Universitat Autònoma de Barcelona

Logistics Management and Control System Specification and Evaluation

2016/2017

Code: 42639
ECTS Credits: 10

Degree	Type	Year	Semester
4313489 Logistics and Supply Chain Management	OT	2	1

Contact

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Use of languages

Principal working language: english (eng)

Prerequisites

The student has to have successfully passed the following subjects:

- Decision making (42653)
- Material handling and transportation technologies (42651)
- Information Technology (42657)

Objectives and Contextualisation

This module has three course units: **Materials Handling Control Systems** (Prof. Dr. Gaby Neumann), **Logistics Management and Control Systems Project Work** (Prof. Dr. Mike Steglich/Michael Mueller) and **Model-based decision support for logistics** (Prof. Dr. Mike Steglich).

CU1: Materials Handling Control Systems (2.5 ECTS)

After the course the student will:

- Understand specific requirements of materials handling control systems and their complexity
- Be able to apply procedure, methods, tools for specifying, selecting, implementing, testing and analysing materials handling control systems
- Be able to evaluate different alternatives and select the materials handling control system to be implemented
- elaborate solid arguments to convince and motivate decision makers

CU2: Logistics Management and Control Systems Project Work (2.5 ECTS)

After the course the student will:

- Understand the role of IT systems in logistics
- Understand specific requirements of logistics management and control and their complexity
- Understand specification needs, market situation of typical LMCS
- Be able to search for and report on state-of-the-art
- Be prepared for Master thesis

CU3: Model-based decision support for logistics (5 ECTS)

Students will gain an understanding of

- the decision making process in logistics and

- the process of modelling and solving selected logistical decision problems.

Students will be able to solve strategic, tactical and operational decisions

- for logistical transportation problems,
- for logistical assignment problems,
- for routing problems and
- for finding optimal locations of facilities.

Skills

- Address problems of management and coordination of logistics operations in production, transport and services in a holistic approach, by means of the consistent application of the supply chain management concepts and strategies, taking into account the pertinent aspects of environment, human capital, quality, technology, and economics.
- Apply a rigorous and efficient approach to problem solving.
- Apply quantitative methods and techniques based on optimisation and/or simulation models in order to evaluate the different alternatives and select the most promising solution to be implemented
- Demonstrate abilities to document and reflect the problem-solving process in order to extract the lessons learned.
- Elaborate solid arguments based on quantitative models and analytical methods in order to convince and motivate decision makers, determine the adequate LCSM partners and then plan and coordinate the project to implement the solution.
- Face a new problem under a scientific perspective.
- Identify the main aspects to be planned in the resolution of a logistic project, specifying the project boundaries, and leading with a solution
- Select and apply the most relevant analytical methodologies, strategies and current technologies for designing solutions to the problams of management and coordination of material, information and financial flows.
- Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
- Students should be able to integrate knowledge and face the complexity of making judgements from information which, being incomplete or limited, include reflections on the social and ethical responsibilities linked to the application of their knowledge and judgements
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
- Work collaboratively in a group.

Learning outcomes

1. Address design problems in Logistics Management and Control from a holistic approach.
2. Apply a rigorous and efficient approach to problem solving.
3. Demonstrate abilities to document and reflect the problem-solving process in order to extract the lessons learned.
4. Elaborate solid arguments to convince/motivate decision makers.
5. Evaluate different alternatives and select the Logistics Management and Control solution to be implemented.
6. Face a new problem under a scientific perspective.
7. Identify the main aspects to be planned in the resolution of a logistic project, specifying the project boundaries, and leading with a solution
8. Select and apply the right methodologies and strategies to specify and formalise the requirements of a Logistics Management and Control system.
9. Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
10. Students should be able to integrate knowledge and face the complexity of making judgements from information which, being incomplete or limited, include reflections on the social and ethical responsibilities linked to the application of their knowledge and judgements

11. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
12. Work collaboratively in a group.

