

German-French Academy for the Industry of the Future

Joint initiative of
Technical University of Munich (TUM)
and Institut Mines-Télécom (IMT)

November 2017



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Editorials



Professor Philippe Jamet
Photo: IMT

Industry for the Future and the digitalization of economy, is about opportunities, disruptions, and risks. It calls for trespassing new technological frontiers, addressing new skills, imagining new pathways for competitiveness, social development and personal achievement.

Germany and France have a long standing history of innovation and economic development. Both countries have experienced the successive milestones of industrial revolutions, and progress. This legacy provides strong foundations to achieve a European leadership inside the fast developing Industry 4.0 context.

As leading higher education, research and technology institutions in their countries, Technical University of Munich (TUM) and Institut Mines-Télécom (IMT) recognize the importance of the challenges linked to the Industry of the Future. Addressing them adequately, and providing innovative responses is a matter of urgency. This put a special emphasis on the new paradigms, technologies, and business models incurred by the pervasiveness of digitalization in industries, services, and markets.

The German-French Academy for the Industry of the Future, a joint initiative of TUM and IMT launched

in 2015, aims at jumpstarting a broader academic effort dedicated to these new challenges. Building jointly the Industry of the Future is also about crafting the University of the Future. We, TUM and IMT, are committed to both goals. For a strong economic and academic Europe, and for a better world.



Professor Philippe Jamet
Executive President of Institut Mines-Télécom



Professor Wolfgang A. Herrmann
Photo: Astrid Eckert/TUM

We are in a new area of the digital transformation of business models, production processes, resource optimization and new forms of customer acquisition. This entails a complete re-think and a departure from previous working methods and conditions, especially in the field of technical engineering.

Digitalization allows engineers exciting new possibilities, but also requires new forms of training. France and Germany are truly proud of their engineering excellence, which is the result of world-class higher education. In order to remain successful, universities must train experienced engineers on -the -job as well as create a new generation of engineers with skills in Industrie 4.0 technologies.

During the last German-French Digital Conference in autumn 2015, the French and German Governments proposed a binational set-up to tackle the challenges of digital transformation in respect of its impact on higher education and research in both countries. Based on these terms of reference, the Institut Mines-Télécom (IMT) and Technical University of Munich (TUM) brought together their excellent scientists and competences with a view to establishing a joint German-French Academy for the Industry of the Future. Within this framework, research tandems from various departments

were formed on strategic research and education areas. Some core activities and projects are already well advanced, others are currently being defined or will be developed in close interaction with industry. This IMT – TUM brochure provides a first glance at the manifold projects and ideas of our faculty.

The IMT and TUM initiative is the ideal basis to foster collaborative research and education to tackle the transformation to Industrie 4.0 and to prepare our countries successfully for the “fourth industrial revolution”.

Digitalization will shape the 21st century. IMT and TUM are ready to face the challenges of the future.

Professor Wolfgang A. Herrmann
President, Technical University of Munich

Summary



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“The digitalization of industry and services is a challenge to European economy.”

Mission statement

A strategic European perspective

In the past two decades, digital technologies have opened new opportunities for growth and competitiveness and many challenges have already been identified by early, disruptive, and successful market stakeholders.

The digitalization of industry and services is a challenge to European economy, but it represents also an opportunity to recover and reinforce its global, innovation-based competitiveness.

In order to be addressed, these opportunities call for an in-depth adaptation of companies, in a relative short time frame. This means making a portfolio of new technologies and methods available to companies, and updating vocational and managerial skills at every qualification level.

Cross-disciplinary issues (e.g. security of processes and infrastructures, business ethics, etc.) are pervasive into the digitalization of economy. Regulations are needed to provide a safe framework for the tools and mechanisms of the Industry of the Future.

The Industry of the Future is a question of radical and fast-paced mutations that will build on profound breaking points in current business models and industry paradigms. Europe must be at the forefront of these transformations and build its leadership on the values it has always been promoting, such as humanism and social inclusiveness.

In pursuing this ambition and addressing these challenges, the academic institutions are natural partners for the socio-economic stakeholders, from their research potential to create new knowledge to their training capacities through innovative methods and lifelong training strategies.

