



# **STRATEGIC TECHNOLOGY MANAGEMENT**

## Course Outline and Reading List

**PROFESSOR DR. FRANK PILLER**  
**PROFESSOR TORSTEN-OLIVER SALGE, PH.D**

School of Business and Economics

**TIME** Research Area | [www.time.rwth-aachen.de](http://www.time.rwth-aachen.de) | Kackertstraße 7, Aachen

Contact: Ekaterina Korneeva | [korneeva@time.rwth-aachen.de](mailto:korneeva@time.rwth-aachen.de)  
Ruth Jiang | [jiang@time.rwth-aachen.de](mailto:jiang@time.rwth-aachen.de)

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## COURSE OVERVIEW

Course Name:	<b>Strategic Technology Management (ID: 17ws-03604)</b>
Degree Programmes:	<ul style="list-style-type: none"> <li>(1) Master BWL (Innovation, Entrepreneurship and Marketing – core course)</li> <li>(2) Master Wirtschaftsingenieurwesen (Management des Innovationsprozesses)</li> <li>(3) Master Wirtschaftswissenschaften (Wahl B)</li> </ul>
Lecturer:	<p>Prof. Dr. Frank Piller Prof. Torsten-Oliver Salge, Ph.D.</p>
Contact:	<p>Ekaterina Korneeva (<a href="mailto:korneeva@time.rwth-aachen.de">korneeva@time.rwth-aachen.de</a>, +49 241 80 99182) Ruth Jiang (<a href="mailto:jiang@time.rwth-aachen.de">jiang@time.rwth-aachen.de</a>; +49 241 80 99177) <b>www.time.rwth-aachen.de</b></p>
Location and Time:	<p>Kackertstraße 15, Room 3020 03.1 (Se 1) Thursdays, 8:30am to 1:00pm, 6 sessions (7 December, 21 December, 11 January, 18 January, 25 January, 1 February)</p>
Content Description:	<p>This course provides an introduction to strategic technology management (STM) based on the analysis of cases studies from practice and results from academic research. The class will revisit some of the foundational concepts and debates in strategic management to examine key strategic decisions at the heart of technology and innovation management. These pertain for instance to the selection of technology fields, the composition of innovation portfolios, the timing of technology development initiatives, the setting of industry standards, the implementation of modular designs, the protection of intellectual property, or the adaptation to rapid technological change.</p>
Qualification Objectives:	<p>After participating in this course students should be in a position to:</p> <ul style="list-style-type: none"> <li>(1) understand and critically reflect upon key concepts and theories in STM,</li> <li>(2) understand and critically discuss conceptual and empirical research papers on STM,</li> <li>(3) analyse and develop adequate solutions to some of the practical challenges of STM, and</li> <li>(4) apply important tools in STM intelligently based on a thorough understanding of their respective strengths and weaknesses.</li> </ul>
Literature:	<p>See below in the session descriptions. All papers will be made available in L2P ahead of the session.</p>
Course Examination:	<p>The grading for this course will comprise two factors:</p> <ul style="list-style-type: none"> <li>(1) group presentation and participation in class (colloquium) based on the preparation of prior assigned papers and case studies will count for 50% of the final grade.</li> <li>(2) A written exam will count for the remaining 50%. The written exam will take place on 22 February 2018 (first examination date). The date for the second written exam (second examination date) will take place on 29 March 2018. We strongly advise participants to participate in the first exam.</li> </ul> <p><b>IMPORTANT: Please note that both components need to be</b></p>

	<b>passed to pass the course. Please, also be aware of the special rules for examination registration and cancelation.</b>
Participation Requirements:	Solid command of English and willingness to prepare each class session in advance (in average, each class session demands 3-4 hours of preparation to read one or two case studies and academic papers).
Group Size:	45 participants (max)
Workload:	30 hours of lecturing 120 hours of individual and group preparation
Type of Teaching Event:	Classroom sessions are likely to comprise a mixture of interactive lectures, case/paper discussions and student presentations.
Language:	English
Credits:	5

## 1 COURSE ORGANISATION

The course comprises seven four-hour sessions, five of which will be subdivided into three parts consisting of (1) an interactive lecture, (2) case study discussion and (3) two student presentations of journal articles. The order and duration of these elements might vary between sessions. The table below depicts the preliminary schedule.

