CAMI
Center for Automotive & Mobility Innovation

Hidden sources of inertia in the evolution of automotive architectures: implications for management research

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The Transformation Of Mobility:
Challenges For Firms And New Directions For Strategy Research

SMS Berlin, September 18 - 2016

Evident sources of inertia…

EMPLOYMENT		
Manufacture of motor vehicles (EU28)	2.3 million people = 7.7% of EU employment in manufacturing	*2013*
Total (EU28 manufacturing, services and construction)	12.2 million people = 5.6% of total EU employment	*2013*

PRODUCTION		
Motor vehicles (world)	91.5 million units	*2015*
Motor vehicles (EU28)	18.4 million units = 20% of global motor vehicle production	*2015*
Passenger cars (world)	73.5 million units	*2015*
Passenger cars (EU28)	16.0 million units = 22% of global passenger car production	*2015*

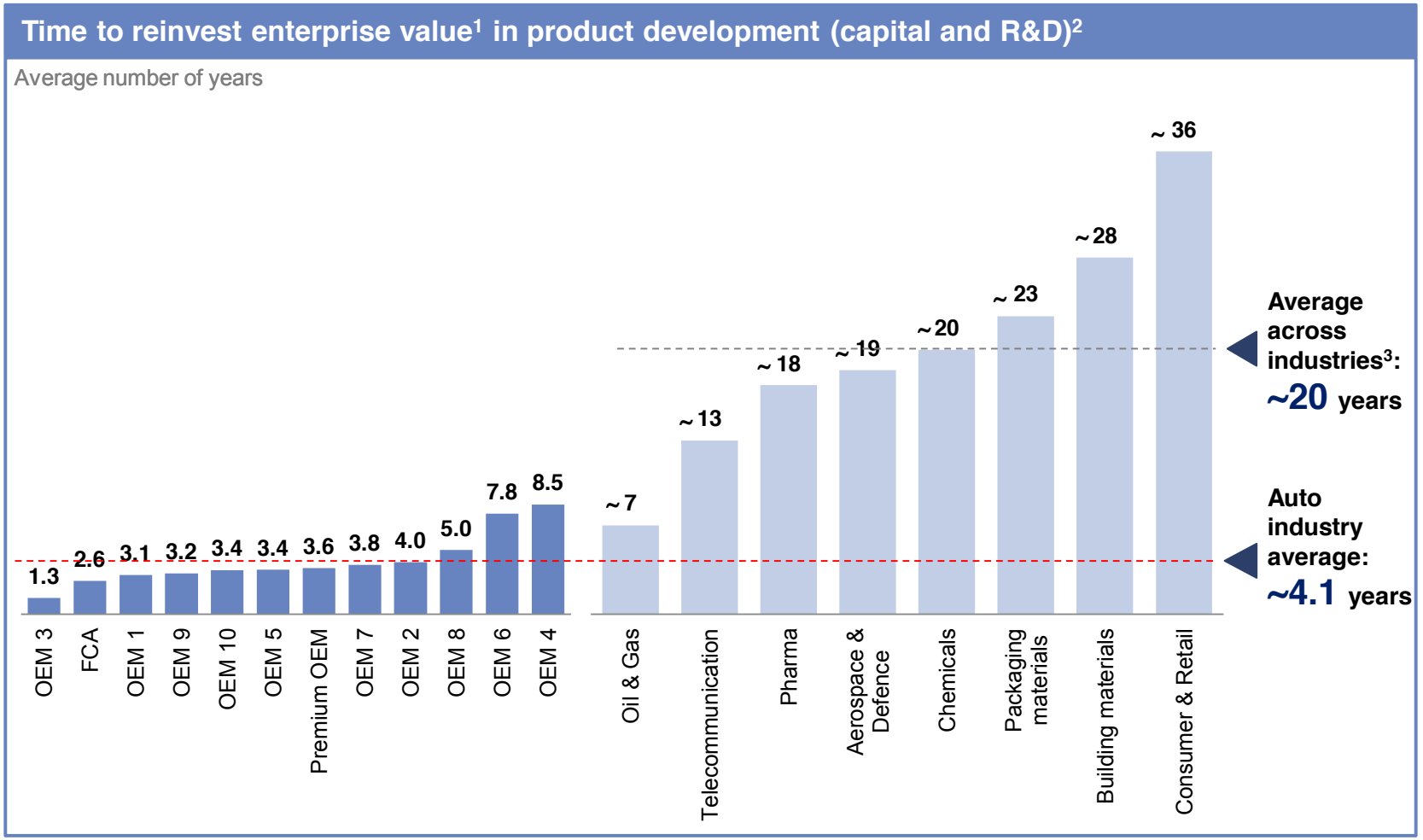
Source ACEA

Focus on OEMs innovation process

Focus on new product development process and OEM's innovation capabilities

- Great investments
- High uncertainty about the market/consumer acceptance
- Long lead times
- High product/technology complexity
- High constraints to NPD (e.g. physical testing needed, safety requirements, pollution regulations, etc.)