Universities also represent privileged venues to elaborate a holistic approach of the transition towards the Industry of the Future, in complement to more segmented and technological approaches. They are also in a good position to provide prospective thinking and strategic foresight, as well as new creation and innovation pathways.

As for other European strategic questions, French-German cooperation is a very strong basis to create a productive momentum. Both countries are major industrial powers of continental Europe. They share the same vision about the relationship between industry and academia. Technical University Munich (TUM) and Institut Mines-Télécom (IMT) have strongly invested on oriented research and transfer of its results, on training scientists and engineers and they both give a high-level of priority on vocational skills issues.

Vision

The ambition of the German-French Academy for the Industry of the Future is to achieve leadership in building the European research, training, and innovation excellence dedicated to the Industry of the Future. Starting with the complementarities of the initial partners, TUM and IMT, the Academy will be extended to other academic and industrial partners of both countries in a later stage.

The objective is to form the backbone of a European-wide network of excellence. This virtual Academy will involve a high-level scientific and teaching community, and will interact with industrial companies, through a specific partnership allowing for joint construction and development of research and teaching programs.

A roadmap, organized along transversal, binational projects sustained by public and private funding sources, streamlines the organization of this community. They will address jointly the key emerging research topics raised by the cross-disciplinary area that represents the Industry of the Future.

Digitalization is a structuring concept for the Industry of the Future. It opens a wide spectrum of scientific and training dimensions, such as design, production, supply chain, servitization, and human factors among others. The digitalization of the economy and the industrial processes are central to the German-French Academy roadmap.

The Academy will also represent a resource to inspire competitive national and European programs dedicated to foster research and development related to the Industry of the Future (such as joint research projects using competitive national, bilateral or European funding programs).

Last, the Academy aims to provide new and innovative forms of cooperation in higher education and research such as:

- industrial transnational chairs on key research topics, selected to express the full potential of the complementarities of the two partners,
- a portfolio of continuing and lifelong training modules, to provide realtime, up-to-date tutorials to companies of selected keysectors strongly impacted by digitalization. This offer will be supported by a library of MOOCs (Massive Open Online Courses), and a network of platforms, and open-innovation venues (e.g. Fablabs, learning labs, innovation labs),
- programs dedicated to start-ups, supported by a network of incubators,
- joint technological platforms.



(l. to r.) Prof. Wolfgang A. Herrmann (TUM),
Prof. Philippe Jamet (IMT)
Photo: Heddergott/TUM



Signature of the joint TUM-IMT declaration (December 15, 2015)

(l to r): Prof. Hana Milanov (TUM), Prof. Francis Jutand (IMT), Prof. Wolfgang A. Herrmann (TUM), Prof. Christian Roux (IMT), Prof. Philippe Jamet (IMT), Dr. Andreas Gördeler (BMW), Dr. Hannemor Keidel (TUM), Emmanuel Caquot (MEIN), Jean-Jacques Pierrat (French Embassy), Photo: Heddergott/TUM

Executive summary

In a first stage, the work has focused on the scope of digitalization of the industry, following the approach of the German Industry 4.0 platform. In a later stage, other topics relevant to the Industry of the Future will be addressed, namely, additive manufacturing, innovative materials and energy efficacy.

Within this framework, a workshop held in March 2016 selected five major research areas: Global industrial data, Secure industry, Sensors and Internet of Things, Human factors in human-machine interactions, and Digital transformation in industry. Researchers from both institutions have worked together in tandems to define specific research projects that are presented in the following section.

On the training side, the creation of two summer schools is proposed in the next section. It is proposed to develop series of online courses designed to provide deep learning and advance career on topics relevant to the digitalization of the economy.

The following project summary contains only a brief description of each project. Detailed project descriptions can be requested. For all questions regarding the German-French Academy for the Industry of the Future, please contact the members of the scientific committee.

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“Digitalization will shape the 21th century. IMT and TUM are ready to face the challenges of the future.”