### Preliminary Schedule for Strategic Technology Management

#	Date	Time & Place	Teacher	Session Title
<b>SESSIONS IN CLASS</b>				
1	07.12.2017	08.30-13.00 <a href="#">3020 03.1</a>	Prof. Salge	<b>Introduction &amp; Technological Change</b>
2	21.12.2017	08.30-13.00 <a href="#">3020 03.1</a>	Prof. Salge	<b>Scoping the Playing Field</b>
3	11.01.2018	08.30-13.00 <a href="#">3020 03.1</a>	Prof. Salge	<b>Orchestrating the Ecosystem</b>
4	18.01.2018	08.30-13.00 <a href="#">3020 03.1</a>	Prof. Piller	<b>Developing Modular Designs</b>
5	25.01.2018	08.30-13.00 <a href="#">3020 03.1</a>	Prof. Piller	<b>Managing Intellectual Property</b>
6	01.02.2018	08.30-13.00 <a href="#">3020 03.1</a>	Prof. Piller	<b>Setting Industry Standards</b>
7	06.02.2018 (optional)	08.30-13.00 3011 037	Prof. Piller Prof. Salge	<b>Summary, Evaluation and Q&amp;A</b>
<b>EXAMINATION</b>				
8	22.02.2018	10.00-12.00 1072 001 (Couden- Halle)		<b>First Examination Date</b>
	29.03.2018	11.30-13.30 1820 207 (Fo 4)		<b>Second Examination Date</b>

This course will be managed via the e-learning platform L2P. All lecture slides, student presentation slides and readings will be deposited here. In addition, we will communicate all important pieces of information (e.g. pptx-Template, group allocation, room changes, course and exam preparation) only via L2P. It is hence essential for you to sign up for our L2P course by 01/12/2017 at the very latest. If you register after that date, we cannot guarantee that we will be able to assign you to a group. We also kindly ask you to send a recent photo of you (filename: yourfirstname\_ yourlastname.jpeg) to [korneeva@time.rwth-aachen.de](mailto:korneeva@time.rwth-aachen.de) by 01/12/2017.

Link: <https://www3.elearning.rwth-aachen.de/ws17/17ws-03604/Dashboard.aspx>

All lectures, discussions and student presentations will be in English language.

## 2 GROUP ASSIGNMENT AND CASE DISCUSSION

A key component of this course is the group assignment and the case discussions in class. Jointly, they will count for 50 percent of your final grade. Only those who have passed this component are eligible for participation in the individual paper, which will count for the remaining 50 percent. As for the case discussions, it is essential for all course participants to carefully read the case at home being ready to discuss the questions listed in the session description below.

As for the group assignment, each student will be assigned to a group typically consisting of three to five members. Each group will be asked to present and critically discuss one academic paper in class. Each paper addresses an important phenomenon in the sphere of strategic technology management. Papers can be conceptual or empirical have been published in leading peer-reviewed journals in the field of Strategic Technology Management such as the Strategic Management Journal, Management Science, Research Policy or the Journal of Product Innovation Management.

In class, 30 minutes will be allocated to each group, of which 20 should be used for the group presentation and 10 for a discussion with the audience. You should support your presentation with up to 20 PowerPoint slides. When preparing your slides, you need to use the PowerPoint template that is available for download on L2P. The final slides and a one page summary (bullet-points) need to be sent to [korneeva@time.rwth.aachen.de](mailto:korneeva@time.rwth.aachen.de) by 4pm on the day BEFORE your presentation in both pptx and pdf format. You will also need to save both files on a memory stick and bring it with you to class along with a printout of your slides. The language for the presentation and the discussion with the audience is English.

Groups will be formed by the lecturer and students will be informed about their group composition via L2P by 08/12/2017 (10:00 pm), provided they have signed up for the L2P course by 01/12/2017. To offer some support during the preparation of your paper presentation, each group is entitled to an optional 30-minute coaching session with Ekaterina Korneeva or Ruth Jiang, which will take place in the premises of the Innovation, Strategy and Organisation Group (ISO) or the Technology and Innovation Management Group (TIM).

We would like to stress that your paper discussion needs to go beyond simply summarizing the content of your assigned paper. Rather you are asked to engage with it critically by discussing its strengths and weaknesses as well as its contributions to our understanding of key aspects of strategic technology management.

A sample structure of your presentation might look like this:

- (1) Introduction
- (2) Paper Description
  - Research Question
  - Conceptual Framework
  - Research Design
  - Contributions to strategic technology management research and practice
- (3) Paper Discussion
  - Strengths
  - Weaknesses
  - Possible Refinements and Extensions
- (4) Conclusion

There will be (up to) two group presentations during each session. The precise schedule for the paper discussions is as follows:

### Schedule for Paper Discussions

#	Date	Group	Paper	Coaching
PD1	21/12/2017	Group 1	Ashton Hawk, Goncalo Pacheco-De-Almeida and Bernard Yeung. "Fast-mover advantages: speed capability and entry into the emerging of atlantic basin LNG", Strategic Management Journal 34.13 (2013): 1531-1550.	Ekaterina Korneeva
		Group 2	Vouri, T.O., and Huy, Q., N. "Distributed Attention and Shared Emotions in the Innovation Process." Administrative Science Quarterly 61.1 (2016): 9-51.	Ekaterina Korneeva
PD2	11/01/2018	Group 3	Jeffrey H. Dyer and Kentaro Nobeoka, K. "Creating and managing a high-performance knowledge-sharing network: The Toyota case." Strategic Management Journal 21.3 (2000): 345–367.	Ekaterina Korneeva
		Group 4	Ron Adner and Rahul Kapoor. "Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations." Strategic Management Journal 31.3 (2010): 306-333.	Ekaterina Korneeva
PD3	18/01/2018	Group 5	Vickery, Shawnee K., Xenophon Koufteros, Cornelia Dröge, and Roger Calantone. "Product Modularity, Process Modularity, and New Product Introduction Performance: Does Complexity Matter?." Production and Operations Management 25, no. 4 (2016): 751-770.	Ekaterina Korneeva
		Group 6	Davies, Jane, and Nitin Joglekar. "Supply chain integration, product modularity, and market valuation: Evidence from the solar energy industry." Production and Operations Management 22, no. 6 (2013): 1494-1508.	Ekaterina Korneeva
PD4	25/01/2018	Group 7	Baldwin, Carliss Y., and Joachim Henkel. "Modularity and intellectual property protection." Strategic Management Journal 36, no. 11 (2015): 1637-1655.	Ruth Jiang
		Group 8	Steensma, H. Kevin, Mukund Chari, and Ralph Heidl. "The quest for expansive intellectual property rights and the failure to disclose known relevant prior art." Strategic Management Journal 36, no. 8 (2015): 1186-1204.	Ruth Jiang
PD5	01/02/2018	Group 9	Two Cases of Recent Standard Battles: Joint presentation of - Gallagher, Scott R. "The battle of the blue laser DVDs: The significance of corporate strategy in standards battles." Technovation 32, no. 2 (2012): 90-98. - Angulo, Jorge, Joan Calzada, and Alejandro Estruch. "Selection of standards for digital television: The battle for Latin America." Telecommunications Policy 35, no. 8 (2011): 773-787.	Ruth Jiang
		Group 10	Suarez, Fernando F., Stine Grodal, and Aleksios Gotsopoulos. "Perfect timing? Dominant category, dominant design, and the window of opportunity for firm entry." Strategic Management Journal 36, no. 3 (2015): 437-448.	Ruth Jiang

### 3 INDIVIDUAL SESSIONS

You find further below a brief description of each session. Please make sure to complete the pre-assignment (case study) before coming to class. In addition, we strongly recommend to read the suggested readings, or at least to skim these papers. This will help you to prepare the case studies for the class discussions.

#### Session 1: Introduction & Technological Change

Session Title:	<b>Introduction &amp; Technological Change</b>
Date:	07.12.2017
Lecturer:	Prof. Torsten-Oliver Salge, Ph.D.
Description:	This first session is meant to introduce you to strategic technology management (STM). In a first part, the overall structure of this course, the teaching approach and the examination requirements will be described. In a second part, we will explore why adopting a strategic approach to technology management is of utmost importance for the performance and survival of firms operating in dynamic environments. We will draw on the theory of structural inertia and the dynamic capabilities view to examine the relative benefits and costs of exploiting existing technologies versus exploring new technological opportunities. We will then identify the circumstances under which a focus on technological exploration or exploitation appears most critical for firm survival. We will conclude by describing some of the key managerial decisions in the field of STM.
Learning Objectives:	<ul style="list-style-type: none"> <li>• Become familiar with the course structure, the teaching approach and the examination requirements</li> <li>• Revisit some of the key concepts with relevance to STM</li> <li>• Understand the need for a delicate balance between technological exploitation and exploration</li> <li>• Learn how to apply arguments from the theory of structural inertia and the dynamic capabilities view to aspects of STM</li> <li>• Identify key managerial decisions in the field of STM</li> </ul>
Pre-Assignment and Required Case:	<p><b>HBS Case 9-706-459: Polaroid: Entering Digital Imaging</b></p> <p>Polaroid Corporation, historically the best-known brand in instant photography, faced a host of challenges in 1997. Although Polaroid had enjoyed spectacular growth from the late 1940s through the late 1970s, its history since then had been more troubled. When its sales declined in the 1980s, Polaroid had attempted to expand into electronic- and digital-imaging technologies. During that decade, Polaroid's R&amp;D expenses averaged 8.8% of total revenues, and by 1989, 42% of the firm's R&amp;D dollars were devoted to electronic-imaging technologies. This research had led to several major technological breakthroughs, but few of the products that resulted from this effort had been successful. Its new-product failures had been extremely costly and had led to substantial losses and layoffs; Polaroid's workforce had shrunk from 21,000 in the late 1970s to about 10,000 in 1997. Most leading stock analysts and business publications were sceptical that Polaroid could turn things around. Internally, there was no consensus on how Polaroid could increase its sales and profits. Although Polaroid currently offered a wide range of traditional and digital-imaging products, in 1996 its established product lines in instant-</p>

