

**Second Phase of Cross-Ministerial Strategic Innovation
Promotion Program**
— Innovation of Automated Driving for Universal Services
(SIP-adus)



**Basic Study in Promotion of Joint
Research on Automated Driving with
Overseas Research Institutions**

Report (Summary)

February 2019

Mobility Innovation Cooperative Research Organization,
The University of Tokyo



Background to study and objectives



- In response to the invitations that Japan has received from Germany, the EU and other countries to conduct joint research, the following activities will be conducted as part of this study:
 - Formation of a liaison conference to promote domestic academic-academic cooperation and help increase the number of academies pursuing automated driving research, in order to promote the establishment of international joint research projects
 - Liaison with domestic research institutions while acting as an go-between for overseas research institutions regarding topics for which cooperation is possible; also liaison regarding the framework for cooperation and assistance in formulating candidate topics for joint research



Study content



- 1. Create a venue for academic-academic cooperation in order to study the promotion of international joint research by academies**
 - ① Establish liaison conference
 - ② Hold liaison conference meetings
 - ③ Determine actual matters for research & development / examples of demonstration tests at universities and research institutions in Japan
 - ④ Study ways to develop into a sustainable organization
- 2. Search for opportunities for international joint research on automated driving by Japan-Germany, Japan-EU etc. and study cooperation schemes**
 - ⑤ Determine locations overseas where academic-academic cooperation appears to be underway and study the implementation status of projects in Germany, the EU etc.
 - ⑥ By means of international conferences, seek potential candidates for cooperative research and gather information on research and development trends, etc.
 - ⑦ Coordinate candidate liaison personnel on both sides and specific candidate topics for cooperation
 - ⑧ Coordinate candidate research institutions and researchers for each specific topic
 - ⑨ Study methods of cooperation, such as joint research, exchange of research information, joint workshops, dispatch of researchers etc.



- 1. Create a venue for academic-academic cooperation in order to study the promotion of international joint research by academies**



Establish a liaison conference to promote mobility innovation



- In October 2018, a Mobility Innovation Liaison Conference was established to serve as the liaison for international cooperation.
- Participating members cover a wide variety of fields:
 - 12 universities and 13 centers and groups conducting research into automated driving
 - Key persons in the field of engineering as well as IT, cybersecurity, mechanical dynamics control, urban planning, technology management, criminal law, civil law, education, public economy, culture and humanities etc.
 - National Research and Development Corporations etc.



Mobility Innovation Liaison Conference members



- As of February 2019. Membership will also be expanded in the future.

Mobility Innovation Liaison Council (Chair: Yoshihiro Suda)
• Automated Driving Unit, Future Science Creation Research Core Institute for Frontier Science Initiative, Kanazawa University
• Comprehensive Research Center for Automated Driving and Driving Safety Support Kyushu Institute of Technology
• Center for Research on Adoption of NextGen Transportation Systems, Organization to Promote Research and University-Industry Collaboration, Gunma University
• Mobility Culture Research Center, Keio University
• Center for Artificial Intelligence Research, University of Tsukuba
• Advanced Mobility Research Center (ITS Center), Institute of Industrial Science, The University of Tokyo
• Smart Mobility Research Center, Tokyo University of Agriculture and Technology
• New Industry Creation Hatchery Center, Tohoku University
• Institute for Technology, Enterprise and Competitiveness, Doshisha University
• Mobility Research Center, Doshisha University
• Green Mobility Research Institute, Institutes of Innovation for Future Society, Nagoya University
• Center for Automotive Research, Institute of Industrial Technology, Nihon University
• Automated Driving Society Comprehensive Research Center, Meiji University

