TECHNOLOGY and innovation management

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| Course code | *GRAI022* |
| Course title | *Technology and Innovation Management* |
| Type of course | *Compulsory* |
| Stage of study | *Graduate* |
| ECTS | *6 ECT ;  32 hours of class work, 128 hours of self-study, 2 hours of consultations (distant or direct form)* |
| Coordinating lecturers | *Dr. Jason Li-Ying, yinli@dtu.dk* |
| Studies form | *Full-time* |
| Prerequisites | *Undergraduate diploma* |
| Language of instruction | *English* |

**Course description**

This course approaches the management of technological innovation from a resource/knowledge based view, which sees technological innovations as a driving force of competitive advantage of organizations through a combination of internal resources and external linkages. Students are introduced to the theories, models, tools and practical cases from industries by understanding what technological innovations are, why they are important, and what are needed to enable and manage technological innovations within and outside of the boundary of organizations. Although most attention will be paid to innovations made by industrial firms, relevant issues of innovations at levels of individual, team, network of organizations, and industry will be addressed as well. The weekly readings consist of a mixture of book chapters, journal articles, and cases.

**Course aim**

The primary goal of the course is to expose students to a variety of perspectives on technological innovation, building on an active learning process and preparing for work experiences in the future.

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| **Course learning outcomes (CLO)** | **Study methods** | **Assessment methods** |
| **CLO 1:** Understanding the phenomena of innovation. Define what innovation is and what different types of innovations are, and explain why innovation is important. | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |
| **CLO 2:** Pinpoint the role of technology in innovation both in theory and in practice. | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |
| **CLO 3** To explain the key concepts of Schumpeterian theory and technology in relation to technological innovation. | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |
| **CLO 4** To be able to describe what are the key concepts of resource-based view and its relevance to innovation strategy | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |
| **CLO 5** To be able to explain the key concepts of knowledge and learning and its relevance to innovation and the innovation process within an organization. | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |
| **CLO 6** To be able to explain the organizational implications, including decision making under uncertainty with regard to innovation and the open innovation perspective and how external resources are possibly expanded into a larger scope thanks to an open approach of innovation. | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |
| **CLO 7** To discuss the strengths and weaknesses of the theoretical perspectives form the course curriculum. | Lectures, seminars, self-study, group work, case studies. | Active participation in discussion, case analyses assessment, and group project. |

**Quality assurance issues**

The lecturer will apply multiple teaching methods to keep the students engaged in the topic (case studies). Continuous student feedback will be encouraged and accommodated to continuously improve class experience.