NPD costs consume value fast



Source: Company annual reports

1 Industrial activities only. Including pension liabilities
2 Calculated as 3-year average of the annual ratio between enterprise value (for the period 2012–2014) and capital expenditures plus R&D expenses
3 Based on the reference sample

Source, FCA

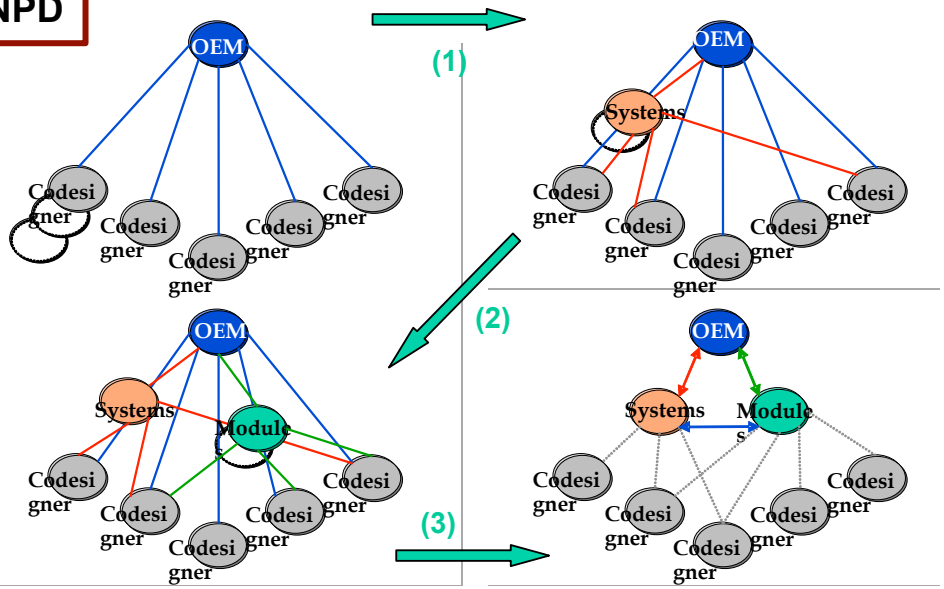
OEMs' struggle to stay profitable…

- Adoption of innovative management solutions:
  - Product platform rationalization and sharing, concurrent engineering, multi project management, suppliers management techniques – e.g. profit sharing, value engineering, etc.

