STRATEGIC TECHNOLOGY MANAGEMENT
Course Outline

PROFESSOR DR. FRANK PILLER
PROFESSOR DR. TORSTEN OLIVER SALGE

School of Business and Economics
TIME Research Area | www.time.rwth-aachen.de | Kackertstraße 7, Aachen

Contact: Fabian Grimm | grimm@time.rwth-aachen.de

WINTER TERM 2021/2022

COURSE OVERVIEW

Course Name:	**Strategic Technology Management**
Degree Programmes:	• Master BWL (Innovation, Entrepreneurship and Marketing – core course) • Master Wirtschaftsingenieurwesen (Management des Innovationsprozesses) • Master Wirtschaftswissenschaften (Wahl B)
Lecturer:	Prof. Dr. Frank Piller and Prof. Dr. Torsten Oliver Salge
Contact:	Fabian Grimm (grimm@time.rwth-aachen.de, +49 241 80 99199)
Location and Time:	1) In-class Sessions at 3011 Kackertstraße-Haus B, Kackertstr. 7 | 037 (3011|037). Tuesday, 10:30am – 2:30pm: 19 October, 26 October, 9 November. 2) In-class Sessions at H11 (1385 | 218) Tuesday, 10:30am – 4:00pm: 7 December, 14 December, 21 December. **Please note:** Due to the covid pandemic, it may be necessary to switch to an online format.
Content Description:	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 might pertain for instance to • the selection of technology fields, • the composition of innovation portfolios, • the timing of technology development initiatives, • the development of innovation processes, • the search for new ideas, • the involvement of users, • the implementation of modular designs, • the orchestration of strategic alliances, • the protection of intellectual property. As part of this course, participants will have the opportunity to become familiar with case studies and/or research papers related to these topics.
Qualification Objectives:	After participating in this course students should be in a position to: • understand and critically reflect upon key concepts and theories in STM, • understand and critically discuss conceptual and empirical research papers on STM, • analyse and develop adequate solutions to some of the practical challenges of STM, and • apply important tools in STM intelligently based on a thorough understanding of their respective strengths and weaknesses.
Literature:	See below in the session descriptions. All papers will be made available on Moodle before a session.
Course Examination:	The final grade can be composed as followed: • Option **A**: Colloquium & presentation (weight: 50%) and student paper (weight: 50%)

	• Option **B**: Colloquium & presentation (weight: 50%) and written exam (75 minutes in total; 60 minutes writing and 15 minutes case reading time, weight: 50%) • Option **C**: Written exam (75 minutes in total; 60 minutes writing and 15 minutes case reading time, weight: 100%) In the winter term 2021/2022, **Option B will be applied** for the grading of this class. A maximum of 60 points can be obtained for each of the elements. The final points and grade is the weighted average of the elements, and you need 50 percent of all points to pass. Note for Master W-Ing students: In addition to the aspects above, all industrial engineers have to pass each of the examination elements individually (according to ÜPO §10 (8) and the program-specific regulations (fachspezifische PO for M.Sc. W.Ing.) §9 (2)). **Please Note**: Please, also be aware of the special rules for examination registration and cancelation.
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 and watching the lecture videos in advance). In case of the digital realization of the course in winter semester 21/22: There is **no compulsory attendance** in this module. However, the class participation grade is 50% of the total grade. We would therefore like to point out to all participants that **video transmission** is desired and recommended for the online sessions in order to enable an interactive learning atmosphere. In addition, we ask you to indicate a clearly **identifiable name** so that we can assign your oral participation accordingly. This module is not based on lecture videos, but on a discussion format. The sessions are **not recorded**. If you do not approve of this format with the necessary digital precautions, please choose another module. Getting an idea of **class participation** in online sessions: You can use the chat function to raise questions or comments. Raise your hand via zoom and wait to speak up. The professors might use “Cold Calls” at all times during the live session, if necessary. There are smaller group work tasks during the live sessions to facilitate interaction (e.g. preparation of a case discussion in small randomly assigned groups, presentation of prepared content in the plenum afterwards or joint interactive development of content in open online documents).
Group Size:	45 participants (max)
Workload:	30 hours of lecturing. 120 hours of individual and group preparation.
Type of Teaching:	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 6 three and a half hour sessions, five of which will be subdivided into three parts consisting of (1) an interactive lecture, (2) case study discussion and (3) up to 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
Sessions in Class				
1	19 Oct 2021	10:30am – 2:30pm; Kackertstraße-Haus B (3011 | B037)	Prof. Dr. Salge	**Introduction & Technological Change**
2	26 Oct 2021	10:30am – 2:30pm; Kackertstraße-Haus B (3011 | B037)	Prof. Dr. Salge	**Scoping the Playing Field**
3	9 Nov 2021	10:30am – 2:30pm; Kackertstraße-Haus B (3011 | B037)	Prof. Dr. Salge & Dr. Caferoglu	**Orchestrating the Ecosystem**
4	7 Dec 2021	10:30am – 4pm; H11 (1385 | 218)	Prof. Dr. Piller	**Developing Modular Designs**
5	14 Dec 2021	10:30am – 4pm; H11 (1385 | 218)	Prof. Dr. Piller	**Managing Intellectual Property**
6	21 Dec 2021	10:30am – 4pm; H11 (1385 | 218)	Prof. Dr. Piller	**Setting Industry Standards**
Examination				
7	tbd	tbd		**Examination Date I**
8	tbd	tbd		**Examination Date II**

