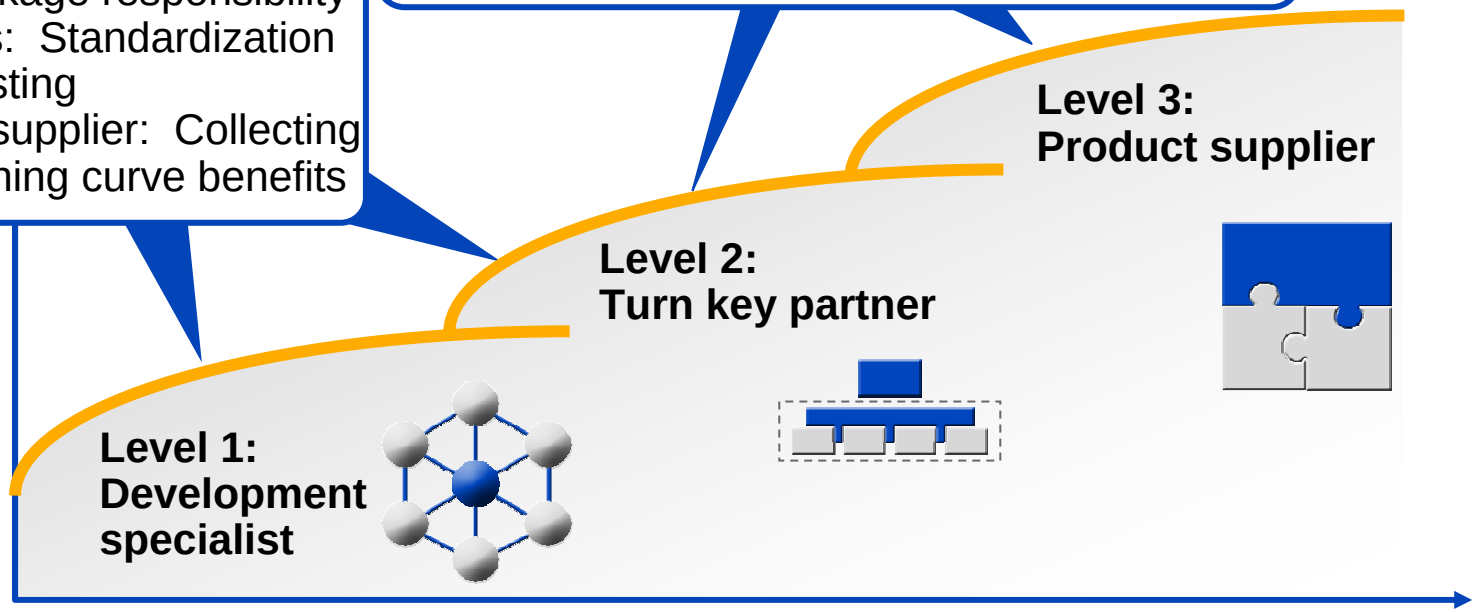
Source: McKinsey

4 While integration itself is not paid for, more complex software development will move to a royalty-based revenue model

SOFTWARE REVENUE MODELS

Move from package delivery to lifecycle support/update and independent variant management/architecture enhancement
- Key arguments towards integrator: Scalability and channel management (sales/services)
- Key benefit to supplier: Participation in volume upside

Move from paid development hours to black box package responsibility
- Key arguments: Standardization and ease of testing
- Key benefit to supplier: Collecting reuse and learning curve benefits



Revenue model	Development contract (pay per hour worked)	Product package (pay per output delivered)	Royalty (pay per product sold)

Source: McKinsey

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