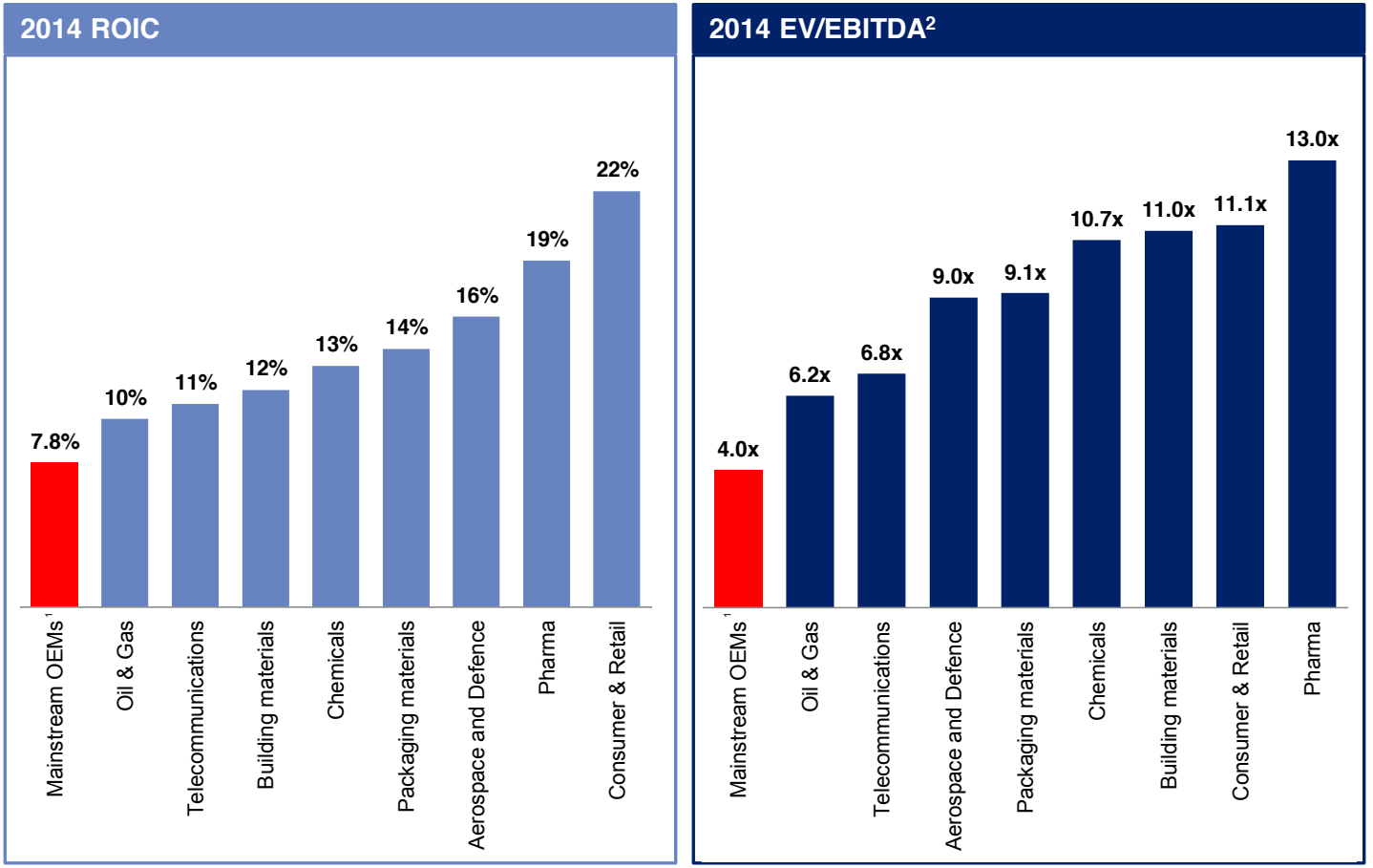
- Reduction of assets and search for economies of scale:
  - Consolidation through merger and acquisitions
  - Outsourcing of components and systems manufacturing (in the '80s) and the also engineering and design (late '80s until now)

Vertical relationships are important

- The innovation processes involved in automotive R&D are:
  - Basic research
  - Components and systems development (7-10 years)
  - **New product development (NPD) (2-3 years)**
- Suppliers perform:
  - Long term components and systems development in order to be able to offer OEMs “shelf innovations”
  - **Components and systems applications for NPD**
  - Components and systems manufacturing



Poor results *vis a vis* other industries



1 Mainstream OEMs include: FCA, Ford, General Motors, Hyundai, Honda, Kia, Nissan, PSA, Renault, Toyota, Volkswagen
2 Based on 2014 average enterprise value for the companies in the reference sample. EV including pension liabilities. EBITDA as per accounting principles adopted by each company

Source, FCA

Structural limits due to a substantial lack of industry standards

Why did these idiosyncrasies arise and how they manifest?

- The **organizational & technological complexity** of NPD forced the OEMs to codify NPD organizational procedures and technical norms
- OEMs have developed over time (before major outsourcing in the industry) **different/incompatible sets of organizational procedures and technical norms** (despite major efforts to foster through consortium and alliances the development of common standards)
- In turn, this has contributed to produce **highly idiosyncratic NPD approaches** and the development of "vertical ecosystems" (e.g. structure of suppliers NPD teams)