Course content

| Date | Topic | Contact hours | | Readings |
| --- | --- | --- | --- | --- |
| Theory | Practice |
|  | Session 1: Introduction: What is innovation and why is it important? **Workshop: The innovation management game:** Paper plane design and innovation. **Mini case on class**: The Driverless Revolution case (Fortune 2012)  **Learning objectives:** (1) Define what innovation is and what different types of innovations are: (2) Explain why innovation is important. Session 2: Technology, innovations, and an overview of technological innovation process **Workshop: Mini case on class**: Smoothed by Science (FT 2013)  **Learning objectives**: (1) Pinpoint the role of technology in innovation both in theory and in practice; (2) Identify relevant issues about innovation when exposed to a real-life situation. | 4 | 4 | **Session 1**  Coursebook: Chapter 1, pp.1-24.  Article 1  **Session 2**  Coursebook:Chapter 3, pp.54-92.  Articles 2 &3 |
|  | Session 3: Make innovation happen: Products and Service Innovation **Workshop: Group exercise on class**: On campus service innovation  **Learning objectives:** (1) distinguish product and service innovations; (2) understanding the relationship between product and service innovations; (3) recognize that innovation is not only a process and but also the success of innovations rely on what the offerings are; (4) understanding products and service innovation needs to create value.  **Session 4**: Make innovation happen: Resource-based view and innovation strategy  **Workshop: Group exercise on class**: The RBV-game. Time reserved for group discussion regarding to case company search. | 4 | 4 | **Session 3**  Course-book Chapter 7, pp.197-234.  Articles 4 & 5  **Session 4**  Course-book  Chapter 4, pp.94-132.  Article 6 |
|  | Session 5: The external side: Open innovation and Networks for innovation - a RBV view **Workshop: Mini case/exercise on class**: TBA  **Learning objectives:** (1) Explain the open innovation perspective and what external technology sources are; (2) Explain how networks and collaboration with external parties are possibly expanded into a larger scope thanks to an open approach of innovation; (3) the importance of external technology sourcing and spill-over effects; (4) the inputs from users for innovation. Session 6: The external side: Open innovation and Networks for innovation - a governance view **Workshop:** Group exercise on class: The network industrial fair. Time reserved for group presentation of the selected case company at the beginning of the afternoon session. Each group has 5 min for pitching and 5 min for feedback. On-site approval will be made.  **Learning objectives:** (1) Explain the governance perspective towards networked innovation management; (2) recognize various means to mitigate risks in innovation by being embedded in networks. | 4 | 4 | **Session 5**  Course-book  Chapter 5, pp.131-159.  Articles 7 & 8.  **Session 6**  Course-book  Chapter 5, pp.131-159.  Articles 9 & 10. |
|  | Session 7: The internal side: R&D Management, Operations, and processes **Workshop:** Chapter 6, pp.160-196 and Chapter 8, pp.235-266  **Learning objectives:** (1) clearly recognize the role of R&D in relation to technological innovation; (2) distinguish the underlying patterns of learning with regard to R&D within an organization. Session 8: Decision Making under Uncertainty and course summary **Workshop:** Group exercise on class: The hypothetical learning plan. Time reserved for Q&A regarding the group assignment of the case company.  **Learning objectives:** (1) Explain how to conceptually define uncertainty; (2) understand and use different tools (stage-gated and learning plan) to cope with uncertainty along the innovation process. | 4 | 4 | **Session 7**  Course-book Chapter 6, pp.160-196 and Chapter 8, pp.235-266  **Session 8**  Articles 11 & 12. |

Self-study and assessment

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| **Type of assignment** | **Hours** | **Evaluation, %** |
| Class attendance | 14 | 10 |
| On-class exercise, presentation and discussion | 14 | 30 |
| Group report (innovation case) | 100 | 60 |
| Total: | **128** | **100** |

**Note**: In case a student fails in the course, the re-take will be an individual report with in-depth discussion about some topics in innovation management. The details will be arranged between the lecturer and the failed student. The re-take will only count for the last 60% of the course and has no implications on the class attendance and on-class performance.

Assignments

**Group report.** The grade will be based on **a group written report** of no more than 5000 words (including everything except the cover, table of content and the reference list) which must be submitted to the **teacher by email AND uploaded on e-learning platform of ISM no later than ….. (23:59). The detailed instruction for the** group report, which is called the ‘**innovation case**’, is provided in the appendix of the syllabus.Groups of students must select a case company, formulate its basic introduction and present it on the lecture of **…..**

**Class attendance.** Students are required to attend all the sessions. Students will not be granted for the 10% of the grade if he/she fails to attend the session for two times without notice in advance. Any non-attendance due to emergency, illness or other urgent incidences must be informed to the lecturer beforehand.

**On-class exercise, presentation and discussion,** Students are required to actively participate in on-class exercise, presentations and discussions. Students’ performance in this respect will be evaluated based on the lecturer’s observation during the course.

**Required reading**

**Course book**:

Dodgson et al. (2008): *The Management of Technological Innovation*.

