Course:

BIS3061E – Internet of Everything (IoE)

Electives A "**Digital Business Models**"
in Module "Electives Digital Enterprise Management"

Lecture and location: according to current lecture plan (see LSF)

Weekly hours:	2 academic hours: (2 x 45 minutes)
ECTS-Credits:	3
Workload:	90 hours, 30 hours within class and 60 hours for self-study and term project
Time:	Tuesday, 17:15-18:45 (W1.2.04)
Begin:	Tuesday, March 17th, 2020
Language:	English; advanced level
Level:	Advanced
Assessment	Exam (60 minutes)
Prerequisites:	Basic knowledge in Computer Science and Information Systems

Lecturer Prof. Dr. Peter Weiß

Office: W2.2.25,
Colloquium: upon appointment
Please use my booking system to reserve a free timeslot: see https://www.timify.com/de-de/profile/peterweiss,

Email: peter.weiss@hs-pforzheim.de (preferred mode of communication)

(Further details: here)

My aim is to ensure that you succeed in your training. Therefore, my aim as lecturer is to interact with students in the classroom and to provide support to their individual learning process. In the case of occurring problems or questions, feel free to contact me, for instance by e-mail. I will answer promptly and if required schedule an appointment.

Course description:

Smart, connected products are transforming competition. At the core of this transformation are digital service innovations and smart objects which are enabler and change driver for many industries. Smart technologies related to Internet-of-Things (IoT) and trends such as **Industry 4.0 provide new technological platforms**, which offer many business opportunities for companies. The evolution of products into

intelligent, connected devices, which are increasingly embedded in broader systems is radically reshaping companies and competition. Current developments related to the integration of products and services, e. g. the **interlinkage of industry and services (Industry 4.0) and the emergence of smart service technologies (systems of service systems) offers new opportunities by integrating innovative services**, such as integrating resources of specific service systems as service component to their product offerings. Suppliers can move into strong competitive positions through digital service innovations by integrating products, services and smart technologies to offer novel value propositions to their customers. The lectures will highlight in which way service-led strategies, underlying architectural designs and enabling technologies are currently transforming industry.

Prerequisites

Besides basic knowledge in Computer Science and Information Systems, there are no special pre-requisites for the course beyond basics in management and being interested in technological matters. Do not take the course if you expect to miss more than one class because attendance and active class participation is critical. As well, please consider that course language is English. Please ensure that you are able to read scientific articles in English and follow the lectures. As well, interventions and contributions from students are expected to be made in English.

Learning outcome:

This course provides a strategic perspective of the challenges and advantages of global manufacturing in multinational and networked companies. In this course the students will learn:

- How the Internet of Things Changes Business Models
- Strategies for the Internet of Things
- Service Systems and Service Innovations
- Strategic Agility and new IT Infrastructure Capabilities required
- Architectures for Internet of Things Solutions
- Enabling technologies
- Case Studies and Use Cases

Upon completion of the course, the students are able to

- Define and repeat the concept "**Internet of Everything**" and describe its strategic and operational aspects as well as its objectives.
- Name and recall foundational premises and theories explaining Internet of Everything and respective value chain constellations.
- Describe and **explain reference architectures** as well as their purpose, objectives, premises, perspectives and opportunities
- Name and conceptualize **Internet of Everything** concepts derived from S-D logic principles and mechanisms.
- Analyse, define and evaluate the **design of strategies** as conclusion of insights gained from concepts and approaches taken from "Internet of Everything" as discipline and discuss their potential for industry (such as manufacturing).

- Know and propose strategic imperatives and opportunities but as well risks viewing value chains through a service-lens.
- Know and apply concepts to concrete examples and conclude how transformations and improved competitive positions are achievable.
- Analyse, describe and discuss major drivers of change and influencing factors for transformations of value chains through Internet of Everything.
- Understand and argue major drivers of change as well as to characterise potential risks for Internet of Everything by referring to concrete examples.
- Understand and argue the impact of the Internet of Everything concept on various organizational and technological dimensions.
- Understand and discuss the interdependency between strategy and operation, strategic capabilities, architecture and IT infrastructure capabilities.
- Differentiate the various concepts and approaches such as Internet of Things, Internet of Everything, Connected Products, and others.

