37208-ENG
DIGITAL INNOVATION AND MANAGEMENT (DIM) LAB

Course Introduction

Tommaso Minola
Cristian Cappellini
Davide Hahn
Marco Zambelli

26/02/2025

Why a lab on *digital innovation and management* in the master degree of Management Engineering?

- The **master in Management Engineering** offers a set of courses that cover several aspects you need to understand to **manage innovation** in a **digital world**:
  - Strategic management and Entrepreneurship in the digital economy
  - Continuous improvement and quality management
  - Project management
  - Operations and Supply Chain Management
  - Integrated product systems
  - Data analysis
  - Statistics for industrial and organizational innovations

Why a lab on digital innovation and management in the master degree of Management Engineering?

- What is missing? An actual «**Lab**» in which students are offered the opportunity to **critically revise and apply** to the innovation process these multidisciplinary contents and tools

- The main focus of this lab: **new product development** in the **manufacturing** sectors

- *The Management Engineering Course aims to develop the students' **entrepreneurial and managerial skills** and to provide them with the ability to plan and manage **complex systems**. The Management Engineer is characterized by strong **analytical and decision-making skills** coupled by an open and **multidisciplinary mindset**.*
  (Master's Degree in Management Engineering website)

Constituting elements of the DIM Lab

- The **innovation** process, and more specifically the **new product development** process, encompasses both *technological* (design, simulation, prototyping) and the *business* aspects (product strategy, market analysis, validation), empowered by the use of digital tools

- In the course students will work on both aspects
  - Learn to use **software for the design of new products** and related simulations
  - Master techniques for **market and strategic analysis** for **new products**, guiding the design
  - Compare different pathways to **prototype and launch the product** on the market

From the syllabus: learning objectives

TECHNOLOGICAL ASPECTS

- **Understand technical elements** of the digitally-enabled innovation in the manufacturing sector
- **Master tools and software** for the design and development of products in the *smart factory*
- **Apply** the acquired knowledge in a practical context

MANAGERIAL ASPECTS

- **Understand management issues** of digitally-enabled innovation in the manufacturing sector
- **Know how to analyze the business** (strategic, commercial and economic) **implications** of digital technologies in the *smart factory*
- **Apply** the acquired knowledge in a practical context

From the syllabus: contents

TECHNOLOGICAL ASPECTS

- Introduction to the **concepts of "digital factory" and "digital manufacturing"**
- Insights about ***smart production systems***

MANAGERIAL ASPECTS

- **Analysis of economic feasibility** and of commercial potential of a new product
- Presentation and discussion of **key tools and cases** relevant for **new product development** in the digital economy

From the syllabus: practice

TECHNOLOGICAL ASPECTS

- Introduction to the use of **software for product design** and development
- **Design and development of a new product, simulation** of the production process, **analysis** of production costs and time in order to identify possible improvements

MANAGERIAL ASPECTS

- Design the **product strategy**, evaluation of the **economic feasibility**, planning of the **commercialization** and presenting to a practitioner audience of a new product
- Interplay of technical, design and business aspects, in iterative development

Technological aspects: specific contents

1. What is digital manufacturing
2. Evolution of processes
3. Machine learning and artificial intelligence
4. Additive manufacturing overview
5. Economical evaluation of processes and production
6. Software for product design and development

When?
Friday 2PM - 4PM

Managerial aspects: specific contents

1. Introduction to new product development and product strategy
2. Product planning
3. Opportunity identification and customers' needs
4. Product specifications and concept generation
5. Concept selection and testing
6. Approaches to design (industrial design, design for manufacturing, robust design)
7. Product Development Economics

When?
Wednesday 2PM - 4PM

Lab-centered approach (technological aspects)

FIRST PART OF THE COURSE

- **Theoretical** references about **digital processes and technologies**.
- Lectures about **the tools useful for the project work development**.

SECOND PART OF THE COURSE

- **Labs** will support the teams in the **project work**.
- Each lab will be linked to specific phases of the new product development processes explained in the first part of the course.

Lab-centered approach (managerial aspects)

FIRST PART OF THE COURSE

- **Problem-based learning (PBL)**
- Under the logic of flipped classroom, for each lecture, 1 team of students will be assigned a specific argument and readings
- Starting from the assigned readings, each team will illustrate the topics to all the other teams of the class

SECOND PART OF THE COURSE

- **Labs** will support the teams in the **project work**
- Each lab will be linked to specific phases of the new product development processes explained in the first part of the course

LimeSurvey

Mural

Project Work

- The project work consists in the **development of a new product**.
- Students are required to apply new product development tools and knowledge learned along the lab to a real case.
- The project work's output consists of a **final presentation**, supplemented by **written document**. Rigor, clarity, documentation of each step are encouraged and graded.
- A comprehensive "project work package" includes the presentation and a written report in electronic form.