**Articles**:

1. Sharma (1999). *Central Dilemmas of Managing Innovation in Large Firms. California Management Review,* 41(3):146-164.
2. Breschi, S., Malerba, F. and Orsenigo, L. (2000), Technological Regimes and Schumpeterian Patterns of Innovation*. The Economic Journal*, 110: 388–410.
3. Jensen, M. B., Johnson, B., Lorenz, E. & Lundvall, B. Å. (2007). Forms of knowledge and modes of innovation. *Research Policy,* 36(5): 680-693.
4. Vargo, S.L. and Lusch, R.F. (2004). Evolving to a new dominant logic for Marketing. *Journal of Marketing*, 68: 1-17.
5. Bitner, M.J., Ostrom, A.L., and Morgan F. N. (2008). Service Blueprinting: A practical technique for service innovation. *California Management Review*, 50(3): 66-
6. Newbert, S. L. (2008), Value, rareness, competitive advantage, and performance: a conceptual-level empirical investigation of the resource-based view of the firm. *Strategic Management Journal*, 29: 745–768.
7. Laursen, K. and Salter, A. (2006): Open for Innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2): 131-150.
8. Chesbrough, H. W. and Appleyard, M. M. (2007). Open innovation and strategy. *California Management Review*, 50(1): 57-76.
9. Gulati, R. and Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly*, 43(4): 781-814.
10. Ding, R., Dekker, H.C., and Groot, T. (2013). Risk, partner selection and contractual control in interfirm relationships. *Management Accounting Research*, 24(2): 140-155.
11. Lane, D. and Maxfield, R. (2005). Ontological uncertainty and innovation. *Journal of Evolutionary Economics*, 15(1), 3-50.
12. Rice et al., (2008). Implementing a learning plan to counter project uncertainty. MIT Sloan Management Review, 49(2): 54-62.

# Requirements

Students are expected to:

* Attend class and engage in discussions.
* Complete the readings **before** attending the lectures.
* Work constructively in groups

After reading a text you should be able to account for:

* The author’s argumentation and viewpoints.
* The structure and composition of the text.
* The school of thought to which the author pledges allegiance and the position of the text vis-à-vis the rest of the curriculum.

You should also think about:

* How might the issues raised be reflected on real-life situations that you’ve experienced?
* What do you find interesting, useful or frustrating about the text?
* What would you like to have clarified or explained?
* What are the limitations of the theories, tools and methods that you just learned?

# Course Timetable

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| **Fridays:** |  |  |  | **Saturdays:** |  |
| 12.30-15.45 | Class (with short breaks) | | | 9.00-12.15 | Class (with short breaks) |
| 15.45-16.45 | Afternoon tea break | | | 12.15-13.15 | Lunch break |
| 16.45-20.00 | Class (with short breaks) | | | 13.15-16.30 | Class (with short breaks) |

# Course Schedule

**Part I: Define Innovation**

To set the stage for the course, this first block of lectures will help students to clarify what is innovation, why innovation is important, and what is the role of technology in innovation. In addition, students should also be able to take from this point to see (1) technology is a key input, which comes from various source, for innovation; (2) innovation is more than just technology; (3) innovation is not only outcomes but also a process. Various small cases, theoretical perspectives, self-reflection, and on-class discussions are used during the course.

## Session 1:–Introduction: What is innovation and why is it important?

**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 1, pp.1-24.
2. Sharma (1999). *Central Dilemmas of Managing Innovation in Large Firms. California Management Review,* 41(3):146-164.

**Learning objectives:** (1) Define what innovation is and what different types of innovations are: (2) Explain why innovation is important.

**The innovation management game:** Paper plane design and innovation

**Mini case on class**: The Driverless Revolution case (Fortune 2012)

## Session 2: Technology, innovations, and an overview of technological innovation process

**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 3, pp.54-92.
2. Breschi, S., Malerba, F. and Orsenigo, L. (2000), Technological Regimes and Schumpeterian Patterns of Innovation*. The Economic Journal*, 110: 388–410.
3. Jensen, M. B., Johnson, B., Lorenz, E. & Lundvall, B. Å. (2007). Forms of knowledge and modes of innovation. *Research Policy,* 36(5): 680-693.

