MASUDEM
MASTER STUDIES IN SUSTAINABLE DEVELOPMENT AND MANAGEMENT

SYLLABUS

Name of course	**TECHNOLOGY AND INNOVATION MANAGEMENT FOR SUSTAINABILITY (TIMS)**				
Code of course	**TBA**				
University	**TBA**				
Faculty	**TBA**				
GENERAL INFORMATION					
Degree level	Graduate				
Year of study	TBA	**Semester**	TBA		
Subject of study	TBA				
Language required for the course	TBA				
List of degree programs	TBA				
ACTIVITIES					
Number of credits, ECTS	2 credits or 4 ECTS				
Lectures, hours	30	**Practices (laboratories, workshop), hours**		**Project, hours**	
Per week		**Per course**			

COURSE DESCRIPTION

To achieve long-term success, firms need to pay attention to sustainability performances, which include social and environmental aspects. Sustainability performances are especially important with consumers increasingly embracing sustainability.

Innovation in modern technologies such as robotics, artificial intelligence, blockchain, internet of things, and technologies that utilize big data can help improve sustainability performances. Robotics and digital twins, for example, can be used to improve efficiency, other digital technologies can help optimize the use of resources, and electrified transportation can decrease or even eliminate carbon emission that is harmful for the environment.

This course not only highlights the importance of technology and innovation, but most importantly how we can manage technology and innovation to improve sustainability performance. We see technology as an enabler of business operations and innovation as a mechanism for continuous improvement, which could also lead to the achievement of sustainable competitive advantage of the future operations.

AIM OF COURSE

This course provides the concepts of technology and innovation management and explores emerging technologies for improving sustainability performances.

CONTENT

1. Technology and innovation management
   i. Circular economy
   ii. Fundamental of technology and innovation management
   iii. Business operations, and value chain
   iv. Technology need assessment
   v. Introduction to digital technologies
   vi. Human vs. Technology

2. Technology and sustainability performances

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i. Sustainability performance metrics
ii. Impacts of technology on sustainability
iii. Sustainable technology innovation
- Value vs. technology innovation
- Frugal innovation
- Open innovation

iv. Sustainable products and services design and development

3. Emerging technologies for improving sustainability performances
   i. Big Data Analytics
   ii. Artificial intelligence
   iii. Robotics and Internet of Things (IoT)
   iv. Blockchain Technology
   v. Agent-based Simulation and Digital twins

EVALUATIONS *(add lines as needed)*		
1	Quizzes, in-class assignment, and participation	*30%*
2	Project	*20%*
3	Final exam	*50%*

ASSESSMENT CRITERIA

Grade.
A: The student must show a good understanding of the concepts of technology and innovation management as well as an excellent ability to analyze sustainability problems and present the solutions through technological innovation.
B: The student shows an overall understanding of all given topics.
C: The student meets below average expectation on both knowledge acquired and analysis.
D: The student does not meet basis expectations in understanding and analyzing the topics and issues presented in the course.

PRE-REQUIREMENTS FOR STUDENTS

None

LEARNING OUTCOMES

Competencies:

Upon successful completion of this course, students are expected to be able to:

a. Explain the concepts of technology and innovation management.
b. Identify emerging technologies for sustainability and examine how different technologies can help improve sustainability performances.
c. Demonstrate the ability to communicate in an effective, persuasive, and professional manner.
d. Develop solutions for sustainability improvement with technology and innovation.
e. Demonstrate the ability to work in team.

Skills:

a. Analytical skill
b. Communication

LEARNING STRATEGIES

- Hands-on Practice

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- This course adopts learning-focussed teaching with semi-flipped classroom approach. Learning-focussed teaching means that students' learning process is paramount and developed through open discussion and critical thinking rather than one-way lecture. In the semi-flipped classroom environment, students are expected to prepare themselves prior to the class discussion. Whilst selected topics and readings are offered to trigger the class discussions, students are welcome to bring and discuss their own materials beyond what has been suggested in this syllabus. This way, students are responsible for their own learning. They are the centre of knowledge that is (re)constructed together with the lecturer acting as a facilitator.