Advisory Committee on the Effect of Automated Driving Systems on Society (Chair: Takashi Oguchi)*
• Hosei University Associate Professor Masato Itohisa (Technology Management)
• Hosei University Professor Takeyoshi Imai (Criminal Law)
• Keio University Associate Professor Keisuke Uehara (IT)
• The University of Tokyo Professor Shusuke Kakiuchi (Civil Law)
• The University of Tokyo Associate Professor Yuto Kitamura (Education)
• Nagoya University Visiting Associate Professor Ryo Kurachi (Cybersecurity)
• Ritsumeikan University Associate Professor Yasuhiro Shiomi (Traffic Engineering)
• Yokohama City University Professor Akihiro Nakamura (Public Economics)
• Tokyo University of Agriculture Associate Professor Pongsathorn Raksincharoensak (Mechanic Dynamics Control)
• Waseda University Professor Akinori Morimoto (Urban Planning)
• Osaka University Associate Professor Goro Yamazaki (Cultural anthropology)

* Not including experts in organizations participating in the Mobility Innovation Liaison Council.

National Research and Development Corporations, etc.
• National Institute of Advanced Industrial Science and Technology (AIST)
• Japan Automobile Research Institute (JARI)
• National Traffic Safety and Environment Laboratory (NTSEL)
• RIKEN



Mobility Innovation Liaison Conference



- The Liaison Conference met three times during this fiscal year, as shown below. Liaison conference meetings were held in between international meetings and conferences.
[ITS World Congress 2018 @ Copenhagen, Japanese-Germany Expert Workshop: September]
- **1st meeting (10/29)**
 - Information relating to Japan-Germany and Japan-EU was provided, based on international meetings and conferences.
 - Research information relating to automated driving at participant organizations, etc. was compiled.
[SIP-adus Workshop 2018, EU-US-Japan Trilateral Automation in Road Transport WG (@Tokyo): November]
- **2nd meeting (December 14)**
 - Information was provided on Japanese-German cooperation and Japanese-EU cooperation, based on international meetings and conferences.
 - Report on the status of information-gathering by key figures, etc. on automated driving research in Japan, Germany and the EU
[Transportation Research Board 2019 (@ Washington D. C.): January]
- **3rd meeting (February 8)**
 - Information was provided on Japanese-German cooperation and Japanese-EU cooperation, based on international meetings and conferences.
 - Organizations for industry-government-academic cooperation in Germany, the United States etc.
 - Summary of information provided at the 2nd meeting of the Liaison Conference



Study of the status of automated driving research & development at universities and research institutions in Japan

- Study and organization via members of the Mobility Innovation Liaison Conference
- Research topics, researchers involved, R&D matters and R&D progress
- Preparation of researcher list (fields of specialty, nature of research etc.)

➔ List of around **180** persons

各組織、研究センター等での自動運転にかかわる活動内容（一覧表）

組織名	① 研究テーマ	② 関連する研究内容	③ 研究開発事項とその進捗状況	④ 実用化の状況	⑤ 国際共同研究の実施状況	⑥ 国際共同研究の形式
東京大学 総合研究機構 先進技術研究センター	自律走行可能な自動運転ロボットの開発・応用実証	新学術研究機構 先進技術研究センター	○自動車自動運転の基礎的技術の開発 ○システム構築技術の開発 ○実証試験の実施 ○自己位置特定技術の開発	○実用化の状況 ○システム構築技術の開発 ○実証試験の実施 ○自己位置特定技術の開発	○国際共同研究の実施状況	○国際共同研究の形式
東京大学 工学系研究科 先進技術研究センター	自律走行可能な自動運転ロボットの開発・応用実証	新学術研究機構 先進技術研究センター	○自動車自動運転の基礎的技術の開発 ○システム構築技術の開発 ○実証試験の実施 ○自己位置特定技術の開発	○実用化の状況 ○システム構築技術の開発 ○実証試験の実施 ○自己位置特定技術の開発	○国際共同研究の実施状況	○国際共同研究の形式
東京大学 工学系研究科 先進技術研究センター	自律走行可能な自動運転ロボットの開発・応用実証	新学術研究機構 先進技術研究センター	○自動車自動運転の基礎的技術の開発 ○システム構築技術の開発 ○実証試験の実施 ○自己位置特定技術の開発	○実用化の状況 ○システム構築技術の開発 ○実証試験の実施 ○自己位置特定技術の開発	○国際共同研究の実施状況	○国際共同研究の形式