**Learning objectives**: (1) Pinpoint the role of technology in innovation both in theory and in practice; (2) Identify relevant issues about innovation when exposed to a real-life situation.

**Mini case on class**: Smoothed by Science (FT 2013)

**Part II: Understand Innovation**

In this part of the course, we establish a sound understanding on how innovation works within and among organizations. Innovations are views as a process that builds on internal resources and external linkages. A resourced-based view and a networked perspective set the scene to understand technological innovations. External interactions within networked innovation management are expected as an extension of internal resources and a mediator for risks and uncertainties pertaining to innovation. Students are also introduced to the role of knowledge as a crucial resource for innovation, and value creation and capture as the drive for innovation in firms. In parallel to lectures in this stage of the course, students are also required to carry out a group assignment, applying the knowledge learned in the lectures. Eventually, the output of this assignment will be an original case study generated, refined and analysed by groups of students. For more detailed information, see the appendix.

## Session 3: Make innovation happen: Products and Service Innovation

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**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 7, pp.197-234.
2. Vargo, S.L. and Lusch, R.F. (2004). Evolving to a new dominant logic for Marketing. *Journal of Marketing*, 68: 1-17.
3. Bitner, M.J., Ostrom, A.L., and Morgan F. N. (2008). Service Blueprinting: A practical technique for service innovation. *California Management Review*, 50(3): 66-

**Learning objectives:** (1) distinguish product and service innovations; (2) understanding the relationship between product and service innovations; (3) recognize that innovation is not only a process and but also the success of innovations rely on what the offerings are; (4) understanding products and service innovation needs to create value.

**Group exercise on class**: On campus service innovation

## Session 4: Make innovation happen: Resource-based view and innovation strategy

**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 4, pp.94-132.
2. Newbert, S. L. (2008), Value, rareness, competitive advantage, and performance: a conceptual-level empirical investigation of the resource-based view of the firm. *Strategic Management Journal*, 29: 745–768.

**Learning objectives:** (1) explain the key concepts of resource-based view; (2) distinguish resources and capabilities; (3) understand what innovation strategy is and what types of innovation strategies in relation to different patterns of resources and capabilities are.

**Group exercise on class**: The RBV-game

**Time reserved for group discussion regarding to case company search**

***Remarks***: The group assignment, making an innovation case by groups of students, starts on the 2nd lecture day, April 18th. Students start exploring the opportunities to find a case company on April 18th.The choice of innovation case needs to be approved by the teacher on the presentation, which will take place on April 24th – this means that groups must start with working on collecting basic information of the case company after session 4.

## Session 5: The external side: Open innovation and Networks for innovation - a RBV view

**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 5, pp.131-159.
2. Laursen, K. and Salter, A. (2006): Open for Innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2): 131-150.
3. Chesbrough, H. W. and Appleyard, M. M. (2007). Open innovation and strategy. *California Management Review*, 50(1): 57-76.

**Learning objectives:** (1) Explain the open innovation perspective and what external technology sources are; (2) Explain how networks and collaboration with external parties are possibly expanded into a larger scope thanks to an open approach of innovation; (3) the importance of external technology sourcing and spill-over effects; (4) the inputs from users for innovation.

**Mini case/exercise on class**: The Better Place case

## Session 6: The external side: Open innovation and Networks for innovation - a governance view

**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 5, pp.131-159.
2. Gulati, R. and Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly*, 43(4): 781-814.
3. Ding, R., Dekker, H.C., and Groot, T. (2013). Risk, partner selection and contractual control in interfirm relationships. *Management Accounting Research*, 24(2): 140-155.

**Learning objectives:** (1) Explain the governance perspective towards networked innovation management; (2) recognize various means to mitigate risks in innovation by being embedded in networks.