	<p>camera and film accounted for 90% of its overall sales of almost \$2.2 billion, and its digital imaging products had lost \$120–\$130 million.</p> <p>Read the case and answer the following questions:</p> <ul style="list-style-type: none"> <li>• How did the top management team attempt to pursue technological exploitation (i.e. analog camera capabilities) and technological exploration (i.e. digital camera capabilities) at the same time? Which challenges did they encounter?</li> <li>• What inertial forces were at play in the case of Polaroid? That is, why was it so difficult for Polaroid to adapt its offerings to the requirements of the digital age?</li> <li>• How would you evaluate the management performance during the transition process?</li> <li>• If consulted during the process, what measures would you have proposed to facilitate the technological adaptation process?</li> </ul> <p><b>To explore these issues in greater depth, we invite you to read the following well-known SMJ article:</b> Mary Tripsas and Giovanni Gavetti. "Capabilities, cognition, and inertia: Evidence from digital imaging." <i>Strategic Management Journal</i> 21.11 (2000): 1147–1161.</p>
Suggested Readings:	<p>J. Jansen, F. Van Den Bosch &amp; H. Volberda, H. "Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators." <i>Management Science</i> 52 (2007): 1661-1674.</p> <p>Jakop Edler, Frieder Meyer-Krahmer and Guido Reger. "Changes in the strategic management of technology: results of a global benchmarking study." <i>R&amp;D Management</i> 32 (2002): 149-164.</p>
Supplemental Readings:	<p>William P. Barnett and John Freeman. "Too much of a good thing? Product proliferation and organizational failure." <i>Organization Science</i> 12.5 (2001): 539–558.</p> <p>Michael T. Hannan and John Freeman. "Structural inertia and organizational change." <i>American Sociological Review</i> 49.2 (1984): 149–164.</p> <p>Charles A. O'Reilly and Michael L. Tushman. "Ambidexterity as a dynamic capability: Resolving the innovator's dilemma." <i>Research in Organizational Behavior</i> 28 (2008): 185-206.</p> <p>David J. Teece. "Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance." <i>Strategic Management Journal</i> 28.13 (2007): 1319–1350.</p>

## Session 2: Scoping the Playing Field

Session Title:	<b>Scoping the Playing Field</b>
Date:	21.12.2017
Lecturer:	Prof. Torsten-Oliver Salge, Ph.D.
Description:	Given the scarcity of their resources, firms need to be selective in their technology development initiatives. Scoping the organisational



	<p>playing field by identifying strategic priorities for technology development is hence paramount for effective STM. In this session, we will turn to the market- and resource-based views in the field of strategy for guidance on this important question. Building on these insights, we will compare and contrast the market pull and technology push model. We will also explore a number of strategy and technology portfolios, which are simple, yet useful tools to map and assess a set of development options. Last, we will discuss the importance of timing by juxtaposing the benefits, challenges and requirements of first-mover and follower strategies.</p>
<p>Learning Objectives:</p>	<ul style="list-style-type: none"> <li>• Gain insights into the debate between the market-based view and the resource-based view in strategic management and its relevance for STM</li> <li>• Distinguish market pull and technology push approaches</li> <li>• Learn how to use strategy and technology portfolios</li> <li>• Understand the importance of timing in technology development</li> <li>• Identify some of the key strategic requirements for first movers and followers</li> <li>• Appreciate the complexities of resource allocation decisions for technology development</li> </ul>
<p>Pre-Assignment and Required Case:</p>	<p><b>HBS Case 4169: Applied Research Technologies, Inc.: Global Innovation’s Challenges</b></p> <p>Applied Research Technologies, Inc. (ART) is a diversified technology company which has built its success on its entrepreneurial culture and its reliance on innovation as a source of its ongoing competitive advantage. The case concentrates on the challenges faced by Peter Vyas, the Filtration Unit’s manager, who must decide whether to request \$2 million in project funding from his boss, Cynthia Jackson, the vice president of the division to which he reports. Similar filtration projects have failed twice before, damaging the credibility of the Filtration Unit and Vyas personally. We also learn that Jackson has recently been appointed to her job as division vice president and has been given the challenge of “turning around or shutting down” the Filtration Unit. To complicate matters further, the Filtration Unit must coordinate with the new technical center in India, which identified and developed the technology on which the new product is based. The students must decide what to do from both a business unit manager perspective as well as a division VP. This two-tier decision focus provides the opportunity to analyze the management decision process at different levels of the organization.</p> <p>Please read the case and answer the following questions:</p> <ul style="list-style-type: none"> <li>• As Peter Vyas, how would you handle the expenditure request for the re-launch of the mini water oxidation system?</li> <li>• As Cynthia Jackson, would you approve the expenditure request if Vyas sends it up to you?</li> <li>• How effective has Vyas been as a front-line manager at ART? How effective has Jackson been as an ART division vice president?</li> <li>• How has ART been able to foster innovation and an entrepreneurial environment in the context of a large corporate entity?</li> </ul>