RECOMMENDED SOURCES

Compulsory literature:

- Study text

Suggested reading:

- White, M. and Bruton, D. (2011). *The management of technology and innovation, a strategic approach*, 2nd edition, South Western, Cengage Learning, USA
- Turban, E., L. Volonino, and G.R. Wood. (2015). *Information Technology for Management: Digital Strategies for Insight, Action, and Sustainable Performance*. 10th Edition. Danvers, MA: John Wileyand Sons. (TVW)
- Carroll, L.S.L. (2017). A comprehensive definition of technology from an ethological perspective. *Social Sciences*, Vol. 6 No. 126, pp. 1-20. (CL)
- Phaal, R., Farrukh, C.J.P. and Probert, D.R. (2001). Technology management process assessment: a case study. *International Journal of Operations and Production Management*, Vol. 21 No. 8, pp. 1116-1132. (PFP)
- Cetindamar, D., Phaal, R. and Probert, D. (2009). Understanding technology management as a dynamic capability: a framework for technology management activities. *Technovation*, Vol. 29, pp. 237-246. (CPP)
- Ahmed, P. K., & Shepherd, C. D. (2010). *Innovation management: Context, strategies, systems and Processes*. Pearson Education Limited.
- Alberto, O. O. Z. C. (2012). *Logistics Management and optimization through Hybrid Artificial Intelligence Systems*. Hershey, PA: Information Science Reference.
- Brown, S. (2020). *The innovation ultimatum: How six strategic technologies will reshape every business in the 2020s*. John Wiley & Sons, Inc.
- Buyya, R., Calheiros, R. N., & Dastjerdi, A. V. (2016). *Big data: Principles and paradigms*. Elsevier/Morgan Kaufmann.
- Kersten, W., Blecker, T., & Ringle, C. M. (2022). *Artificial Intelligence and digital transformation in Supply Chain Management: Innovative Approaches for Supply Chains*. Berlin: epubli GmbH.
- Tim A. Herberge, J. J. D. (2021). Digitalization, Digital Transformation and Sustainability in the Global Economy: Risks and Opportunities. In. Springer.
- Elangovan, U. (2019). Smart Automation to Smart Manufacturing. Momentum Press.
- Gacovski, Z. (2020). Mechatronics and Robotics. Arcler Press.
- Radziwill, N. M., & Knovel. (2020). Connected, intelligent, automated : the definitive guide to digital transformation and quality 4.0 (First edition. ed.). Quality Press.
- Balusamy, B., R, N. A., Kadry, S., Gandomi, A. H., & Wiley, I. (2021). Big data : concepts, technology and architecture (First edition. ed.). John Wiley and Sons, Inc.

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- Marr, B. (2022). Data strategy : how to profit from a world of big data, analytics and artificial intelligence (Second edition. ed.). Kogan Page Limited.
- Bashir, I. (2018). Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained. Packt Publishing.
- Fuller, A., Fan, Z., Day, C., & Barlow, C. (2020). Digital Twin: Enabling Technologies, Challenges and Open Research. IEEE Access, 8, 108952-108971. https://doi.org/10.1109/ACCESS.2020.2998358

Selected internet sources:

UN (2016) Technology Needs Assessment Handbook
https://www.undp.org/publications/technology-needs-assessment-handbook

GROUP OF COURSE DEVELOPERS

Course Leader:

Board:

Date of approval the course

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Comments:

No.	Date	Comment
1.	05/09/2023	Add “Data Analytics” in course content
2.	05/09/2023	Add “Hands-on Practice” in learning strategies (for Data Analytics)
3.	09/09/2023	Add “technology need assessment”
4.	12/09/2023	Proposed title: Technology and innovation management for sustainability Some content items to think about: 1. Importance of technology and innovation to sustainability 2. Tools for technology management 3. Innovation process 4. Technology stages and planning
5.	12/09/2023	1. Edit and add details on the course description 2. Add suggestions on the assessment methods 3. Refine and suggest the learning outcomes 4. Ensure the use of “technology and innovation management” consistently throughout the document 5. Add “fundamentals of technology and innovation management”, “technology, innovation, business operations, and value chain”, “technology, innovation, and circular economy”, and “digital twins” on the proposed content. 6. Add learning strategies 7. Add suggested readings
6		Link to texts ***https://www.dropbox.com/scl/fo/bkvaydfqtj24uo6ql2wi3/h?rlkey=3qjlqnqhsuwoy0ixr8ij2cpzs&dl=0***
7	07/11/2023	Adjust the learning outcome according to Bloom Taxonomy.
8	05/12/2023	1. Change topic and content : Data Analytics > Big Data Analytics Robotics > Robotics and Internet of Things (IoT) 2. Add suggested readings

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