

Business, Technology and Engineering the German Way DRAFT

Business, Technology and Engineering the German Way (BTE-GW) is a 2+2-weeks Summer School in Munich at the University of Applied Sciences. It offers an in-depth study of engineering and cultural business topics with a focus on „The German Way“.

The participants of BTE-GW will get a personal insight into several best practice companies and learn about their successful methods first hand (see selected levels for business and engineering excellence at work, and discuss company-specific topics with the managers in charge). They will as well conduct teamwork and projects in joint teams with German students. For almost 10 years, the academic setup of this summer school is based on the German university regulation framework and standards.

To get most value out of the summer school, we provide a combination of two parts, **Part 1: Preparatory Courses Online** and **Part 2: Immersion Courses Onsite in Munich**:

Preparatory Courses Online

Part 1: **Preparatory Courses Online** provide the Students with a sound basis and understanding of Business, Technology and Engineering the German Way. Participants learn about similarities and differences in work culture, legal framework and market specifics in order to understand the specific ways German companies operate. The lectures will be given online and are mandatory to be eligible for part 2; Immersion Courses Onsite in Munich.

The course consists of **45 hours online lecture** and teamwork preparation.

Module name: *Global German Production Footprint*

- **Credits and Contact Hours:** 10 contact hours
- **Instructor:** Prof. Dr. Reinhard Koether

- **Textbook:** none

Optional Reading Recommendation:

Ferdows, K.: Making the Most of Foreign Factories. In Harvard Business Review March-April 1997, Reprint No: 97204

Loch, C. H.; Chick, S.; Huchzermeier, A.: Management Quality and Competitiveness - Lessons from the Industrial Excellence Award. Berlin, Heidelberg: Springer 2008

Posth, M., Trevis, I.: 1,000 Days in Shanghai: The Volkswagen Story - The First Chinese-German Car Factory. John Wiley & Sons 2008

Slack, N.; Lewis, M.: *Operations Strategy*, 3e. Financial Times Prentice Hall, Harlow - latest edition

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

Manufacturing industry contributes a major part to Germany's welfare and export surplus. The module starts with a general introduction to manufacturing technologies and their consequences on quality, cost and make-or-buy decisions. The module provides insight in the manufacturing industry and the impacts of qualification, technology and integration of international suppliers. Managing complexity is an important success factor and explains why German products like premium cars, special machinery and business software are well accepted by international customers. This module will address complexity management for products and production processes and shows how German manufacturers use technological tools to provide customer specific products with short lead times. As manufactured goods can be shipped and marketed globally, international aspects are also addressed. This includes the integration of owned factories and of third-party suppliers in foreign countries.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide an understanding of quality and cost of manufacturing technologies
- To explain the contribution of German manufacturing industry with Germany's economic model
- To show how complexity can be managed to fulfill customers' specifications
- To teach the fundamental concepts and techniques for an international production process
- To provide an understanding of how to produce and deliver customized products with a short lead time.

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. wirklich??? an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** Introduction to manufacturing technologies, quality, fixed and variable cost, technologies for make or buy in production, the role of manufacturing industry for Germany's economic model, goals and configuration of an international production network, managing complexity in product and production processes, production network with suppliers, consequence of production in designing and managing the supply chain, distribution of customer specific products with short lead times.
- **Factory tour:** This module is combined with a factory tour.

Module name: *Planning and Managing a Factory in a Digital World*

- **Credits and Contact Hours:** 11 contact hours
- **Instructors:** Prof. Dr. Andreas Rieger, Prof. Dr. Jürgen Spitznagel
- **Textbook:** none

Optional Reading Recommendation:

- **Canetta, L., Redaelli, C.:** “Digital Factory for Human-oriented Production Systems: The Integration of International Research Projects”, 2011.
- **Rother, M. & Shook, J.:** “Learning to See”, latest edition.

Supplemental materials: Extensive instructor’s notes/handouts/overheads

- **Specific Module Information:**

This module provides an overview of digital factory planning (processes and layout), factory simulation as well as methods and principles of lean production from a German perspective. In addition, the students experience the use of a simulation tool for digital factory planning. Finally, the students are asked to run their own production shop and learn how to improve productivity through lean methods and principles. The integrated module concept supports a systematic analysis, simulation and real practice of processes and structures in a factory environment.