Team formation

- **Teams** working on the Project Work will have **3-4 people**.
- We highly recommend to form teams not only relying on the *interpersonal attraction strategy* (e.g., teaming up with friends) but also and foremost on the *resource-seeking strategy* (e.g., teaming up with people with complementary skills).
- For example, try to have at least one member in the team that is familiar with industrial design and one that is keen about managerial issues.
- **Multidisciplinary and complementary background**, competences and skills are key to team success.
- **Fill this form with the team composition by the 4th March**: https://docs.google.com/spreadsheets/d/1z8n73j1AG7x0d2hZXz8ep0oNPMgCz0YBoHMEl9bNA50/edit?usp=sharing

Project Work roadmap

- Identify a **pilot product-company dyad** (more on the next slides)
- Search the target market and **define the customers' need**
- **Generate and validate the concept** the basis of customers' need
- Define the main **design specification**
- **Re-design in additive manufacturing logics**
- Production of the **pilot product** by means of the material extrusion process
- **Economic evaluation** of production by additive manufacturing
- **Market** validation

The “art” of contacting companies

- Identify companies (closeness, openness, innovativeness) in a sector, from university library data sources, but also personal contacts
- Always offer a “value proposition”
  - Solve a concrete problem in your company
  - Access to & contribute to train young talent
  - Access innovative and diverse perspectives
  - Strengthen the link between business and university
  - Visibility and recognition
- Clarify
  - costs and benefits of collaboration
  - timeline
- “In progress” check with the faculty
- Manage expectations (including product features, etc.)

Project Work rules

- The project work must be **original text**. Students are expected not to use others' text or work and present it as their own. References shall always be cited. In case of plagiarism the entire exam will be failed.
- Each student of the group will put their own effort to make sure that their **contribution and presentation will be comparable among the members**. Each team member will be selected by the Faculty to present different parts. Each student may be assigned a different grade.
- The Faculty will **evaluate** the project work considering originality, internal consistency, relevance to the assigned theme, methodological rigor, accuracy of report and presentation, clarity of in-class presentation, efficient teamwork.
- The comprehensive package of the project work will be sent to the Faculty **one week before the exam** through uploading on the e-learning platforms.

Lab policy

- **Attendance**
  –The faculty strongly recommends **physical presence in the classroom** in order to facilitate interaction among students and between students and faculty.
  –Students are expected to show a professional behavior in the classroom. Please be on time for the class and be respectful of others' viewpoints even if in disagreement with them.

- **Academic integrity**
  –The **university policies regarding plagiarism, cheating and similar activities will be pursued as appropriate**. Downloading or use of material obtained from an online site without proper citation is plagiarism. Citing sources properly is necessary to demonstrate where your information is coming from.

Exam policy

- Discussion of the applicative project work carried out in the laboratories
- The discussion includes the preparation of a ***.ppt* presentation** discussed in front of a committee
- **A *.doc* report** containing the details of the process applied for project work development, as well as detailed methodologies and outcomes, must also be prepared
- During the presentation the evaluation committee will further investigate the discussed topics **by asking questions** related to what has been covered in the course

Non-attending students

- The course has been conceived as a Lab and attendance is highly recommended to prepare the exam consisting the project presentation.
- **Non-attending students** who are not included in a team will deliver a final project work on an **individual-basis**.
- To do so, they need to follow the Project Work Map illustrated in the previous slides, although the physical realization of the prototype will not be required.
- **Non-attending students will be asked additional questions** in written or oral form to assess their learning of theoretical contents taught in the course.

Faculty

Professors

Cristian Cappellini
cristian.cappellini@unibg.it
Tommaso Minola
tommaso.minola@unibg.it

Teaching assistants

Davide Hahn
davide.hahn@unibg.it
Marco Zambelli
marco.zambelli@unibg.it




Bibliography

- Morgan, T., & Jaspersen, L. J. (2022). Design Thinking for Student Projects. SAGE.
- Pichler, R. (2022). Strategize: product strategy and product roadmap practices for the digital age (Vol. 2). Pichler Consulting.
- Ulrich, K. T., & Eppinger, S. D. (2017). Product design and development (Vol. 4, pp. 1-3). Boston: McGraw-Hill higher education.

Change in schedule

Suspended lectures

- 28th March 2025
- 25th April 2025
- 23rd May 2025
- 4th June 2025
- The lecture of FRI 2nd May 2025 will be rescheduled

Swap WED-FRI

- WED March 12th 2025 - Technological aspects
- WED April 23rd 2025 - Technological aspects

Further changes in schedule will be shared in advance on Moodle