This course will be managed via the e-learning platform Moodle. 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 Moodle. It is hence essential for you to **sign up for our Moodle course by 18 October 2021** 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 kindly ask you to **send a recent photo** of you (filename: yourfirstname_ yourlastname.jpg) in an eMail with the Subject "STM Picture" to grimm@time.rwth-aachen.de by **18 October 2021**. Without your picture, the grading process of your class contributions will be more challenging.

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. Hence attendance is highly recommended. As for the **case discussions**, it is essential for all course participants to carefully read the case at home, ready to discuss the questions listed in the session description below. Further, we provide lecture videos, which help to understand the contents discussed in class.

As for the **group assignment**, each student will be assigned to a group typically consisting of three to four members. We will ask each group to present and critically discuss one academic paper in a **recorded screencast**. Additionally, each group will pitch their paper in class and discuss it with the audience. It is therefore **recommended for all participants to watch the screencast** before each in-class session. 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.*

The **screencast** needs to be supported with **up to 20 PowerPoint slides** and should **not exceed 20 minutes**. The final screencast needs to be **uploaded to Moodle by 3 pm the Sunday BEFORE your presentation**. Instructions how to create and upload a screencast are available on Moodle.

In class, 15 minutes will be allocated to each group, of which 5 should be used to **pitch the core messages and conclusions of your paper** and 10 for **questions and answers with the audience**. You *can* support your pitch with up to 5 PowerPoint slides using the template available on Moodle *(but you can also use other means of presentation)*. Additionally, you *can* provide a handout to the audience. If you decide to include slides and a handout for your pitch, both files (pitch slides and handout) need to be uploaded to Moodle by **3 pm the Sunday BEFORE your presentation in ppt and pdf format**. You will also need to save both files on a memory stick and bring it with you to class. The language for the screencast and the pitch along with the discussion with the audience is English.

You can select your preferred group via Moodle. You can only select one group. Group size is limited to a maximum of 4 members per group. Groups will have to have at least 2 members to be formed. The group allocation starts after the first session on **19 October, 8 pm**. Please apply for your preferred group **until 20 October, 8 pm**. If you do not select a preferred group, you will be assigned to a group by the lecturer. Final group compositions will be announced **via Moodle by 22 October.**

There will be **a coaching session** on **21 October,** from **03:00pm – 4:00pm** on how to best approach your paper discussion held by Fabian Grimm. We will meet via Zoom. The link for entering the meeting will be available on RWTHmoodle. In addition, each group can request an optional 45-minute coaching session with Fabian Grimm, which will take place via Zoom. We expect that you proactively get in contact with Fabian Grimm to schedule an appointment.