Projects

Hybrid Blockchain Architectures for the Industry of the Future (HyBlockArch)

Key words/Application Areas

Blockchain Technologies, Industry 4.0,
Energy Management, Security

TUM Principal Investigator

Prof. Dr. Georg Carle,
Chair of Network Architectures and Services

IMT Principal Investigator

Prof. Dr. Gérard Memmi,
Télécom ParisTech, Networks & Computer
Science Department

Goal

This project aims to design and prototypically implement an innovative industrial platform with a hybrid blockchain architecture.

The project aims to achieve:

- Establishment of a platform with hybrid blockchain architecture scalable, energy-efficient and privacy-preserving services;
- Implementation of application service components to advertise, tender, and transact resource they supply or demand, to adjust to changes in supply and demand, and to work within specific and aggregate resource budgets;
- Evaluation of the applicability of the platform in two use cases (electricity consumption control and charging and communication service resource market).

Secure Connected Industry of the Future

Key words/Application Areas

Dual Tenure-Track Program, Machine
Communication Networks, Network Security

TUM Principal Investigators

Prof. Dr. Georg Sigl,
Chair of Security in Information Technology

Prof. Dr. Gerhard Kramer,
Institute for Communications Engineering

Prof. Dr. Wolfgang Utschick,
Chair of Signal Processing

IMT Principal Investigators

Prof. Dr. David Gésbert,
Eurécom, Communication Systems Department

Prof. Dr. Refik Molva,
Eurécom, Digital Security Department

Goal

The Program builds upon three main components:

- Funding for two Tenure-Track Professorships, one located at TUM and one at EURECOM,
- A specific research fund promoting collaborative research projects within the two Professorships,
- A complementary research fund designed to promote collaboration with existing Faculty in the cross-disciplinary area of Communications and Security,
- Some initiatives to encourage student exchange, and a joint result dissemination events.

Industry without borders?

The transformation of organizational control in the Industry of the Future

Key words/Application Areas

Digital transformation, industry, organization studies, management, organizational borders, control, business models

TUM Principal Investigator

Dr. Uli Meyer,
Munich Center for Technology in Society (MCTS)

IMT Principal Investigator

Prof. Dr. Madeleine Besson,
Télécom Ecole de Management

Goal

The goal of the project is to:

- analyze and understand changes in organizational borders as a result of digital transformations,
- identify opportunities and challenges which accompany these changes,
- identify organizational forms and business models which utilize opportunities and mitigate challenges of these changes.

Smart Cyber-pHysical Environments for Industry of the Future (SCHEIF)

Key words/Application Areas

Industry 4.0, Internet of Things, Robotics, Automated Vehicles

TUM Principal Investigators

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Eurécom, Communications Systems

Prof. Dr. Ulrich Finger,
Eurécom, Director

Goal

The aim is to design a hardware and software reference architecture, decision flows, and additional technical enablers for smart Decentralized Cyber-Physical Environments (D-CPE). As core

concept, the project will integrate intelligent, context-aware, connected and responsive agents. This D-CPE for the Industry of the Future does have the following properties:

- It supports Decentralized Production Control: locally optimized decision-making agents are capable of gathering all required information for taking decisions autonomously.
- It supports Evolving Production Environments: autonomous agents reconfigure the-selves for new tasks. They evolve and adapt according to the evolution of the environment.
- It enables Plug-and-Produce: highly flexible production lines are implemented using standardized Internet technologies and agile agents on constrained devices.
- It realizes Hybrid-level Cooperation: agents cooperate with each other and with humans.
- It is secure and resilient by design: high availability is provided by using distributed autonomous software agents that are secured with state-of-the-art security methodology.