Content

CU1: Materials Handling Control Systems (2.5 ECTS)

Introduction to materials handling control

- What is materials handling control?
- Why materials handling control is relevant in logistics?

How to control automated material flows

- Terminology and model
- Controlling versus regulating
- Architectural concepts
- Strategies and parameters

Material flow automation

- Terminology and history
- Components of automated materials handling systems
- Examples of automated materials handling systems
- Lab session 1: Controlling LEGO models

Identification and identification technology

- The role of identification in materials handling
- Technology for manual identification
- Technology for automatic identification
- How to select identification technology

Materials handling control systems

- Material flow control systems and hierarchical model of them
- Logistics management systems
- Logistics information systems
- Lab session 2: Controlling a conveyor system

How to design materials handling control

- Material flow process design vs. material flow control design
- Challenges in control design
- Procedure to design control algorithms and specify materials handling control systems
- Models and methods to describe materials handling processes and control logic
- Lab session 3: Controlling by use of a PLC

CU2: Logistics Management and Control Systems Project Work (2.5 ECTS)

Analysis, description, classification of a specific class of LMCS and discussion of its role in logistics systems' management and control

Topics covered include but are not limited to:

(1) Analysis, description, explanation, categorization of and examples for the following IT tools and discussion of their role in logistics and SCM:

- logistics information systems (LIS)

- freight exchange platforms
- tracking and tracing systems
- warehouse management systems
- pick by voice / picking support systems
- transport information systems
- logistics Apps

(2) Analysis, description, explanation, categorization of and examples for the following methods and/or IT tools and discussion their role in logistics and SCM:

- The use of Google's APIs to support logistical decisions
- A market survey of logistical decision support software
- Alternative mathematical approaches to solve the Travelling Salesman Problem (TSP), Vehicle Routing Problems, Warehouse Location Problems, etc.
- Logistical problems under uncertainty (e.g. Transportation Problems with uncertain demands and supplies)

CU3: Model-based decision support for logistics (5 ECTS)

A Selected theoretical basics for logistical decisions

1. Logistical decisions
2. Decision making and optimisation
3. Optimisation software

B Modelling and solving of selected logistical decisions

1. Transportation Problems

    - The Standard Transportation Problem
    - Capacitated Transportation Problems
    - Bottleneck Transportation Problems
    - Multi-commodity Problems
    - Transhipment Problems

2. Logistical Assignment Problems

    - The Standard Assignment Problem
    - Maximum Cardinality Problems
    - Quadratic Assignment Problems
    - Non-bipartite Assignment Problems

3. Routing Problems

    - Shortest Path Problem
    - Traveling Salesman Problem
    - Chinese Postman Problem
    - Vehicle Routing Problems

4. Location Problems

    - Median and Centre Problems
    - Location Covering Problems
    - Warehouse Location Problems

Methodology

CU1: Materials Handling Control Systems (2.5 ECTS)

The course is organized by means of traditional lectures combined with seminars and practical work. The learning process will combine the following activities:

- Classroom sessions: include theory lectures and guest lectures. Aims to understand specific requirements of logistics management and control and their complexity; understand specification needs, market situation of typical materials handling control systems; specify and formalize requirements for an logistics management and control systems; explain procedure, methods, tools for specifying, selecting, implementing, testing and analysing materials handling control systems.
- Lab sessions: include demonstrations, experiments in physical environment, classroom discussions. Aims to understand challenges, elements and solutions for materials handling control.
- Practical assignment: experiments in physical environment, classroom discussions, group work, experimentation reporting. Aims to understand working principle, functionality and applicability of sensor technology to control material flows; understand working principle, resulting processes and constraints in materials handling control; implement simple control algorithms for running an automated materials handling system; setup test scenarios, plan and run experiments, report experimentation outcome for testing materials handling control technology in a practical setting.
- Autonomous work: reading, self-testing, reflecting. Retrieve and analyse information from different sources; reflect learning and problemsolving processes in order to derive lessons learned.