**Group exercise on class**: The network industrial fair

**Time reserved for group presentation of the selected case company at the beginning of the afternoon session. Each group has 5 min for pitching and 5 min for feedback. On-site approval will be made.**

## Session 7: The internal side: R&D Management, Operations, and processes

**Reading material:**

1. Dodgson et al. (2008): *The Management of Technological Innovation*. Chapter 6, pp.160-196 and Chapter 8, pp.235-266

**Learning objectives:** (1) clearly recognize the role of R&D in relation to technological innovation; (2) distinguish the underlying patterns of learning with regard to R&D within an organization.

**Mini case on class**: Boeing 787 Dreamliner

## Session 8: Decision Making under Uncertainty and course summary

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**Reading material:**

1. Lane, D. and Maxfield, R. (2005). Ontological uncertainty and innovation. *Journal of Evolutionary Economics*, 15(1), 3-50.
2. Rice et al., (2008). Implementing a learning plan to counter project uncertainty. MIT Sloan Management Review, 49(2): 54-62.

**Learning objectives:** (1) Explain how to conceptually define uncertainty; (2) understand and use different tools (stage-gated and learning plan) to cope with uncertainty along the innovation process.

**Group exercise on class**: The hypothetical learning plan

**Time reserved for Q&A regarding the group assignment of the case company.**

## Appendix

**Guidelines for innovation case selection and group assignment**

**THE GROUP**

A group must be composed of 4 students. In order to ensure diversity in the groups as much as possible, we ***suggest*** that a group should *NOT*,

* Be composed of students of only one gender. So all-boys or all-girls group are not recommended;
* Be composed of students from only one discipline.

**THE TASK**

The task is to write a case about a particular innovation of a company or an innovative company, upon the choice of each group of students. This task starts after the 4th session. This means that after the 4th session, formal groups of students should be formed and each group needs to decide on working on an innovation case, with which the group is familiar or has access to sufficient information about. A finalized group composition and the choice of your case for each group need to be decided and a presentation on the company’s basic introduction needs to be made on the lecture of **April 24, 2020**. The students are required to build up their innovation case, bit by bit, based on their own research about the case company.

**THE PURPOSE**

To ensure that you have met the learning objectives of the course, i.e., explain them and apply the theories in the curriculum in a critical manner to an applied context.

**WHAT IS ELIGIBLE FOR A SELECTED CASE?**

Any company that you feel inspired by its innovations can be eligible for the case study. You can either focus on the innovation management issues of this case company with regard to a particular product/service innovation or the overall practice of the company. The case can also be based on a particular innovative project that some of you are working on. While searching for secondary data about this company on the internet is inevitable, you are also encouraged to collect primary data through interviews, which can be arranged with the case company. Therefore, you shall also consider how you can get access to this company. A company that your father/mother works for, one where you used to have an internship, or one you know an insider contact person may become handy. If you have any difficulties, please come to ask the teachers, and we will try to assist you.

**THE SPECIFICATIONS**

**An acceptable report must:**

* Be written with no more than 5000 words (including everything excluding the cover, table of content, and the reference list).
* Clearly address no less than 4 specific aspects of innovation management of the case company.
* Make explicit references to and applications of the relevant theories, frameworks, and/or methods that you learned from this course.

**The good report will also:**

* Clearly address as many specific aspects of innovation management of the case company as possible;
* Provide concrete solutions to some identified challenges of the company;
* Make sound arguments for any bold statements;
* Reflect on the availability and adequacy of data;
* Juxtapose theoretical perspectives and discuss their comparative limitations and advantages in reality.

**SUPPORT**

To make sure your selected case company is eligible and appropriate, we design an exploration session on April 18th, 2020 and a presentation session for feedback on April 24th, 2020. You are also welcome to discuss with the teacher any time during the course period via email or face-to-face talk at the teacher’s office.

**SUBMISSION**

Once your assignment report is completed, the finalized version of your report must be uploaded to ISM’s e-learning platformin **Word** or **pdf** format *AND* by email to prof. Jason Li-Ying ([yinli@dtu.dk](mailto:yinli@dtu.dk)) by **May 15th, 2020 (Friday) at 23:59.**