NO.	氏名	所属・職名	分野/分科/科目	連絡先(メールアドレス)	研究キーワード	研究テーマ(自動運転に関連した内容)	その他参考情報(URL等)
1	山口 敬	東京大学産学技術研究所次世代モビリティ研究センター センター長	工学/土木工学		道路ネットワーク	・車路連携のためのACCモデリング ・マルチボイスダイナミクスによる車路の最適化	http://www.transport.its.u-tokyo.ac.jp/
2	須田 義大	東京大学産学技術研究所次世代モビリティ研究センター 教授	工学/機械工学		車路連携	・V2X通信技術	http://www.mozumi.its.u-tokyo.ac.jp/
3	中野 公彦	東京大学大学院情報学環 准教授 (東京大学産学技術研究所次世代モビリティ研究センター)	工学/機械工学 /機械力学・制御		車路、制御、力学	・ADAS用ニューマンシーティングシステム ・自動運転	http://www.knakanob.its.u-tokyo.ac.jp/
4	大石 由史	東京大学産学技術研究所次世代モビリティ研究センター 准教授 (東京大学モビリティイノベーション連携研究機構 准教授)	工学系/人間情報学/知能ロボティクス		認知・認知心理学	・大規模空間の三次元デジタル化 ・ニューメディアの活用による空間認識 ・車路連携技術の開発	http://www.ovl.its.u-tokyo.ac.jp/
5	坂井 康一	東京大学産学技術研究所次世代モビリティ研究センター 准教授 (東京大学モビリティイノベーション連携研究機構 准教授)	工学/土木工学 /土木計画学/交通工学		交通流理論、交通流シミュレーション	・自動運転サービスの社会的インパクト ・ニューメディアの活用による空間認識 ・車路連携技術の開発	http://www.its.u-tokyo.ac.jp/
6	小野 晋太郎	東京大学産学技術研究所次世代モビリティ研究センター 特任准教授	情報学/人間情報学/知覚情報処理		画像処理、センシング	・道路空間における各種車、指示・行動の予測 ・道路空間の形状における車路の予測 ・道路空間の形状	http://www.its.u-tokyo.ac.jp/
7	沢田 康	客員教授					
8	平沢 隆之	東京大学産学技術研究所次世代モビリティ研究センター 助教 (東京大学モビリティイノベーション連携研究機構 専任准教授)	工学/デザイン工学/サービス工学		特性評価、交通シミュレーション	・ITSサービスの設計 ・次世代交通サービス ・ITSサービス設計	http://www.its.u-tokyo.ac.jp/
9	貝塚 尚	東京大学産学技術研究所次世代モビリティ研究センター 助教 (東京大学モビリティイノベーション連携研究機構 助教)	工学/機械工学/機械力学・制御		車路連携、車路連携	・力覚制御技術 ・ADAS用ニューマンシーティングシステム ・自動運転 ・車路連携技術	http://www.knakanob.its.u-tokyo.ac.jp/
10	結田 太郎	東京大学産学技術研究所次世代モビリティ研究センター 助教 (東京大学モビリティイノベーション連携研究機構 助教)	工学/土木工学 /土木計画学/交通工学		交通流理論、交通流シミュレーション	・道路空間における各種車、指示・行動の予測 ・道路空間の形状における車路の予測 ・道路空間の形状	http://www.its.u-tokyo.ac.jp/
11	辻 世明	特任助教					
12	野 健	東京大学産学技術研究所次世代モビリティ研究センター 特任研究員	工学/人間工学		人間工学、生体計測	・生体情報に基づくドライバー/ランチャージャー ・ドライバー状態評価に基づく車内環境デザイン ・自動運転に関する実証評価	http://www.its.u-tokyo.ac.jp/
13	河野 賢司	東京大学産学技術研究所次世代モビリティ研究センター 特任研究員	工学/電気・電子工学		センシング	・画像処理技術による車路情報	http://www.its.u-tokyo.ac.jp/



Study of ways to develop into a sustainable organization

- The following table shows the special characteristics of research associations, academic societies (incorporated associations) and NPOs.