We want 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 screencast might look like this – but you are open to find another structure to differentiate your presentation from the others! Be creative!

(1) Introduction: Tell us why the paper's research question matters for research & practice
(2) Paper Description
    - Research Question
    - Conceptual Framework and Research Design
(3) Paper Discussion
    - Strengths and Weaknesses
    - Possible Refinements and Extensions
(4) Conclusions and contributions to strategic technology management

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

Schedule for Paper Discussions

#	Date	Group	Paper (Please Note: The final paper assignments will be announced with the group composition. The papers listed below are for your orientation only.)
PD1	09/11/2021	Group 1	Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. Strategic Management Journal, 21(3), 345–367.
		Group 2	Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. Strategic Management Journal, 31(3), 306-333.
PD2	07/12/2021	Group 3	Vickery, S. K., Koufteros, X., Dröge, C., & Calantone, R. (2016). Product modularity, process modularity, and new product introduction performance: does complexity matter?. *Production and Operations Management*, *25*(4), 751-770.
		Group 4	Ethiraj, S. K., Levinthal, D., & Roy, R. R. (2008). The dual role of modularity: Innovation and imitation. *Management Science*, *54*(5), 939-955.
PD3	14/12/2021	Group 5	Chung, J., Lorenz, A., & Somaya, D. (2019). Dealing with intellectual property (IP) landmines: Defensive measures to address the problem of IP access. *Research Policy*, *48*(9), 103828.
		Group 6	Friesike, S., Flath, C. M., Wirth, M., & Thiesse, F. (2019). Creativity and productivity in product design for additive manufacturing: Mechanisms and platform outcomes of remixing. *Journal of Operations Management*, *65*(8), 735-752.
PD4	21/12/2021	Group 7	Beltagui, A., Rosli, A., & Candi, M. (2020). Exaptation in a digital innovation ecosystem: The disruptive impacts of 3D printing. *Research policy*, *49*(1), 103833.
		Group 8	Roscoe, S., Cousins, P. D., & Handfield, R. (2019). The microfoundations of an operational capability in digital manufacturing. *Journal of Operations Management*, *65*(8), 774-793.

3 INDIVIDUAL SESSIONS

At the beginning of the semester, you will find a description of each session in the detailed syllabus. 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:	Introduction & Technological Change
Date:	19 Oct 2021
Lecturer:	Prof. Dr. Salge
Description:	This 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 Objective:	• Become familiar with the course structure, the teaching approach and the examination requirements • Revisit some of the key concepts with relevance to STM • Understand the need for a delicate balance between technological exploitation and exploration • Learn how to apply arguments from the theory of structural inertia and the dynamic capabilities view to aspects of STM • Identify key managerial decisions in the field of STM
Pre-Assignment and Required Case:	**HBS Case 9-706-459: Polaroid: Entering Digital Imaging** 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&D expenses averaged 8.8% of total revenues, and by 1989, 42% of the firm's R&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-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. Read the case and answer the following questions: • 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? • 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? • How would you evaluate the management performance during the transition process? • If consulted during the process, what measures would you have proposed to facilitate the technological adaptation process? To explore these issues in greater depth, we invite you to read the following well-known SMJ article: Tripsas, M., & Gavetti, G. (2000). Capabilities, cognition, and inertia: Evidence from digital imaging. Strategic Management Journal, 21(11), 1147–1161.
Suggested Readings:	Jansen, J., Van Den Bosch, F., & Volberda, H. (2007). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. Management Science, 52, 1661-1674. Edler, J., Meyer-Krahmer, F., & Reger, G. (2002). Changes in the strategic management of technology: results of a global benchmarking study. R&D Management, 32, 149- 164.
Supplemental Readings:	Barnett, W. P., & Freeman, J. (2001). Too much of a good thing? Product proliferation and organizational failure. Organization Science, 12(5), 539–558. Hannan, M. T., & Freeman, J. (1984). Structural inertia and organizational change. American Sociological Review, 49(2), 149–164. O'Reilly, C. A., & Tushman, M. L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. Research in Organizational Behavior, 28, 185-206. Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. Strategic Management Journal, 28(13), 1319–1350