<p>Suggested Readings:</p>	<p>Ashton Hawk, Goncalo Pacheco-De-Almeida and Bernard Yeung. Fast-mover advantages: speed capability and entry into the emerging of atlantic basin LNG, Strategic Management Journal 34.13 (2013): 1531-1550. <b>(Paper to be presented by Group 1)</b></p> <p>Vouri, T.O., and Huy, Q., N. "Distributed Attention and Shared Emotions in the Innovation Process." Administrative Science Quarterly 61.1 (2016): 9-51. <b>(Paper to be presented by Group 2)</b></p>
<p>Supplemental Readings:</p>	<p>Jay B. Barney. "Firm Resources and Sustained Competitive Advantage." Journal of Management 17.1 (1991): 99-120.</p> <p>Jay B. Barney, M. Wright and D.J. Ketchen. "The resource-based view of the firm: Ten years after 1991." Journal of Management 27.6 (2001): 625-641.</p> <p>Michael E. Porter. "The five competitive forces that shape strategy." Harvard Business Review 86.1 (2008): 78-93.</p>

### Session 3: Orchestrating the Ecosystem

<p>Session Title:</p>	<p><b>Orchestrating the Ecosystem</b></p>
<p>Date:</p>	<p>11.01.2018</p>
<p>Lecturer:</p>	<p>Prof. Torsten-Oliver Salge, Ph.D.</p>
<p>Description:</p>	<p>The locus of technology development and competition is shifting from the individual organization to the organizational ecosystem. As a result, the long dominant closed innovation model is gradually being replaced by more open approaches as part of which organizations broaden the range of external partners they rely upon to fuel their technology development efforts. Establishing and managing this ecosystem thus become a vital task of STM. In this session, we will draw on the relational view of the firm to explore the merits and challenges associated with such a more collaborative model. We will also identify key resources and capabilities firms need to establish if they are to establish, cultivate and benefit from a strong innovation ecosystem.</p>
<p>Learning Objectives:</p>	<ul style="list-style-type: none"> <li>• Become familiar with the relational view of the firm as an extension of the resource-based view</li> <li>• Identify critical interdependencies among ecosystem members</li> <li>• Understand the merits and challenges of a collaborative approach to technological exploration and exploitation</li> <li>• Unpack the notion of orchestration capabilities and discuss other enablers of effective ecosystem leadership.</li> </ul>
<p>Pre-Assignment and Required Case:</p>	<p><b>Case by Ron Adner (2012): Michelin's PAX System: Why Things Go Wrong When You Do Everything Right</b></p> <p>In 1992, Michelin sought to come up with the next big innovation, one that would spur sales, grow profits, and redefine the way consumers would think about tires. The result—the PAX System—was an idea so good, so powerful, that it launched Michelin on an ambitious path to transform the entire tire industry. "The PAX System is our biggest technological breakthrough since we patented the radial tire in 1946," the company proudly announced. "In simple terms, we have reinvented the tire." The PAX System was a run-flat tire that would continue to "run flat" and not sacrifice performance even if punctured.</p>

	<p>If you suffered a blowout with run-flat tires, you could continue to drive as if nothing had happened. No need for an emergency pull-over. No need to get out the spare tire and jack from the trunk. And no need to call a tow truck and wait by the side of the road until it finally arrived. Instead, a light on your dashboard would let you know a puncture had occurred and that you could drive for another 125 miles, at up to 55 mph, before having to pull into a garage to get the tire repaired affordably and efficiently. Here was a truly great innovation—one that would make customers' lives easier and safer, while driving new profitable growth for the company. “The adoption of the PAX System is inevitable,” said Thierry Sortais, the PAX project director, summing up Michelin's expectations. High expectations indeed! By traditional standards, Michelin executed brilliantly on a well-thought-out innovation strategy. But in the end, despite brilliant execution, the PAX story is one of failure. Because when your success depends on others, as it did for Michelin, execution is not enough.</p> <p>Please read the case and answer the following questions:</p> <ul style="list-style-type: none"> <li>• Why did the new PAX system have such far-reaching implications for the tire industry?</li> <li>• Which key members of the innovation ecosystem needed to be on board for the innovation to succeed?</li> <li>• How do you evaluate Michelin's effectiveness in orchestrating the innovation ecosystem?</li> <li>• What would you have done differently? What alternative markets might have been an easier target to start with?</li> </ul>
<p>Suggested Readings:</p>	<p>Jeffrey H. Dyer and Kentaro Nobeoka, K. “Creating and managing a high-performance knowledge-sharing network: The Toyota case.” <i>Strategic Management Journal</i> 21.3 (2000): 345–367. <b><u>(Paper to be presented by Group 3)</u></b></p> <p>Ron Adner and Rahul Kapoor. “Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations.” <i>Strategic Management Journal</i> 31.3 (2010): 306-333. <b><u>(Paper to be presented by Group 4)</u></b></p>
<p>Supplemental Readings:</p>	<p>Ron Adner. “Match your innovation strategy to your innovation ecosystem.” <i>Harvard Business Review</i> 84.4 (2006): 98–107.</p> <p>Carliss Baldwin and Eric von Hippel. “Modeling a paradigm shift: From producer innovation to user and open collaborative innovation.” <i>Organization Science</i> 22 (2011): 1399–1417.</p> <p>Charles Dhanaraj and Arvind Parkhe. “Orchestrating innovation networks.” <i>Academy of Management Review</i> 31.3 (2006): 659-669.</p> <p>Jeffrey H. Dyer and Harbir Singh. The relational view: Cooperative strategy and sources of interorganizational competitive advantage. <i>Academy of Management Review</i> 23.4 (1998): 660–679.</p> <p>Keld Laursen and Ammon Salter. “Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms.” <i>Strategic Management Journal</i> 27 (2006): 131-150.</p>