	Research Association	Academic society (incorporated association)	Non-profit Organization (NPO)
Method of establishment	Approved by the competent minister + registered	Registered only	Approved by competent authority + registered
Time required for establishment	N/A	Around 2 weeks	4 - 6 months
Funds at time of establishment	None	None	None
Ability to receive outside funds	Yes (There are plans to enable technical research associations to accept subsidies. In general, they collect levied payments from association members and use these funds.)	Yes (Academic societies conduct research study projects using outside funds. In general, they also collect membership dues from society members and use these funds.)	Yes (Basically, this is possible, as NPOs have corporate status.)
Personnel recruitment	Personnel from each member organization participate (no need for loan of employees). They can also secure researchers by contributing research costs to universities.	Secured as academic society members (student members and general members).	Secured as members (from individual companies and universities).
Continuity	Dissolved once the objective has been achieved (however, in some cases a second term is considered)	Active on a semi-permanent basis	Active on a semi-permanent basis



2. Search for opportunities for international joint research on automated driving by Japan-Germany, Japan-EU etc. and study of cooperation schemes





Japanese-German cooperation

- Background

- Activities based on the Joint Declaration of Intent on Japanese – German Cooperation on the Promotion of Research and Development on Automated Driving Technologies (signed January 12, 2017) for promoting research and development of automated driving technologies.
- In November 2017, the first Japanese-German Expert Workshop was held, timed to coincide at the time of the SIP-adus Workshop (@Tokyo).
- The areas and topics for cooperation should be finalized and cooperative activities should be pursued.



2nd Japanese-German Expert Workshop



- Date and time: September 17, 2018 12:00 - 3:45 p.m.
- Venue: Crowne Plaza Copenhagen Towers Meeting Room “Lake Geneva”
- Participants:
 - Germany: Mr. Zielonka, Federal Ministry of Education and Research (BMBF), experts from individual fields, etc.
 - Japan: Cabinet Office (Kuzumaki PD, Koga Planning Officer etc.), Assistant Chief Investigator of International Cooperation Working Group, liaison expert for international cooperation topics, Japanese Embassy in Germany, National Police Agency, Ministry of Economy, Trade and Industry, project outsourcee (The University of Tokyo) etc.
- Purpose of workshop
 - Share with the German side the target domain candidates and the tentative schedule up to the start of joint research
 - Propose a structure for Japanese-German cooperation, including liaison officers etc.
 - Introduce the content of topics of interest to Japan and Germany and enable experts on both sides to get acquainted with one another etc.





2nd Japanese-German Expert Workshop

- Proposal for structure of Japanese-German cooperation including liaison and other personnel.
 - The following structure was proposed.

Structure of Japanese-German Research Co-operation (Proposal)



2nd Japanese-German Expert Workshop



- Proposed roles in Japanese-German cooperation structure
 - Steering Committee (SC)
 - Decision-making body for Japanese-German cooperation. Made up of Cabinet Office, BMBF and other government agencies.
 - Venue for discussion and decision-making with regard to specific cooperation areas and resources (funding, personnel etc.)
 - Coordinating Secretariat (CS)
 - Coordinating organization for content of cooperation, made up of experts.
 - Proposes specific cooperation content, etc. to the SC and also coordinates among experts.
 - Expert Workshop (EW)
 - Forum for communication among experts.
 - Research Team (RT)
 - Composition dependent on areas (topics) decided by the SC





2nd Japanese-German Expert Workshop

- Results of discussions at Japanese-German Expert Workshops (in September 2018) in 4 areas of cooperation
 - **Human Factor**
 - There were spirited discussions among experts. Further expert discussions will be pursued in order to develop specific proposals for joint research.
 - **Socioeconomic Impact**
 - Progress was made on identifying experts to be in charge. From this point on, discussions among experts will be promoted and studies will be pursued to determine whether there is specific content for which joint research can be conducted.
 - **Validation, Modeling, Simulation**
 - From this point on, experts to be in charge on the Japan side will be identified, and discussions among experts will be pursued to determine whether there is specific content for which joint research can be conducted.
 - **Cybersecurity**
 - From this point on, experts to be in charge will be identified, and discussions among experts will be pursued to determine whether there is specific content for which joint research can be conducted.