Prerequisites: none

a) Specific Goals for the Module:

- To provide students with an understanding of the concept behind digital factory incl. the usage of virtual reality (VR)
- To teach methods and tools to plan the production processes for a certain product from the early design phase, through building up workplaces to the operative control of the factory
- To use discrete event simulation tools for plant-, line- and/or process-simulation and
- To enable students to learn effective methods to implement lean work systems in production

Thus, the students are able to build up a simulation model of a real plant/ production line and compare it with their hands-on experience on a real shop floor. They are also able to evaluate the output of plant-, line- and/or process simulations and improvements.

b) Applicable ABET Outcomes:

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
3. an ability to communicate effectively with a range of audiences

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4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
 5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
- **Topics covered:** Global Challenges for Production, factory targets and factory planning, introduction to Lean Thinking, planning of production processes (VR vs. real), plant-, line- and/or process simulation, run and improve a production shop.

Module name: *Service Business Models in Germany*

- **Credits and Contact Hours:** 9 contact hours
- **Instructors:** Prof. Dr. Jörg Elias

- **Textbook: none**

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**
Service businesses are getting more and more important in today's engineering environment. High productivity targets in the automotive Industry can only be achieved by excellent planning of the value chain from Engineering to End-Of-Life. With a high level of fixed cost, profitability management is an important factor in the service industry. This module covers the most relevant aspects and success factors for service excellence in Germany.

Prerequisites: none

- **Specific Goals for the Module:**
 - To enable the students to understand the entire automotive value chain from Engineering to End-Of-Life vehicle as an area for service businesses
 - To detail business models, market specifics and challenges of the most relevant of the service offerings
 - To enable the students to evaluate different service offerings regarding their market viability and future prospects
 - To introduce the students to some selected German legal regulations governing relevant service business areas
 - To contrast, where effective, the differences of the German service market vs. the US service market

- **Applicable ABET Outcomes**

After having successfully finished this module, the students will have:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** An introduction to the specifics of service business is given covering some important areas for future development of the offerings. The German automotive sector is quickly introduced and an overview of services along the value chain is presented. Some legal specifics for the European Market regarding car sales, car maintenance and car operation are discussed. New service offerings in the area of mobility and transport are presented and discussed. This covers the areas of E-mobility, car sharing and autonomous vehicles.
- **Factory tour:** This module is combined with a factory tour to an engineering service provider in the automotive industry.

Module name: *Ergonomics in a German production environment*

- **Credits and Contact Hours:** 10 contact hours
- **Instructor:** Prof. Dr.-Ing. Johannes Brombach

- **Textbook: none**

Optional Reading Recommendation:

Bridger, R.S.: Introduction to ergonomics. Taylor & Francis, ISBN 0-415-27378-1

Schlick, Bruder, Luczak: Arbeitswissenschaft. Springer, Heidelberg 2010
ISBN 978-3-540-78333-6

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**
This module begins by giving students an overview of the basics of ergonomics with respect to legal and social demands developed in Germany. The core competences of an ergonomist are: anthropo-technics, occupational physiology, human capabilities and environmental interactions. These aspects will be used to generate basic application principles for designing products, tools, workplaces and human-machine interactions. Special attention will be paid to physiological measurements (e.g. EMG) and effects of age, noise prevention, and the design of the workplace with regard to workflow typical for the German industry.

Prerequisites: none

- **Specific Goals for the Module:**
 - To provide an understanding of interaction of human beings and work in Germany
 - To teach the fundamental concepts and techniques used in analyzing work situations with respect to main stress factors in the German Industry
 - To evaluate strategies for goods designed, i.e. healthy and stress reduced work places and machine or product interactions
 - To emphasize the social, economic and human demands on ergonomic work
 - To support practical applications in lab exercises

- **Applicable ABET Outcomes:**
After having successfully finished this module, the students will have:
 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
 2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
 4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

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6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
- **Topics covered:** economic, social and legal aspects of ergonomic work and work safety, principle of stress and strain, fatigue and recreation, biomechanics (forces, weights), anthropometrics, environmental factors, seat design, working tools, human machine interaction, software ergonomics.
 - **Factory tour:** This module is combined with a factory tour in Part 2.