CU2: Logistics Management and Control Systems Project Work (2.5 ECTS)

The course is organized in the form of a scientific workshop. Each student works independently on an individual topic searching for relevant literature (textbooks, technical journals), implementation and application reports (technical journals, websites), technical details of IT systems (fact sheets, supplier brochures/websites). An individual mentor gives support and provides guidance in topic specification, identification of research questions, literature review and project report design. The topic can either be chosen from a given list or proposed by the student. Each student has to submit his/her topic together with a 200 words abstract to all mentors. Mentors decide about acceptance/rejection of the topic and who is going to supervise. Student reports will be marked by the mentor; presentations/discussions will be marked by the group of mentors and by the students (peer review).

The learning process will combine the following activities:

- Seminar/consultation: include classroom discussion, student presentation, coaching. Aims to identify and specify topics of relevance in logistics management and control; present approach, structure, state-of-work; ask questions.
- Workshop: Scientific paper, student presentation. Aims to clarify topic, research questions and expected outcomes in the form of an abstract to be submitted to a scientific workshop; write a scientific workshop paper; present project results in the workshop and discuss with workshop participants.
- Project work: Literature search and review, project reporting, student presentation. Aims to analyse, describe, classify a specific class of logistics management and control systems; discuss about its role in logistics systems' management and control; present approach and findings in a structured way in writing and orally; follow formal procedure of a scientific workshop.
- Autonomous work: reading, self-testing, reflecting. Retrieve and analyse information from different sources; reflect learning and problem solving processes in order to derive lessons learned.

CU3: Model-based decision support for logistics (5 ECTS)

The course is organized by means of traditional lectures combined with seminars and practical work. The learning process will combine the following activities:

- Classroom sessions: include theory lectures and classroom discussions. Aims to understand theoretical issues of the decision making process in logistics environments and for modelling and solving selected logistics decisions.
- Computer lab (D): includes demonstrations of decision support software in a computer lab and classroom discussions. Understanding of logistical decision support software (LogisticsLab and SolverStudio/Cmpl) and their use for modelling and solving of selected logistics decision problems.

- Computer lab (S): includes supervised use of decision support software and classroom discussion. The students will be able to analyse selected logistical decision problems, to formulate the mathematical model, to allocate the required data and to solve it with LogisticsLab or SolverStudio/Cmpl.
- Autonomous work: reading, self-testing, reflecting. Retrieve and analyse information from different sources; reflect learning and problem solving processes in order to derive lessons learned.

All theoretical issues will be also discussed by using LogisticsLab and SolverStudio/Cmpl.

LogisticsLab is an academic decision support software for logistics. This software has been created by Dieter Feige (previously University Erlangen-Nürnberg) and Mike Steglich (TUAS Wildau).

- TPP - Transportation Problems
- TSP - Traveling Salesman Problems
- CPP - Chinese Postman Problems
- VRP - Vehicle Routing Problems
- WLP - Warehouse Location Problems
- CLP - Continuous Location Planning Problems
- NWF - Network Flow Problems

SolverStudio is an add-in for Excel on Windows that allows a user to build and solve optimisation models in Excel using several optimisation modelling languages. One of the supported modelling languages is CMPL. SolverStudio has been created by Andrew Mason (Department of Engineering Science, University of Auckland, New Zealand).

CMPL (<Coliop|Coin> Mathematical Programming Language) is a mathematical programming language and a system for mathematical programming and optimization of linear optimization problems. CMPL is a COIN-OR project initiated by the Technical University of Applied Sciences Wildau. It has been created by Thomas Schleif and Mike Steglich. The SolverStudio plug-in for CMPL is written by Mike Steglich.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
CU1. Laboratory work	8	0.32	1, 2, 5, 7, 8, 10, 12
CU1. Theory lectures	20	0.8	1, 5, 8, 10
CU2. Seminar	20	0.8	1, 8, 12
CU2. Workshop	8	0.32	1, 3, 7, 8, 10, 11, 12
CU3. Computer lab (D)	30	1.2	1, 4, 5, 7, 9, 12
CU3. Theory lectures	30	1.2	1, 4, 5
Type: Supervised			
CU1. Practical assignment	28	1.12	1, 4, 5, 6, 8, 10, 11, 12
CU2. project work	28	1.12	1, 3, 4, 8, 10, 11
CU3. Computer lab (S)	60	2.4	1, 2, 3, 4, 5, 6, 10, 11, 12
Type: Autonomous			
Self-learning	16	0.64	1, 4, 5, 8, 9