Coordination of specific candidate topics for cooperation



- Determination of content of German proposals (November 2018) in 4 areas of cooperation
 - **Human Factor**
 - Collaboration on Intended use and successful interaction as basis for automated driving
 - **Socio-economic Impact**
 - Diffusion of Connected and Automated Driving in a Future Vehicle Stock
 - Societal Acceptance of Automated Driving Explored
 - **Validation, Modeling, Simulation**
 - Cross-Cultural High Performance Digital Reality for Autonomous Driving
 - Virtual Validation Tool Chain for Automated and Connected Driving
 - **Cybersecurity**
 - Security for Connected & Automated Cars in a Joint Approach with Japan Expertise



Coordination of specific candidate topics for cooperation



- Proposed Japanese-German joint research topics (December 2018)
 - **Human Factor**
 - *ICHAT* (International Collaboration on Human factors in Automated Driving)
 - **Socio-economic Impact**
 - *DICADES* (Diffusion of Connected and Automated Driving in a Future Vehicle Stock)
 - *SACCADE* (Societal Acceptance of Automated Driving Explored)





Coordination of specific candidate topics for cooperation

- Proposed projects for Japanese-German joint research (Human Factor, Socio-economic Impact) were evaluated and coordinated by the Japanese-German Coordinating Secretariat.
- The proposals were evaluated by the Steering Committee and the above topics for cooperative research were finalized (on January 31, 2019).
 - Condition: Socio-economic Impact proposals must be integrated into a single project.

The image shows two pages of an evaluation sheet. The top page is titled 'JAPANESE-GERMAN RESEARCH CO-OPERATION ON CONNECTED AND AUTOMATED DRIVING' and includes a table for 'Evaluation of collaboration projects'. The table has columns for 'Title', 'Research area', 'German evaluator', 'Japanese evaluator', 'Collaboration partners', and 'Overall costs'. Below the table are sections for 'Short summary of collaboration project', 'Short summary to be included here', 'Evaluation points', and 'Approval criteria'. The bottom page is a continuation of the form, showing a table for 'German research project' and 'Collaboration work packages'.

▲ Evaluation sheet



Japanese-EU cooperation



● Background

- Horizon 2020, which is being promoted by the European Commission, recommends that international cooperation be conducted with the United States, countries in Asia and Oceania and so on.
 - Applications from research institutions and companies outside the EU are encouraged (bottom-up).
 - Cooperation among governments providing financial assistance is encouraged (top-down).
- In cooperation between governments:
 - The EU has conducted twinning research with the U. S. Department of Transportation in the past.
 - The EU seeks to conduct twinning research with Japan in the area of automated driving.
- [Reference] The following three frameworks have been established by the EC for collaboration with countries outside the EU.
 - **Joint call**: Both sides consult with one another from the start to promote open proposal projects.
 - **Co-funding**: Both sides agree in advance to provide individual budgets to participants.
 - **Twinning**: Backup. Each side establishes its own project. In general, this does not involve budgetary support.

Japanese-EU meeting at the SIP-adus Workshop

- Date and time: November 13, 2018 (Tuesday) 1:00 - 2:00 p.m.
- Venue: Tokyo International Exchange Center 5F VIP Room 2
- Participants
 - Europe: European Commission DG-RTD Director etc., Delegation of the EU to Japan, ERTICO
 - Japan: Cabinet Office (Kuzumaki PD, Koga Planning Officer etc.), SIP-adus International Cooperation Working Group: Chief Investigator Amano, Assistant Chief Investigator Uchimura, project outsourcee (The University of Tokyo)
- Main topics of discussion
 - Exchange of letters
 - Cooperation areas and content
 - Future schedule