Module name: *German Enterprise Law*

- **Credits and Contact Hours:** 5 contact hours
- **Instructor:** Prof. Dr. Thomas Wilrich
- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

This module provides an overview on the impact of German/ European laws on the engineering and machinery industry. In addition, the impact of technical harmonization on engineering is highlighted and discussed. To complete the most important legal aspects, the responsibilities of managers and other executives when placing products on the European market are covered in detail.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide an understanding of the German/ European law concerning engineering
- To teach the fundamental concepts of the legal basis in technical law in Germany/ Europe

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, *legal* (editors note) and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** European Technical Harmonization (*Single Market*) of company organizational trade law concerning machinery and other technical products, interface of technology and law, the legal impact of standards (ISO EN DIN), the responsibilities of the economic operators (producers, importers and distributors), the responsibilities of managers and other executives.

Immersion Courses Onsite in Munich

Part 2: Immersion Courses Onsite in Munich: The world becomes more and more globalized. Companies are working in an environment of international competition. However, how to best prepare for an international career? Which influences have cultural aspects and what are success factors? What is the difference to other countries? Direct contact to German fellow students, lecturers and German industry experts provide deep cultural and business insights into the German business culture.

The course includes models and methods to analyze and use cultural aspects, explains historical developments in Germany, if needed, and gives the students the opportunity to apply their knowledge and solve real business tasks. They will be teamed-up with German students of similar level to foster hands-on experience sharing and international cooperation. The Students will be supervised and supported by experienced international managers while they are working together in teams. Special focus is given to Business culture in Germany and working abroad.

The course consists of **45 contact hours** and a factory tour. The students will be graded for their presentations, the outcome of their group work together with the German students, written exams and they will receive personal feedback for their work.

Course number and name: *German Culture & Workplace*

- **Credits and Contact Hours:** 10 contact hours
- **Instructor:** Prof. Dr. Mathias Gabrysch

- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Course Information:**

There is a special culture at German workplaces, which is different from that of an American company. An inside look on how Germans work helps to understand culture as a success factor for business and to be better prepared for a potential internship or career in a German, European or international company.

Prerequisites: none

- **Specific Goals for the Course:**

- To provide an understanding, what are the specific aspects in business culture
- To learn the concept, how to assess the culture (on company and national level)
- To get to know methods and tools, to influence and change the culture in a company
- To understand how Culture and Innovation influence each other
- To gain a compass about, what is typical in German, European or Asian culture
- To learn about "Hidden Champions" and if they are typical for German Culture

Applicable ABET Outcomes:

After having successfully finished this module, the students will have:

3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** The students learn to analyze typical cultural aspects in order to understand differences in the social system of a company and use this knowledge to improve processes

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and structures. Therefore, they work with appropriate analytical methods and apply their knowledge on real business examples, given by experienced international Managers.

- **Factory tour:** This module is combined with a factory tour.

Module name: *Business in a foreign country – Survive in discussions!*

- **Credits and Contact Hours:** 5 contact hours
- **Instructor:** Prof. Dr. Johannes Brombach
- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

The students do not need to speak German to survive in international business. However, it is nice to know a few key methods of translation and how to understand the basic language structure of German in order to efficiently participate in a discussion. The main goal is to apply the knowledge learned and to try it out.

Prerequisites: Module German workplace culture

- **Specific Goals for the Module:**

- To discuss an engineering topic, “tooth and nail” – Negotiation with language barriers
- To help yourself by using drawings, technical descriptions to make people understand
- To support efficient discussion outcomes by visualizing results
- To learn to translate foreign texts by using appropriate tools and methods
- To gain a better cultural understanding about small talk and body language – cross-cultural competencies

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** The students learn and practice cross-cultural competencies. In group work/ set-up a scenario, they discuss and negotiate topics with Germans (that are not fluent in English). A technical problem is given. The students will have to apply their acquired

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knowledge in order to come up with good negotiation results. Afterwards, the role-play will be evaluated and a personal feedback will be given.