## Session 4: Developing Modular Designs

Session Title:	<b>Developing Modular Designs</b>
Date:	18.01.2018
Lecturer:	Prof. Dr. Frank Piller
Description:	<p>Product modularity is a method of designing a product based on well-defined interfaces and architecture that fosters the organization of complex designs and process operations more efficiently by decomposing complex systems into simpler subsystems. Defining product architecture is a key strategic element in the engineering design of modular products. Well-defined product architecture and interfaces can foster the development of product platforms, which can help a firm easily introduce successive revenue-generating variants. During up-front product design, intelligently designing modularity into components and subsystems is an essential step toward development of a successful product line. Modular product architectures have many benefits from manufacturing flexibility to reduced R&amp;D expenses during product redesign. But modularity also has challenges and may even affect a strategic inability of a firm to innovate.</p>
Learning Objectives:	<ul style="list-style-type: none"> <li>• Understand the principles of modular product architecture and design</li> <li>• Understand the concept of a product platform</li> <li>• Obtain a basic understanding of the principles of developing a modular product architecture</li> <li>• Learn about the strategic opportunities and challenges of modularity and product platforms and generate an understanding of situations when integrated products are better</li> <li>• Understand the relationship between product modularity and disruptive technological innovation</li> </ul>
Pre-Assignment and Required Case:	<p><b>HBS Case 612002 (2013): Carl Zeiss Micro-Imaging</b> For Carl Zeiss Microimaging, modular hardware and software enabled customers to tailor Zeiss's broad range of microscopy systems hardware and software to meet a wide range of needs from basic scientific research in the biological and medical sciences to clinical applications, materials science, and industrial sectors.</p> <p>Modularity also provided Carl Zeiss' engineers the benefit of decoupling the development schedules of individual components and subsystems. Yet the well codified interfaces at many module boundaries also opened the system up to outside providers of components, mainly software. This served research scientists who were doing cutting edge research extremely well, as they wanted to be able to apply the latest techniques and analysis tools.</p> <p>At the other extreme, clinical and QA/QC applications by their nature had a much higher need for automation, because of the repetitive nature of tasks. Simple, integrated solutions seemed to make more sense in these circumstances, and many applications did not demand the ultraprecision of Carl Zeiss's hardware platforms. Rather there was a call for simplicity and robustness, especially in production environments. The case exposes some of the strategic issues and opportunities facing a business relying on strong modular product design.</p>

	<p>Read the case and answer the following questions:</p> <ul style="list-style-type: none"> <li>• What are the benefits of modularity for the customers of Zeiss's products targeting high-end research scientists?</li> <li>• What are the benefits of this approach for Zeiss? Could there be any alternative to the development approach taken by Zeiss?</li> <li>• Is Zeiss following the right approach in serving different markets with the same platforms? Do you agree with the segmentation between biomedical and industrial segments?</li> <li>• What alternatives does Zeiss have regarding digital microscopy software? Where would you focus the company's energies?</li> </ul>
<p>Suggested Readings:</p>	<p>David Robertson and Karl Ulrich. "Planning for Product Platforms." Sloan Management Review 39.4 (1998): 19-31.</p> <p>Vickery, Shawnee K., Xenophon Koufteros, Cornelia Dröge, and Roger Calantone. "Product Modularity, Process Modularity, and New Product Introduction Performance: Does Complexity Matter?" Production and Operations Management 25, no. 4 (2016): 751-770. <b>(Paper to be presented by Group 5)</b></p> <p>Davies, Jane, and Nitin Joglekar. "Supply chain integration, product modularity, and market valuation: Evidence from the solar energy industry." Production and Operations Management 22, no. 6 (2013): 1494-1508. <b>(Paper to be presented by Group 6)</b></p>
<p>Supplemental Readings:</p>	<p>Karl Ulrich and Steven Eppinger. Product Design and Development. McGraw-Hill 2008/2011, Chapter 9 on "Product Architecture".</p> <p>Simpson, Timothy W. "Product platform design and customization: status and promise." AI EDAM: Artificial Intelligence for Engineering Design, Analysis and Manufacturing 18.01 (2004): 3-20.</p> <p>Carliss Y. Baldwin and Kim B. Clark: Modularity in the Design of Complex Engineering Systems. In: Complex Engineered Systems, edited by Dan Braha et al. New York: Springer 2006: 175-205.</p>