Specific candidate projects for cooperative research

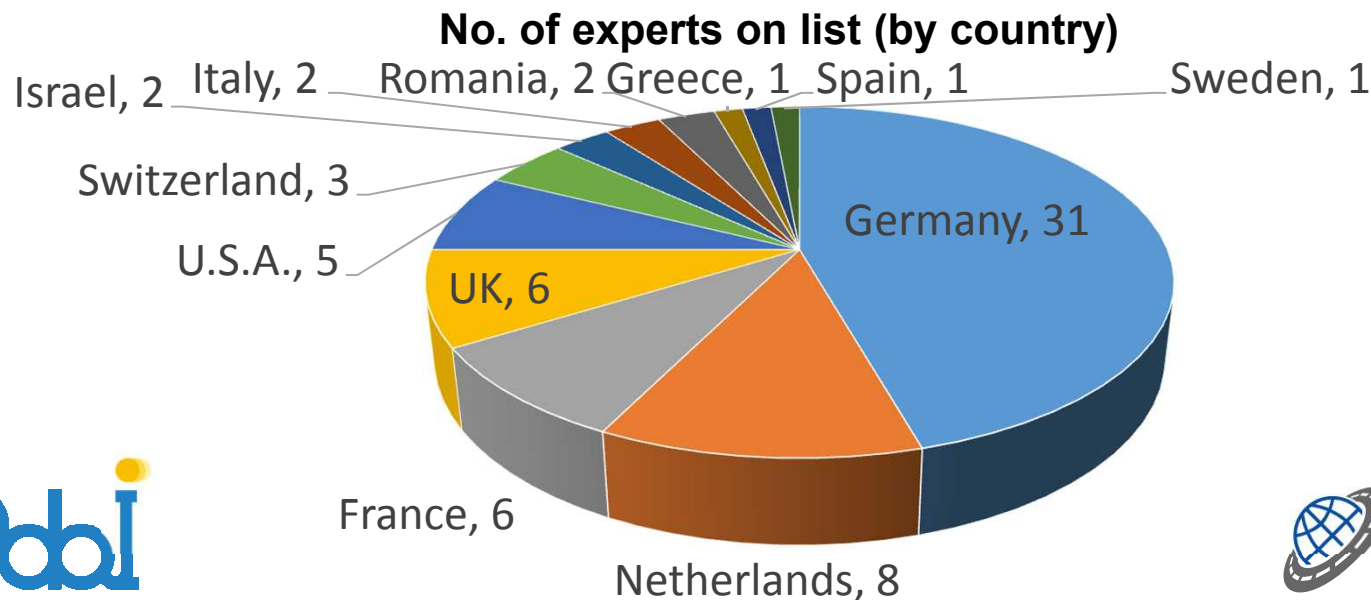


- H2020 Call 2018-2020 Digitising and Transforming European Industry and Services: Automated Road Transport (DT-ART)
 - **Deadline for proposal: April 4, 2018**
 - DT-ART-01-2018: **Testing, validation and certification procedures** for highly automated driving functions under various traffic scenarios based on pilot test data
 - DT-ART-02-2018: **Support for networking** activities and **impact assessment** for road automation
 - **Reference is made to twinning with the U. S. Department of Transportation.**
 - **Deadline for proposal : April 25, 2019**
 - DT-ART-03-2019: **Human centered design** for the new driver role in highly automated vehicles
 - DT-ART-04-2019: Developing and testing **shared, connected and cooperative automated vehicle fleets** in urban areas for the mobility of all
 - **Reference is made to twinning not only with the U. S. Department of Transportation but also with Japan.**
 - **Deadline for proposal : April 2020 (anticipated)**
 - DT-ART-05-2020: Efficient and safe connected and automated **heavy-duty vehicles in real logistics operations**
 - DT-ART-06-2020: **Large-scale, cross-border demonstration** of highly automated driving functions for passenger cars

Search for candidates for cooperative research with Germany, the EU etc. and gathering of information on research and development trends, etc.



- Studied and organized via the members of the Mobility Innovation Liaison Conference
 - Preparation of a list of researchers at research institutions in Germany and the EU, fields of specialty, matters of interest etc.
 - ➔ List contains more than 70 names, primarily from Germany
 - As the list includes information that can be accessed by individuals, careful study is needed regarding handling.



