University-Industry Collaboration – Is It a Real Opportunity?

Ömer Rüştü Ergen
University-Industry Collaboration – Is It a Real Opportunity?
R&D at Ford Otosan

- Developing automotive products, services and technologies
- >1500 engineers
- 3 R&D Centers
- Advanced laboratories and state of the art infrastructure
- 464 Mil. TL annual R&D expense (2016)
- $ 106 Mil. R&D export (2016)
- 178 patent application (2016)
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R&D at Ford Otosan

Automotive Trends
- Platform Modularization
- CO₂ Reduction
- Electrification
- Light-weighting
- Connectivity, IoT
- Big Data
- Autonomous Vehicles
- Supply Chain Integration
- Restructuring Business Models

Major R&D fields at Ford Otosan
- Autonomous Vehicles
- Connected Vehicles
- CO₂ Reduction
- Lightweighting
- Electrified Powertrain and Electrification
Industry and academia research approaches and structures are different as their
• motivation
• constraints (time, budget, effort)
• competition environment
• resources (financial, human, facility)
• targeted outputs
are far more different than it is reflected.

Examples to Collaboration Forms:

- Product development projects
- Technology development projects
- Continuous research programs
- Seed type projects
- Training support by university
- Infrastructure sharing / co-investment
- Curriculam development

Do we really consider the differences?
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R&D Landscape

TRL 1: Basic research. Principles postulated and observed but no experimental proof available.

TRL 2: Technology formulation. Concept and application have been formulated.

TRL 3: Applied research. First laboratory tests completed; proof of concept.

TRL 4: Small scale prototype built in a laboratory environment (“ugly” prototype).

TRL 5: Large scale prototype tested in intended environment.

TRL 6: Prototype system tested in intended environment close to expected performance.

TRL 7: Demonstration system operating in operational environment at pre-commercial scale.

TRL 8: First of a kind commercial system. Manufacturing issues solved.

TRL 9: Full commercial application, technology available for consumers.


Industry is dominantly at the «Product» end, while university is rather on «knowledge» side
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R&D Landscape

- Universities
  - Understanding the physics
  - Fundamental knowledge

- Universities & suppliers
  - Proven concept in view of functionality
  - Technically feasible manufacturing methods
  - Acceptable level of robustness

- Suppliers and partners from industry
  - Proven adoption of technology to automotive
  - Full set of development methodologies and tools
  - Fully developed serial production processes
  - Confirmed technical feasibility and clarified cost and investment level

- Industry
  - Competitive features and products through optimization and design

University collaboration becomes crucial as the project portfolio moves to left
### University-Industry Collaboration – Is It a Real Opportunity? How to Design the Collaboration?

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<tr>
<th>Strategy</th>
<th>Creation/Selection</th>
<th>Structuring</th>
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<tr>
<td>Strong link between tangible needs of company and collaboration topic</td>
<td>Strategic alliance and mutual interest</td>
<td>Boundary spanning managers at industry side</td>
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<td>Long term partnership approach</td>
<td>Mutually developed long term plan</td>
<td>Dedicated teams at both university and industry</td>
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<td>Regular strategic reviews</td>
<td>Effective feasibility phase</td>
<td>Share of roles conforming to differences in motivation, constraints, competition environment resources and goals</td>
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<td>Sound infrastructure plan</td>
<td>Steering committee as an enabler to cross reporting</td>
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## University-Industry Collaboration – Is It a Real Opportunity? How to Design the Collaboration?

<table>
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<tr>
<th>Execution</th>
<th>Funding</th>
<th>IP Ownership</th>
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<tr>
<td>Share company vision</td>
<td>Funding models tailored to form of the collaboration</td>
<td>Fair share of IP complying industry practices</td>
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<tr>
<td>Regular and open communication channels</td>
<td>Joint effort for funding</td>
<td>Agreed IP strategy at the project start, tailored to each individual case/project (avoid frame agreements approach)</td>
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<td>High level of interactivity and knowledge exchange</td>
<td>Utilization of synergies (project packs)</td>
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<td>Maximized incentives</td>
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A test rig where chemical reactions are studied and data for chemical models are extracted for development & controls purposes.

A professor, a post-doc researcher, an M.S. student and a PhD student at University side.

Koç University

Conference Proceedings:
- Transient kinetic modeling and model validation of NH3-SCR and related reactions on Cu-chabazite monolith catalyst, Europacat 2017

Book Chapter:

MSc. Thesis:
- Three-Site Kinetic Model for Selective Catalytic Reduction of NOx with Ammonia over a Commercial Catalyst for Calibration of Aftertreatment Systems in Diesel Powered Heavy Duty Vehicles

Ford Otosan

A chemical model that can help predict the catalyst behavior under different operating conditions and can be used in calibration:
- Optimization of SCR efficiency maps
- FASP optimization
- SCR catalyst size optimization

SGB at Koç University is a successful example for outcomes of «long term planning»
Ford Otosan-SAU Engineering Center

- CAE models
- Digital twins of manufacturing facilities for smart manufacturing
- 3D design and optimization for virtual vehicle prototypes

Established on 18 March 2016

20 Mechanical Engineering students supervised by industry

Sakarya University  Ford Otosan

Industry practice for students  Resource for CAD related tasks of R&D work

Design the collaboration considering «mutual interests»
A heavy duty diesel engine airpath controller development

**Sabancı University**

**Conference Proceedings**

**Journal Papers (work in progress)**
- Journals papers based on novel approaches are being prepared
- Real engine application of simulation tested novel methods
- Decreasing product development time with machine learning approaches

**Ph.D. Thessies (work in progress)**

**Ford Otosan**

In-house control algorithm directly applicable to product yielding flexibility in hardware selection

One thesis – one project
Collaboration with universities is crucial for fundamental and applied research fields.

Strategic alliance and mutual interest is a key.

Industry should consider the differences in motivation, constraints, resources and goals.

IP issues should not restrain the best effort of partners.

Successful university-industry collaboration is a must for the industry in the era of knowledge economy.