## Session 5: Managing Intellectual Property

<p>Session Title:</p>	<p><b>Managing Intellectual Property</b></p>
<p>Date:</p>	<p>25.01.2018</p>
<p>Lecturer:</p>	<p>Prof. Dr. Frank Piller</p>
<p>Description:</p>	<p>Intellectual Property (IP) represents the output or intangible product of an individual's mind or intellect. IP can be an invention with patentable potential, copyright, a design, trademark, process or the practical application of a good idea (know-how). It is the typical outcome of a successful innovation process. IP can be one of the most valuable assets of an organization, as it can become a source of competitive advantage and bring considerable value to an organization when managed appropriately and effectively. Managing Intellectual Property is the process by which an organization can accurately identify, capture, evaluate, protect and monitor IP frequently for the purposes of further exploitation, usually</p>

	commercialization of some kind.
Learning Objectives:	<ul style="list-style-type: none"> <li>• Understand the different concepts of intellectual property</li> <li>• Get an idea what a patent is and how the process of obtaining a patent works</li> <li>• Frame intellectual property issues around appropriability and strategy.</li> <li>• Understand options to commercialize IP and the different forms of profiting from IP</li> <li>• Understand the ethical issues connected with managing IP</li> </ul>
Pre-Assignment and Required Case:	<p><b>HBS Case 613079: The LEGO Group: Publish or Protect?</b></p> <p>This first case refers to the strategic decision whether to patent an invention (and hence to reveal it to the public) or not. Senior managers at the LEGO Group are faced with a quandary: Should they patent inventions coming out of their manufacturing process development work, should they keep them as trade secrets, or should they publish them so that they would go into the public domain and nobody else could patent them? They wish to preserve their freedom to practice, but are very concerned about competitors' ability to benefit from LEGO Group's R&amp;D investments, or alternately interfere with its freedom to operate.</p> <p>To get a background of the patent system, <b>watch this video before reading the case</b> (it explains the US patent system but is also relevant for this case):</p> <ul style="list-style-type: none"> <li>• Video: Introduction to the Patent system: <a href="https://www.youtube.com/watch?v=vZ1SBP8ul1s">youtube.com/watch?v=vZ1SBP8ul1s</a></li> </ul> <p>The read the case and answer the following questions:</p> <ul style="list-style-type: none"> <li>• How much know-how should LEGO share with its tool suppliers? How practical is it in reality to prevent spillovers?</li> <li>• How much of LEGO Groups' process innovations are actually detectable, i.e., can one see the manufacturing process when looking at the product?</li> <li>• What is your recommendation how to drive the molding platform and how to protect it?</li> </ul> <p>Note: In case you do not know these technologies, these videos will help you to understand the technology behind the case study:</p> <ul style="list-style-type: none"> <li>• Plastic Injection Molding: <a href="https://www.youtube.com/watch?v=eUthHS3MTdA">youtube.com/watch?v=eUthHS3MTdA</a></li> <li>• EOS Laser Sintering of Tooling: <a href="https://www.youtube.com/watch?v=zqWOrwBzOjU">youtube.com/watch?v=zqWOrwBzOjU</a></li> </ul>
Suggested Readings:	<p>Baldwin, Carliss Y., and Joachim Henkel. "Modularity and intellectual property protection." <i>Strategic Management Journal</i> 36, no. 11 (2015): 1637-1655) (<b>Paper to be presented by Group 7</b>)</p> <p>Steensma, H. Kevin, Mukund Chari, and Ralph Heidl. "The quest for expansive intellectual property rights and the failure to disclose known relevant prior art." <i>Strategic Management Journal</i> 36, no. 8</p>

	(2015): 1186-1204. <b>(Paper to be presented by Group 8)</b>
Supplemental Readings:	<p>Fisher III, William W., and Felix Oberholzer-Gee. "Strategic management of intellectual property." California management review 55, no. 4 (2013): 157-183.</p> <p>Karl Ulrich and Steven Eppinger. Product Design and Development. McGraw-Hill 2008/2011, Chapter 14 on "Patents and Intellectual Property".</p>