Acatech (German Academy of Science and Engineering)



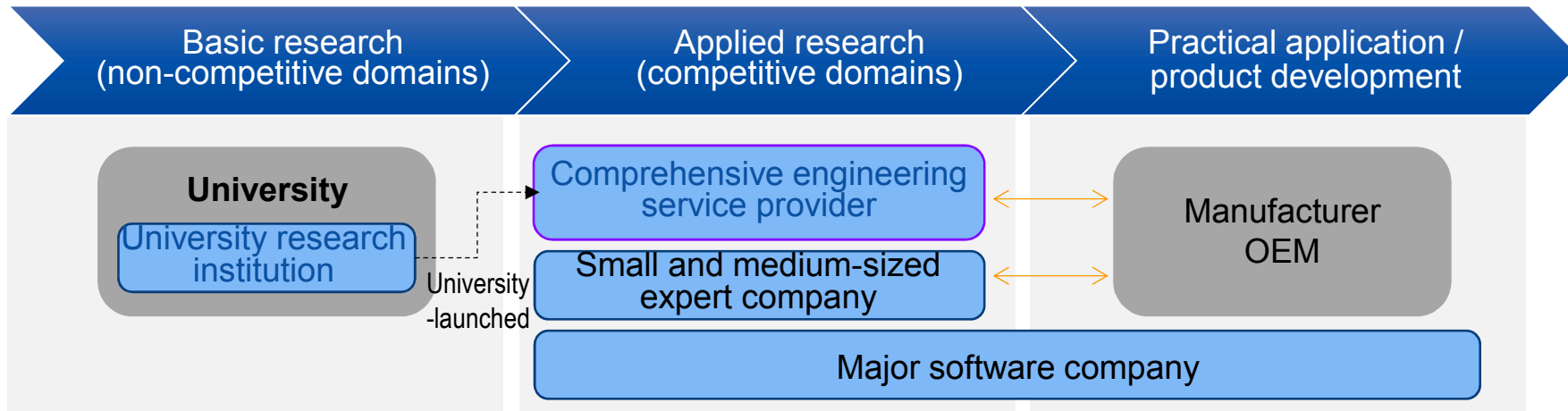
- Acatech was established in 2008 as an independent nonprofit organization to represent the interests of German science and technology both at home and abroad. It is an organization for official industry-academic cooperation in all areas of German industry and science technology.
- Acatech supports policymakers and German society through technical assessments by experts and forward-looking proposals.
- Some 380 researchers with an outstanding record of achievement serve as members. Researchers must demonstrate achievement in research in order to become
- ~~members~~ members are selected from the business community and scientific organizations. There are two chairpersons.
- Industry 4.0, promoted by Acatech, has been adopted as a national project with the participation of major companies, research institutions, engineering colleges and industry organizations.
- In Germany's electric vehicle standardization program, Acatech members play a coordinating role with various standardization organizations.



Industry-academic liaison in Germany (example)



- Comprehensive engineering service providers work in cooperation with university research institutions to develop business projects.



- VKA, the internal combustion engine laboratory at RWTH Aachen University, is an example of a university research institution. FEV is an example of a comprehensive engineering service provider launched by RWTH Aachen University.
- Professor Franz Pischinger, a principal member of Acatech, is a top manager at VKA.

Organization name	Size	Description
FEV	No. of employees: 4,000	Engineering service provider launched by RWTH Aachen University
VKA	Scientific Employees : 80 Non-Scientific Employees : 108	Internal combustion engine laboratory at RWTH Aachen University



Example of overseas industry-government-academic cooperation



- U. S. Transportation Research Board (TRB)
 - One of the seven main departments of the National Academy of Sciences
 - Throughout the year, more than 7,000 engineers, scientists, transportation researchers and businesspersons from the public sector, private sector and academic world participate in TRB committees, panels, etc.
 - The three missions of the TRB are Research, Convene and Advise.





Study of cooperation methods such as joint research, exchange of research information, joint workshops, researcher dispatch etc.

- Study of cooperation methods by means of Japanese-German and Japan-EU cooperative activities

Japanese Japanese-
-German EU