Session 2: Scoping the Playing Field

Session Title:	Scoping the Playing Field
Date:	26 Oct 2021

Lecturer:	Prof. Dr. Salge
Description:	Given the scarcity of their resources, firms need to be selective in their technology development initiatives. Scoping the organisational 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.
Learning Objective:	• Gain insights into the debate between the market-based view and the resource-based view in strategic management and ist relevance for STM • Distinguish market pull and technology push approaches • Learn how to use strategy and technology portfolios
Pre-Assignment and Required Case:	**HBS Case 4169: Applied Research Technologies, Inc.: Global Innovation's Challenges** 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. Please read the case and answer the following questions: • As Peter Vyas, how would you handle the expenditure request for the re-launch of the mini water oxidation system? • As Cynthia Jackson, would you approve the expenditure request if Vyas sends it up to you?

	• How effective has Vyas been as a front-line manager at ART? How effective has Jackson been as an ART division vice president? • How has ART been able to foster innovation and an entrepreneurial environment in the context of a large corporate entity?
Suggested Readings:	Hawk, A., Pacheco-De-Almeida, G., & Yeung, B. (2013). Fast mover advantages: speed capability and entry into the emerging of atlantic basin LNG. Strategic Management Journal, 34(13), 1531-1550. Vouri, T.O., & Huy, Q., N. (2016). Distributed Attention and Shared Emotions in the Innovation Process. Administrative Science Quarterly, 61(1), 9-51.
Supplemental Readings:	Barney, J. B.(1991). Firm Resources and Sustained Competitive Advantage. Journal of Management, 17(1), 99-120. Barney, J. B., Wright, M. & Ketchen, D. J. (2001). The resource-based view of the firm: Ten years after 1991. Journal of Management, 27(6), 625–641. Porter, M. E. (2008). The five competitive forces that shape strategy. Harvard Business Review, 86(1), 78–93.

Session 3: Orchestrating the Ecosystem

Session Title:	Orchestrating the Ecosystem
Date:	09 Nov 2021
Lecturer:	Prof. Dr. Salge & Dr. Caferoglu
Description:	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.
Learning Objective:	• Become familiar with the relational view of the firm as an extension of the resource-based view • Identify critical interdependencies among ecosystem members • Understand the merits and challenges of a collaborative approach to technological exploration and exploitation • Unpack the notion of orchestration capabilities and discuss other enablers of effective ecosystem leadership.
Pre-Assignment and Required Case:	**Case by Ron Adner (2012): Michelin's PAX System: Why Things Go Wrong When You Do Everything Right**

	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. 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*. Please read the case and answer the following questions: • Why did the new PAX system have such far-reaching implications for the tire industry? • Which key members of the innovation ecosystem needed to be on board for the innovation to succeed? • How do you evaluate Michelin's effectiveness in orchestrating the innovation ecosystem? • What would you have done differently? What alternative markets might have been an easier target to start with?
Suggested Readings:	Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. Strategic Management Journal, 21(3), 345–367. Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm per¬formance in new technology generations. Strategic Management Journal, 31(3), 306-333.
Supplemental Readings:	Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. Harvard Business Review, 84(4), 98–107. Baldwin, C., & von Hippel, E. (2011). Modeling a paradigm shift: From producer innovation to user and open collaborative innovation. Organization Science, 22, 1399– 1417.

	Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. Academy of Management Review, 31(3), 659- 669. Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. Academy of Management Review, 23(4), 660–679. Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. Strategic Management Journal, 27, 131-150.