Summer School on Connected Vehicles Driving on Digital Roads (DRIVE-ME)

Key words/Application Areas

V2X Communication, Automated Vehicle, Shared Economy, Smart Mobility, Big Data in Automotive, Deep Learning

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IMT Principal Investigators

Prof. Dr. Jérôme Härri,
Eurécom, Communications Systems

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Eurécom, Director

BMW Principal Investigator

Dr. Hans-Jörg Vögel,
BMW Group, E/E Architekturen und Technologien

Goal

The objective of this Summer School is first to provide participating young scientists with a balanced program between academic guided technical domains and industry-driven innovation visions:

- Keynote Presentations – renowned experts provide technical visions to participants
- Poster Presentation – participants present their work and interact with experts
- Innovation Management – participants work in small groups on practical case

Summer Schools in Human Factors Aspects of Cooperative Systems Design

Key words/Application Areas

Robotics, Cars, Machinery for Manufacturing and Logistics

TUM Principal Investigator

Prof. Dr. Klaus Bengler,
Chair of Ergonomics

IMT Principal Investigator

Prof. Dr. Arnaud de la Fortelle,
Mines ParisTech, Center for Robotics

Goal

The objective of these events is to unit about 30 young scientists (PhD), Industry Experts, and up to 5 selected graduate students. The Summer Schools will be organized in France in 2017 and Bavaria in 2018, with balanced plenary sessions, work groups, poster sessions and spare time for participants to discuss and interact.

Next steps ...

Education

MicroMasters provided on the edX MOOC (Massive Open Online Course) platform bridges the gap between education and workplace. These programs are a series of graduate level courses from top universities designed to advance career. They provide deep learning in a specific career field and are recognized by employers for their real job relevance. MicroMasters aim to create a new category of Master's level online education based on MOOC to advance careers in the most in-demand fields while also offering a pathway to building an accelerated, credit-based access to a Master's degree.

TUM and IMT are both partners of edX. This offers an opportunity to build an Academy MicroMaster on Industry 4.0 endorsed by French and German companies. Successful completion of all courses relevant to the MicroMaster curriculum will lead to the issuance of certificates on each MOOC of the program. These credentials could qualify students to enter selected Masters at both TUM and IMT.

Executive education

An executive education program will be designed for leaders and executive seeking the full perspective needed to understand and lead the digital transformation.

A collection of short MOOCs (MOOClets) will be designed to build a French-German professional training offer.

Industrial partners

Partnership with companies will be sought to bring industrial expertise in the steering of the research and the training activities and to share their visions of the trends in various fields, technological roadmaps and needs. In addition to a direct access to the precompetitive research results of the Academy, they will be given the opportunity to support more focused and advanced research activities linked to their future business in various ways including industrial chairs and research programs linked to their own technological challenges.

The Academy will also provide partner companies with a unique venue to link with students, to develop internships and to recruit young talents with high-value skills in the industry of the future and a French-German culture.

A tentative list of such economic partners includes several French-German and international companies which are key players in the digitalization of the industry, some of them being already actively involved in the research and training tracks in progress.

Interaction with [Plattform Industrie 4.0 \(Germany\)](#) and [Alliance Industrie du Futur \(France\)](#)

The creation of the German-French Academy for the Industry of the Future, takes place in the framework of partnership between the two French and German initiatives to foster industrial development and growth. The goal is to organize advanced research activities and the creation of joint curricula to train future engineers and managers with skills to tackle the challenges of tomorrow. Another objective is to detect technologies, competencies an organization needs shared by the two platforms. Designed and experimented by TUM and IMT, the Academy is destined to be opened to other academic entities of the two platforms.

Conclusion

After a first year of gestation that has created the ground for core activities of research and education, based on the teaming of French and German researchers, the mean term goals are:

- To enlarge and deepen research activities on the core topics of digitization of industry.
- To launch a second wave of topics on impact of others technologies on key issues for industry: energy management, innovative materials, 3D manufacturing and impact of digital and sustainable development on design, products and business model.
- The creation of common contents and curricula to develop a MOOC collection for the Industry of the Future and associated certification process linked to a MicroMaster.
- The creation of common diploma for French-German student's cohorts.
- To organize a framework for partnerships with French and German industrial companies including research, innovation, continuous and life-long training, prospective, and their involvement in the strategy and orientations of the Academy activities.
- To create a program of prospective studies on industry, company and economy.
- The development of opened actions and their dissemination, under the aegis of the French-German University (DFH-UFA).
- To bring vision and contents for the partnership between French and Germany, and European Industry.

Imprint

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