Course contributions to degree program target

	Learning Outcome	**Contribution**
1.1	Students demonstrate key knowledge in Technical Basics.	Introduction to and communication of interdependencies between technical and business requirements (IT-business alignment)
1.2	Students demonstrate key knowledge in Mechanical Engineering.	
1.3	Students demonstrate key knowledge in Business Administration.	Introduction to and communication and cross-organisational interaction and also discussions based on expert knowledge, especially of production management.
1.4	Students demonstrate key knowledge in Economics.	Introduction to and communication of relational management approaches such as Internet of Things (IoT), Industry 4.0, service management (S-D logic, open service innovation), collaborative networks and resource-based management theories and approaches.
1.5	Students demonstrate key knowledge in Mathematics.	
1.6	Students demonstrate key knowledge in Quantitative Methods.	
1.7	Students demonstrate key knowledge in Computer Science.	
2.1	Students demonstrate proficiency in using current computer programs to solve business and technical problems.	
2.2	Students demonstrate the ability to use information systems effectively in real world business settings.	
3.	Students are able to apply analytical and critical thinking skills to complex problems.	Students strengthen and enhance their analytical skills and critical thinking by studying in depth selected cases and related concepts and designs (both technically and business-related). Students will achieve insights to anticipate developments such as future networked business constellations, drawing from principles of interacting platforms and service systems.
4.	Students are able to develop business ethics-based strategies and are able to apply them to typical business decision-making problems.	A win-win approach is necessary in order to produce globally. Ethics-based strategies form the basics of this approach.
5.1	Students demonstrate their ability to express complex issues in writing.	Students demonstrate and improve conceptual skills and their ability to express solutions based on valid

		concepts and business strategies through the preparation of a small case study.
5.2	Students demonstrate their oral communication skills in presentations and lectures.	Students will demonstrate and improve their presentation skills in small teams and will in this way strengthen their oral communication skills.
6.	Students show that they are able to work successfully in a team by performing practical tasks.	Students demonstrate their ability to work in teams, coordinate and work collaboratively on a given problem or case, and finally, present jointly yielded results in small teams.
7.	Students demonstrate their ability to develop and present complex interdisciplinary solutions by means of an application oriented assignment.	
7.	For specific cases students demonstrate their ability to understand and design cross-functional as well as cross-company business processes in a global context.	Aim is a holistic design and optimization of value chain through shifting focus on relational aspects and related challenges. Nowadays, platform-based business and service-logic is questioning many of established design patterns and management thinking.
7.	Students show that they are able to apply their cross-cultural skills in specific situations.	Cross-cultural skills in specific situations are the basis for production management in cross-organisational settings.
7.1	Students are able to explain interdisciplinary terms on the basis of complex problems safely and competently.	
7.2	To solve strategic and operational problems, the students are able to use the necessary methods combined and apply them to the problem.	
7.3	Students demonstrate their ability to develop and present complex interdisciplinary solutions by means of an application oriented assignment.	With the obtained knowledge about the various theories and foundational premises the students gain deeper insight into the future evolution of competition natured by digital technologies and new business logics to anticipate change. The students get acquainted with conflicting goals of organisations and will learn a concept on how to handle these conflicting goals.
7.1	Students demonstrate key knowledge and methodological know-how in international management and engineering.	
7.2	Students demonstrate their ability of analytical and critical reflection and their capacity to work out viable solutions for challenges in international management and engineering.	
7.3	Students show that they are able to apply their international management and engineering competencies in specific situations.	

Teaching and learning concept

Internet of Everything is an interactive lecture with discussion based on International Business case studies. To participate fully in class, students are expected to attend classes, read the assigned literature / cases and engage in discussion.

Performance record regulations:

The students will realize a term project. Details are outlined during the first sessions in the class room, as well as assessment criteria. Important criteria are presented and will be clarified during the first lectures.

In general, the assessment will be as follows:

Term Project/ Presentation: 50%
Term Paper: 50%
Total: 100%

Assessment is based on a term project which includes a written scientific term paper (elaborated learning papers based on assigned IoE topic) and a presentation of the assigned IoE term project.

Further information will be provided during the first lecture. You will be prepared for the exam during the lectures. Also the style of the exam will be explained during lectures.

Grading:

The grading approach will be discussed during the first lecture.

Course literature:

- Weiß, P.; Bulander, R.; Kölmel, B. (2016): Digital Service Innovation and Smart Technologies: Developing Digital Strategies based on Industry 4.0 and Product Service Systems for the Renewal Energy Sector. September 2016, Conference: RESER Conference Proceedings, Naples, Italy; 2016
- Bandyopadhyay, D.; Sen J. (2011): Internet of Things: Applications and Challenges in Technology and Standardization. In: Wireless Personal Communications. May 2011, Volume 58, Issue 1, pp. 49-69.
- Porter, M. E.; Heppelmann, J. E. (2014): How Smart, Connected Products Are Transforming Competition. In: Harvard Business Review Online; https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition, last visit 31.07.2016.
- Porter, M. E.; Heppelmann, J. E. (2015): How Smart, Connected Products Are Transforming Companies. In: Harvard Business Review Online; In: Harvard Business Review Online; https://hbr.org/2015/10/how-smart-connected-products-are-transforming-companies, last visit 31.07.2016.
- Spohrer, J.; Maglio, P. P. (2008): The Emergence of Service Science: Toward Systematic Service Innovations to Accelerate Co-Creation of Value. In: Production and Operations Management, Vol.17 No.3, May-June, pp. 238-246.