Session 4: Developing Modular Designs

Session Title:	Developing Modular Designs
Date:	07 Dec 2021
Lecturer:	Prof. Dr. Piller
Description:	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&D expenses during product redesign. But modularity also has challenges and may even affect a strategic inability of a firm to innovate.
Learning Objective:	• Understand the principles of modular product architecture and design • Understand the concept of a product platform • Obtain a basic understanding of the principles of developing a modular product architecture • Learn about the strategic opportunities and challenges of modularity and product platforms and generate an understanding of situations when integrated products are better • Understand the relationship between product modularity and disruptive technological innovation
Pre-Assignment and Required Case:	**HBS 614007: Carl Zeiss and Free-form Production: Can We See Clearly Yet?** In this class, we look at a key framework for understanding the structure of much of today's technology sector: modularity and the associated vertical specialization found in many industry value chains. Modularity is an important framework for understanding the

	structure of products, firms, and markets. Modularizing a system is an approach used by many technology product designers, as well as service providers, to managing complexity in design and production. By dividing complex systems into smaller pieces (modules), connected to each other with well-defined interfaces, firms can accomplish a division of labor that enables flexibility and specialization, accommodating different rates of technological progression, and exploitation of scale economies. Carl Zeiss Vision International is a longtime incumbent in the vision care industry, manufacturing both a number of instruments used by eye care professionals (ECPs) and the prescription lenses for correcting vision. The Zeiss case opens with Karen Roberts, Director of New Business at Carl Zeiss Vision International, talking about the emergence of a new technology, free-form production, which promises to offer more flexibility and supplant traditional lens production technologies for the manufacture of progressive lenses. Key Zeiss competitor Essilor has assembled a significant amount of channel control in the traditional distribution value network for eye care products. As you read through it, consider the following questions: • Can you use the Baldwin and Clark reading as a framework to explain the current state of the prescription eyewear industry? • How would you characterize the changes to the production methods for free-form lenses? • Where did all the profit go in the prescription Rx value chain? • What alternatives are available to Zeiss, and what do you recommend? Carliss Y. Baldwin and Kim B. Clark, “Managing in an Age of Modularity,” Harvard Business Review, Vol. 75, No. 5 (September-October 1997): pp. 84-93
Suggested Readings:	Vickery, S. K., Koufteros, X., Dröge, C., & Calantone, R. (2016). Product modularity, process modularity, and new product introduction performance: does complexity matter?. *Production and Operations Management*, *25*(4), 751-770. Ethiraj, S. K., Levinthal, D., & Roy, R. R. (2008). The dual role of modularity: Innovation and imitation. *Management Science*, *54*(5), 939-955.

Session 5: Managing Intellectual Property

Session Title:	Managing Intellectual Property
Date:	14 Dec 2021
Lecturer:	Prof. Dr. Piller

Description:	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 commercialization of some kind.
Learning Objective:	• Understand the different concepts of intellectual property • Get an idea what a patent is and how the process of obtaining a patent works • Frame intellectual property issues around • appropriability and strategy. • Understand options to commercialize IP and the different forms of profiting from IP • Understand the ethical issues connected with managing IP
Pre-Assignment and Required Case:	**Ivey W20431: The PikoGym Entrepreneurs: Muscling Up through Intellectual Property** Frustrated with the available means of working out while travelling, the three founders of PikoGym, a start-up out of Erlangen, Germany, had the idea to build a workout device that allowed users to train anywhere and everywhere. The lightweight and compact solution would be combined with a progressive web application to facilitate customers meeting up for workouts, provide motivation, and build community. PikoGym would be entering a growing but highly competitive and relatively fragmented market. Although competitors' solutions were similar to PikoGym's, they lacked the versatility and comfort offered by the latter. The three entrepreneurs wanted to ensure that their intellectual property (IP) management strategy aligned with their business goals and long-term plans for the company's success. The case presents problems faced by many start-up founders at the very beginning of the founding process, with a special emphasis on IP rights and their strategic use. By working through the case study and assignment questions, we will discuss how different IP rights and product specifications reflect strategic IP options, examine relevant IP strategies for new market entrants, and practice to select the right relevant strategic options regarding IP. As you read through THE CASE, consider the following questions: 1) Analyze the use of IP by PikoGym's competitors? Which strategic options do they employ? 2) What are the strategic options for IP you can identify for the founders of PikoGym? 3) What would you recommend them as a legal or de factor IP protection for their startup?