Evaluation

CU1: Materials Handling Control Systems (2.5 ECTS)

The final mark of this course will be calculated from the assessment of following evaluation activities:

- Final exam. Theoretical questions on topics addressed throughout the semester in order to present an understanding of model-based decision making in logistics.
- Practical assignments. Student teams plan and run experiments in a physical lab environment to experience certain aspects of materials handling control by use of typical methods and systems (from LEGO to PLC). For each lab session a report is required that follows given structural guidelines. All reports are marked according to formal and contents aspects.

CU2: Logistics Management and Control Systems Project Work (2.5 ECTS)

The final mark of this course will be calculated from the assessment of following evaluation activity:

- Project. The topic can either be chosen from a given list or proposed by the student. Each student has to submit his/her topic together with a 200 words abstract to all mentors. Mentors decide about acceptance/rejection of the topic and who is going to supervise. Student reports will be marked by the mentor; presentations/discussions will be marked by the group of mentors and by the students (peer review).

CU3: Model-based decision support for logistics (5 ECTS)

The final mark of this course will be calculated from the assessment of following evaluation activities:

- Final exam. Theoretical questions on topics addressed throughout the semester in order to present an understanding of model-based decision making in logistics.
- Practical assignments. Each student has to solve several logistics decision problems in a computer lab by using LogisticsLab or SolverStudio/Cmpl. For each case the results have tobe reported following given structural guidelines.

CU1, CU2 and **CU3**

There is one final exam per module covering courses CU1 and CU3. It is comprised of theoretical questions and small cases on topics addressed throughout the semester in order to present generic understanding on both materials handling control systems and model-based decision support in correspondence to learning objectives. The final exam is run electronically; cases might require additional performance on paper or by applying specific software packages evaluated as part of the exam.

The student passes the module if the practical assignments, project and the final exam are evaluated "sufficient" (grade 4.0 corresponding to a minimum of 50% of the maximum performance per evaluation activity) at least. The student fails if performance in at least one of the evaluation activities does not reach the 50% threshold or if practical assignments and project reports are not submitted within the due date specified by the professor.

In case of fail the student needs to retake just that part of module exam s/he failed. The decision about this is in hands of the examiner. If any of the practical assignments or the project are failed, the student will either be provided with a new assignment/project or asked to re-submit its report according to the corrections/indications provided by the professor.

Students who fail an exam may be permitted the opportunity to retake this examination twice at a maximum. After that his/her right for examination terminates. Retaking an exam is allowed only in case the student previously failed, but not to improve grades achieved so far.

Examination dates are announced in due time, but at least two weeks prior to the respective exam. Submission deadlines for practical assignments, project reports and any presentation activities related to them are announced when giving assignments/project to students. The final exam and a first opportunity for eventually

retaking it are scheduled within specified examination periods. Specific examination dates are published on the university's website.

The weights of each evaluation activity are given in the table below.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
CU1. Practical assignments	11.25%	0	0	1, 2, 5, 7, 8, 10, 12
CU2. Project work	25%	0	0	1, 3, 4, 8, 10, 11
CU3. Practical assignments	30%	0	0	1, 2, 3, 4, 5, 6, 10, 11, 12
Final exam (CU1 & CU3)	33.75%	2	0.08	1, 2, 4, 5, 8, 9

Bibliography

To be provided during lecturing period