Students are recommended to read this book, as it is referred to its cases, concepts and foundations.

Additional Literature and Recommendations for further self-directed studies and research:

- Lusch, R. F., Vargo, S.L. (2014): Service-Dominant Logic: Premises, Perspectives and Possibilities. Cambridge University Press, Boston.

Selected excellent case studies (Harvard, MIT) and high-level research papers (articles published in leading research journals) to introduce major concepts following an action-oriented approach. Students will acquire required conceptual basis to strengthen their problem-solving capabilities and independent thinking relevant for their professional career development. This is seen as critical and fundamental for future Internet of Everything capabilities in order to lead required transformations in industry and in given real life contexts. Following this approach, students are acquainted with scientific literature and related standards.

Theory and related concepts will be discussed and explained in classroom with reference to real life examples and industrial cases.

My self-perception as lecturer

My aim is to establish a fundamental comprehension for the common topics in Internet of Everything, especially value networks. That should enable you to have an overview referring to planning activities that are across functions and process borders in order to pursue the overall optimum instead of a suboptimal company optimum. Therefore, I want to encourage you to take a holistic view, which may be a competitive advantage towards business partners and competitors.
My aim is to establish a fundamental comprehension for the common topics in Internet of Everything, especially connectivity as strategic asset reflected in emerging disciplines such **as Industry 4.0 and the Industrial Internet.**
As well, I will get students acquainted with new paradigms to view management challenges through the lens of service management and Service-Dominant (S-D) logic.
My aim is to enable students to synthesize solution approaches to typical problems and challenges of networked businesses.
My aim is to enable students to follow eclectic research approaches and conceptualize solutions design to improve planning activities that are across functions and process borders in order to pursue the overall optimum instead of a suboptimal company optimum. Therefore, I want to encourage students to take a holistic view and service-led view, which may be a competitive advantage towards business partners and competitors (service makes the difference).
My lectures are research-led not losing focus concerning essential aspects to apply results in real life industrial contexts. Students on bachelor level are encouraged to use scientific literature and to work with state-of-the-art material and concepts from the emerging transdisciplinary service science. In this way, students will strengthen and improve their analytical and conceptual skills.
Service-led thinking and to use service strategies to achieve competitive advantage is a major paradigm of my teaching and research.

Preliminary time schedule (tentative)

Week 1	**Introduction and Motivation/ Overview** Introduction to course and material Time planning and assignment of tasks (own read and term project)
Week 2	**Internet of Everything (1)** Introduction and Overview Internet of Everything
Week 3	**Internet of Everything (2)** Definitions, concepts and real life examples (case studies)
Week 4	**IoT Strategies: Challenges and Opportunities (1)**
Week 5	**IoT Strategies: Challenges and Opportunities (2)**
Week 6	**IoT Strategies: Challenges and Opportunities (3)**
Week 7	**IOT Business Models (1)**
Week 8	**IOT Business Models (2)**
Week 9	**IOT Business Models (3)**
Week 10	**Foundations of Execution: Service Systems and Platforms (1)** **Reference architectures for IoE and IoT:** RAMI, OneM2M, OPC UA and Industry 4.0, standards and reference architectures of Industrial Internet Consortium and others
Week 11	**Foundations of Execution: Service Systems and Platforms (3):** **Reference architectures for IoE and IoT:** RAMI, OneM2M, OPC UA and Industry 4.0, standards and reference architectures of Industrial Internet Consortium and others
Week 12	**Foundations of Execution: Service Systems and Platforms (3):** **Reference architectures for IoE and IoT** RAMI, OneM2M, OPC UA and Industry 4.0, standards and reference architectures of Industrial Internet Consortium and others
Week 13	**IoT Case Studies (1)**
Week 14	**IoT Case Studies (2)**
Week 15	**Industry Talk**
Week 16	**Capstone Session/ Recap**

Rules for proper academic work

The lecturer appreciates a substantial exchange between the students, because the fellow students may have valuable contributions to the comprehension of occurring problems or questions.

Following the arguments, collaboration and also an autonomous exercise solving or the discussions on upcoming questions within the lectures are fundamental for a clearer understanding of the subject matter.

Especially large class sizes and foreign languages imply a risk of a high noise level, which has a strong negative influence on the work climate, knowledge acquisition and collaboration. Predominantly a high noise level is caused by a few group members. These ‘troublemakers’ hinder the other ones from being able to concentrate and therefore won’t be tolerated and will be ejected from the class.