Suggested Readings:	Chung, J., Lorenz, A., & Somaya, D. (2019). Dealing with intellectual property (IP) landmines: Defensive measures to address the problem of IP access. *Research Policy*, *48*(9), 103828. Friesike, S., Flath, C. M., Wirth, M., & Thiesse, F. (2019). Creativity and productivity in product design for additive manufacturing: Mechanisms and platform outcomes of remixing. *Journal of Operations Management*, *65*(8), 735-752.

Session 6: Setting Industry Standards

Session Title:	Setting Industry Standards
Date:	21 Dec 2021
Lecturer:	Prof. Dr. Piller
Description:	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. 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). 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.
Learning Objective:	• Understand the idea of de-facto (industry) standards and possible ways how a company can establish such a standard. • Understand key factors that influence the adoption of new products or technologies from a customer/user point of view. • Understand the trajectory of disruptive technologies and their progressive impact on established businesses. • The potential for self-disruption strategies as an alternative to competitive disruption.

Pre-Assignment and Required Case:	**HBS 717428: Digitalization at Siemens** The case discusses the digitalization strategy of Siemens AG within the Industrial Internet of Things (IIOT). The increasing impact of digital technologies on all of its business units had prompted the CEO Joe Kaeser and his team to put digitalization at the core of the new corporate strategy, alongside electrification and automation. The challenge was to balance this corporate initiative with the many business units within Siemens, which were used to being independent and had very specific offerings for their clients. For its new analytics platform, Siemens had opted for a push and pull approach to involve business units in its creation, rather than conceptualizing the platform centrally and imposing it on the business units afterwards. But will this approach drive digitalization within Siemens fast enough, given the exponential developments in data generation and analytics? We will examine how the industrial internet will involve, and whether Siemens has the right approach to ensuring its adoption throughout the corporation. We will expand our discussion into the positioning of a huge company like Siemens in the even larger world of IIOT and the role of data spaces and open vs. proprietary standards connecting those. As you read through it, consider the following questions: • What is the vision for the future of the industrial internet (Internet of Things/Industry 4.0)? What new business models does it support? What changes is it leading to in your businesses? • Does it make sense for Siemens to pursue the “Digitalization” initiative as part of Vision 2020? • How do you evaluate Siemens approach to digitalization? Is it likely to be more or less effective than the comparable effort at GE? • More generally, and given you experiences, when do corporate level initiatives like this work? Not work? When is it appropriate for a company to launch a “corporate initiative?
Suggested Readings:	Beltagui, A., Rosli, A., & Candi, M. (2020). Exaptation in a digital innovation ecosystem: The disruptive impacts of 3D printing. *Research policy*, *49*(1), 103833. Roscoe, S., Cousins, P. D., & Handfield, R. (2019). The microfoundations of an operational capability in digital manufacturing. *Journal of Operations Management*, *65*(8), 774-793.

4 COURSE EXAMINATION

The final grade can be composed as followed:

- Option A: Colloquium & presentation (weight: 50%) and student paper (weight: 50%)
- Option B: Colloquium & presentation (weight: 50%) and written exam (75 minutes in total; 60 minutes writing and 15 minutes case reading time, weight: 50%)
- Option C: Written exam (75 minutes in total; 60 minutes writing and 15 minutes case reading time, weight: 100%)

In the winter term 2021/2022, **Option B will be applied** for the grading of this class.
A maximum of 60 points can be obtained for each of the elements. The final points and grade is the weighted average of the elements, and you need 50 percent of all points to pass.

Note for Master W-Ing students: In addition to the aspects above, all industrial engineers have to pass each of the examination elements individually (according to ÜPO §10 (8) and the program-specific regulations (fachspezifische PO for M.Sc. W.Ing.) §9 (2)).

Please Note: Please, also be aware of the special rules for examination registration and cancelation.

The written exam 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 – e.g. closed-ended questions, gapped-texts
- 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. The individual written exam will be in English language. The exam is currently scheduled to take 75 minutes, of which 15 minutes are dedicated solely to reading the case and 60 minutes to solve the exam.

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