## Session 6: Setting Industry Standards

Session Title:	<b>Setting Industry Standards</b>
Date:	01.02.2018
Lecturer:	Prof. Dr. Frank Piller
Description:	<p>This session will look upon two different, but interrelated topics of strategic technology management: The strive of firms to establish an industry standard and dominant design, and the challenge in firms often connected with such a strategy in cases to manage a disruptive technological change. We will use two case studies and two articles to discuss these issues.</p> <p>An industry (also: de facto) standard is a convention, product, or system that has achieved a dominant position by public acceptance or market forces (such as early entrance to the market) in an industry. A company that can establish such a standard based on its own products can gain a strong competitive position (an example is Microsoft's Windows OS or BlueRay system for HD videos). In recent years, "standard battles" have intensified, as often such a standard also allows becoming a central player in an entire industry ecosystem (a current example is the "fight" between Apple's iOS and Google's Android platform).</p> <p>Within a firm, the establishment of such a new standard often demands to cope with internal inertia to strategic change and technological disruption. We will study the change within one established company from one technological standard to another (conventional telephone service to Voice-over-IP) and look into typical strategic decisions of a technology manager in such a situation.</p>
Learning Objectives:	<ul style="list-style-type: none"> <li>• Understand the idea of de-facto (industry) standards and possible ways how a company can establish such a standard</li> <li>• Understand key factors that influence the adoption of new products or technologies from a customer/user point of view</li> <li>• Understand the trajectory of disruptive technologies and their progressive impact on established businesses.</li> <li>• The potential for self-disruption strategies as an alternative to competitive disruption.</li> <li>• The possibility of generating technical innovations that adapt disruptions into sustaining innovations for established businesses</li> </ul>
Pre-Assignment and Required Case:	<p><b>Ivey Case 901M03: Glegg Water Co. and the E-Cell: Securing the Adoption of a Superior Technology</b></p> <p>Glegg Water Co. is an international company that specializes in</p>

	<p>customizing pre-manufactured components into full industrial water treatment systems. In the early 1990s, the water treatment industry had introduced a process that removes charged particles from water used in industrial applications. This technology was superior to resin technology because it was more environmentally sound and more reliable. However, its applications were limited to low water flows. Glegg, through its development of the E-Cell, refined the technology, making it available to high water flow operations. Despite the clear technological superiority, Glegg was finding it difficult penetrating the market. The CEO must develop a strategy that will facilitate the adoption of this technology and make the E-Cell the industry standard.</p> <p>Read the case and answer the following questions:</p> <ul style="list-style-type: none"> <li>• What are the hurdles that the industry faces when introducing EDI (electrodeionization) technology?</li> <li>• What are key factors that are driving the adoption of this technology?</li> <li>• How could Glaegg Water Company facilitate the adoption of the E-Cell as the standard technology?</li> </ul>
<p><b>Suggested Readings:</b></p>	<p>Carl Shapiro and Hal R. Varian. "Art of Standard Wars." California Management Review 41.2 (1999): 8-32.</p> <p>Two Cases of Recent Standard Battles: Joint presentation of</p> <ul style="list-style-type: none"> <li>- Gallagher, Scott R. "The battle of the blue laser DVDs: The significance of corporate strategy in standards battles." Technovation 32, no. 2 (2012): 90-98.</li> <li>- Angulo, Jorge, Joan Calzada, and Alejandro Estruch. "Selection of standards for digital television: The battle for Latin America." Telecommunications Policy 35, no. 8 (2011): 773-787. <b>(Papers to be presented by Group 9)</b></li> </ul> <p>Suarez, Fernando F., Stine Grodal, and Aleksios Gotsopoulos. "Perfect timing? Dominant category, dominant design, and the window of opportunity for firm entry." Strategic Management Journal 36, no. 3 (2015): 437-448. <b>(Paper to be presented by Group 10)</b></p>
<p><b>Supplemental Readings:</b></p>	<p>Melissa A. Schilling. Strategic management of technological innovation. New York: McGraw-Hill/Irwin, 2005. <u>Chapter 4</u>: Standards Battles and Design Dominance: 63-81.</p>

## Session 7: Summary, Evaluation and Q&A

<p><b>Session Title:</b></p>	<p><b>Concluding Strategic Technology Management</b></p>
<p><b>Date:</b></p>	<p>tbc</p>
<p><b>Lecturer:</b></p>	<p>Prof. Dr. Frank Piller Prof. Torsten-Oliver Salge</p>
<p><b>Description:</b></p>	<p>This optional session scheduled to last about an hour offers you the opportunity to provide detailed feedback on this course and to discuss any examination-related questions you might have. Attending this session is optional.</p>



## 4 COURSE EXAMINATION

The exam for this course, counting for 50 percent of your overall mark, is likely to be structured as follows (obviously, only the structure announced on the exam day will apply):

### **Part 1: STM RESEARCH**

- Max. 30 points - probably two questions with up to three sub-questions each
- Explanation, illustration and/or application of key concepts, theories and tools in the field of STM.

### **Part 2: STM PRACTICE**

- Max. 30 points – short case study with probably three sub-questions
- Application of theoretical knowledge to particular case scenario (Need to analyse scenario using the knowledge acquired during the course in an attempt to propose thoughtful recommendations for managerial action)

A maximum of 60 points can hence be obtained. A minimum of 30 points will be required to pass the exam. Only those that passed the colloquium (group assignment and case discussion) are eligible for participation in the exam. The individual written exam will be formulated in English language. That said, students may decide to answer in either English or German. It is acceptable to switch language between questions (e.g. answer question 1 in English and question 2 in German). However, you may not switch languages within the same question. The exam is currently scheduled to take 60 minutes.

**We hope you will enjoy the course and look forward to working with you!**