Module name: *Innovation Management in a German context*

- **Credits and Contact Hours:** 10 contact hours
- **Instructor:** Prof. Dr. Klaus Pischetsrieder

- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

This module provides an overview of the development process for complex products like automobiles or machines. Topics include a general introduction to requirements and success factors for a successful product development from a German perspective. Goals, inputs and expectations of all stakeholders inside and outside the company are addressed. Main points are the tools and methods to manage and control the research and product development process.

Prerequisites: General understanding of collaboration and interaction between the functions marketing and sales, design, manufacturing as well as project management.

- **Specific Goals for the Module:**

- To provide an understanding of a research and product development process
- To teach the fundamental concepts and techniques used in product development
- To provide an understanding of the key questions of product development and some solutions from German best practice companies

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
4. Wirklich? an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** Tasks in product development, research and product development, organization of development projects, strategic product planning, planning and controlling product development processes, innovation management, managing product variants, dealing with technology and design changes, collaborative development projects.

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- **Factory tour:** This module is combined with a factory tour.

Module name: *Case Study Competition*

- **Credits and Contact Hours:** 10 contact hours
- **Instructors:** Prof. Dr. Johannes Brombach & Prof. Dr. Jürgen Spitznagel
- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

In today's complex international business it is important to quickly understand the essential business kernel of an engineering company. The necessary ability and knowledge can be best acquired by solving a real case study of an international engineering company, based in Germany. The module is designed as a case study competition between several student teams. The teams get all the needed tools and methodology to do the consulting job. Based on the same background information about the company, the teams develop their individual business solutions and present their cases to the jury.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide methods and tools to solve a complex business case of an international engineering company
- To analyze and understand the business models, the market specifics and the challenges of the selected business case
- To enable the students to evaluate different strategic directions regarding technology and cost position as well as market viability and success
- To enable the students to develop a short management presentation with all the key findings and their recommendations
- To learn from the other teams and give feedback to each other

- **Applicable ABET Outcomes**

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

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6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

- **Topics covered:** The students get an introduction about the necessary tools and methods to solve a complex business case. The module is based on a real business case of a German engineering company in trouble. 3-4 different student teams try to understand the described scenario regarding the most important technological and business aspects and come up with a turnaround strategy. The individual strategies will be presented in a “battle” in front of a jury.

Module name: *Entrepreneurs for industrial services*

- **Credits and Contact Hours:** 10 contact hours
- **Instructors:** Prof. Dr. Jörg Elias & Prof. Dr. Andreas Rieger
- **Textbook: none**

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

This module is all about entrepreneurship and creative development of industrial service offerings. The module starts with an introduction to current megatrends in industrial services as well as several successful business models in Germany. The module also provides an introduction to necessary tools and techniques to create a new business idea as an entrepreneur. The students are challenged to develop a new service offering in a competition between several teams and present their business cases to the jury. These concepts may include market analysis, competitive analysis, value proposition, service processes and profit/loss calculation.

Prerequisites: Module Service business in Germany

- **Specific Goals for the Module:**

- To analyze and understand business models, market specifics and current megatrends in industrial services
- To provide methods and tools to create a business case for an innovative service offered in the mobility and transport area
- To enable the students to develop future market strategies for existing services offered in the light of relevant megatrends
- To enable the students to evaluate different strategic directions regarding technology and cost position as well as market viability and success
- To enable the students to develop a short management presentation with all the key elements of the business model for their new business idea
- To learn from the other teams and give feedback to each other

- **Applicable ABET Outcomes**

After having successfully finished this module, the students will have:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

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5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
- **Topics covered:** The principles of the entrepreneurship process are discussed. The students then are guided through the steps of generating, modifying, sharpening and defining business ideas. A set of tools such as Morphological Analysis, Empathy map and Blue Ocean Strategy are introduced to facilitate this process and to consecutively home in on a viable and profitable business model. The result is documented in a Business Model Canvas, a method widely used to document start-up business ideas. The individual team's service business ideas are presented in a competition in front of a jury.