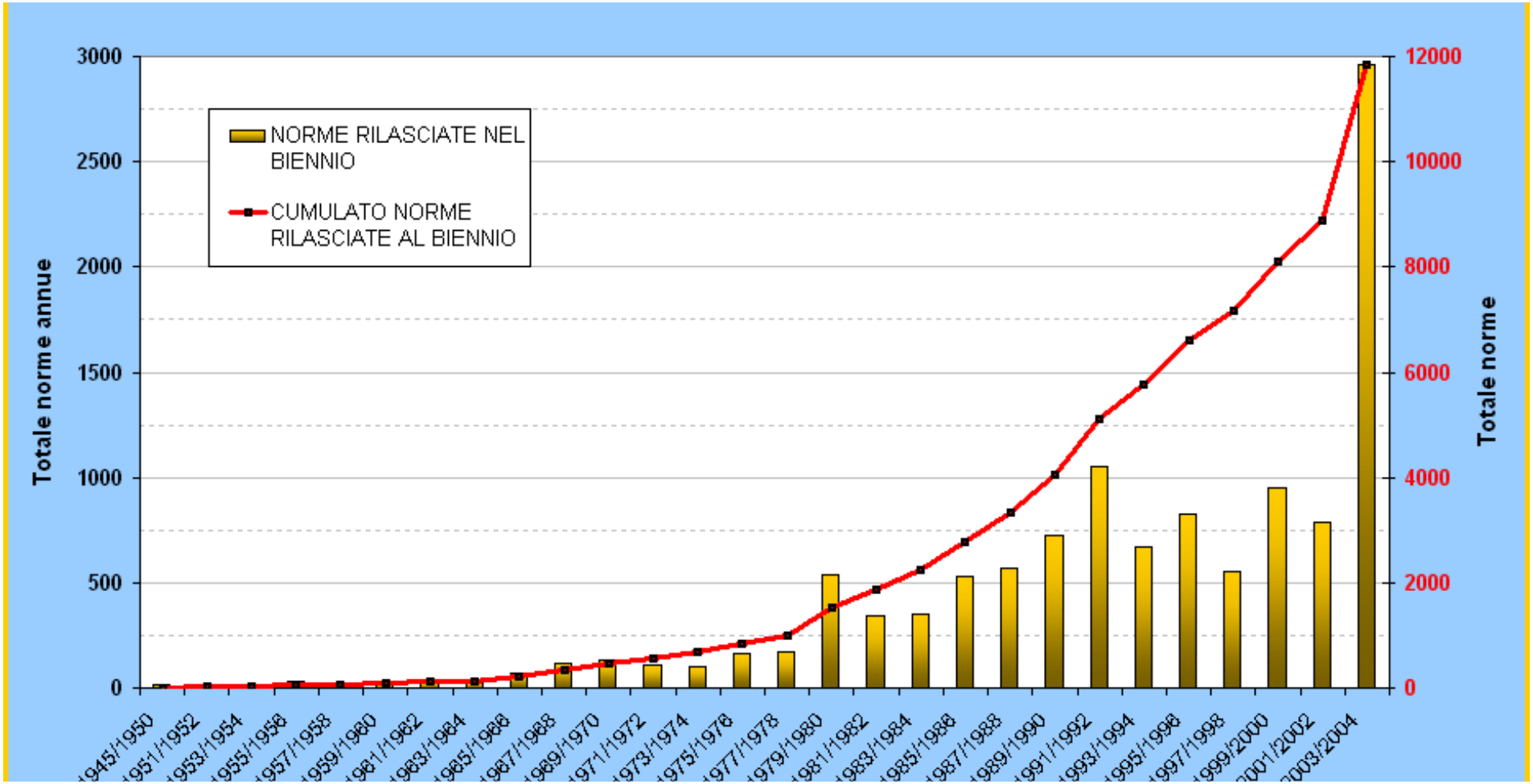
Zooming into organizational complexity in NPD

- OEMs **needed to codify** both **organizational procedures** and **technical norms** in order to cope simultaneously with:
  - competitive pressures on time, cost and quality
  - technological complexity
  - (regulatory responsibility and legal liability)

"The norms are the essence of engineering and design. If a company that develops cars want to list on a stock exchange it has to demonstrate that it has got such body of technical norms. What do you do if you do not have a whole set of norms. Nothing. You cannot buy it on the market. You cannot go and ask the OEM X or the OEM Y to give you their norms and there are no standard technical norms you can use. So what makes a carmaker unique is its set of technical norms" (our interview, 2012)

- On average OEMs have got about 10.000 technical norms!

FIAT's codification of engineering knowledge into norms



Implication for the evolution of product architecture and the industry

Beyond the evident explanation that OEMs still have huge markets to serve (about 90 million cars manufactured in 2015), there are other reasons why OEMs are **reluctant to shift to new business models**:

- **OEMs are trapped** by the "system" they developed to cope with market and technological complexity
- Absent a dominant design **OEMs are reluctant to start altering their products architecture and embark in new *B to B* relationships and/ or business models** given the many interdependences they should cope with and the potential sunk costs
- **Policymakers and governments** are also concerned about a radical change of the actual architecture of the industry

Source of inspiration for management research

- The automotive industry is an exceptional instantiation of (and is anticipating) features common to other settings:
  - The blurring of firms boundaries
    - Different task and knowledge partitioning with same "object" of exchange
    - Multiple/simultaneous types of relationships with same supplier
  - Multiple embedding of intra and inter organizational relationships
  - High complexity, uncertainty and ambiguity

- The industry offers empirical evidence that can inform theory on:
  - Network evolution ("network theory" of the firm)
  - Decision making and strategy implementation
  - Business model adaptation

Thank you!