Universitat Autònoma de Barcelona

2017/2018

Decision Making

Code: 42653
ECTS Credits: 9

Degree	Type	Year	Semester
4313489 Logistics and Supply Chain Management	OB	1	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

Nina Rebecca Schefers

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Prerequisites

None

Objectives and Contextualisation

Along a supply chain hundreds and thousands of individual decisions have to be made and coordinated every minute. These decisions are of different importance. They comprise the rather simple question "Which job has to be scheduled next on a respective machine?" as well as the very serious task whether to open or close a factory. The more important a decision is, the better it has to be prepared.

This preparation is the job of planning in its widest sense. Planning supports decision-making by identifying alternatives of future activities and selecting some good ones or even the best one. Planning can be subdivided into the phases:

- recognition and analysis of a decision problem,
- definition of objectives,
- forecasting of future developments,
- identification and evaluation of feasible activities (solutions), and finally
- selection of good solutions.

Supply chains are very complex. Not every detail that has to be dealt with in reality can and should be respected in a plan and during the planning process. Therefore, it is always necessary to abstract from reality and to use a simplified copy of reality, a so-called model, as a basis for establishing a plan. The "art of model building" is to represent reality as simple as possible but as detailed as necessary, i. e. without ignoring any serious real world constraints.

The main objective of this subject is to introduce quantitative methods and techniques aimed to help the planning activities and, therefore, to support the decision making process. These methods are based in the use of formal models and their corresponding solving techniques. The student will learn how to model the system

and its decision making process and then how to apply the methods and techniques to select the optimal solutions. Basic case studies representing typical problems (e.g. planning, scheduling, distribution or routing) are used in the learning process.

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.
- Analyse, organise and discuss situations in logistics in order to identify and model the dependency relationships, influence and impact that usually occur in the main performance indicators and quality factors as well as evaluating their complexity.
- 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.
- Demonstrate information management skills: ability to retrieve and analyse information from different sources.
- 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.
- 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.
- 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 apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study
- Work collaboratively in a group.

Learning outcomes

1. Analyze, structure and propose mechanisms in order to identify and solve a decision problem in logistics systems
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. Demonstrate information management skills: ability to retrieve and analyse information from different sources.
5. Evaluate and compare the different alternatives to select the solution to be implemented, being able to assess beliefs and methods by combining intuition and analytical methods to identify the best solution.
6. Face a new problem under a scientific perspective.
7. Select and apply suitable methodologies and strategies to design a solution for a decision-making problem in LCSM.
8. 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
9. Students should know how to apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study
10. Understand how to model the system and the decision-making process

11. Understand the main methods and techniques supporting decision making
12. Work collaboratively in a group.
13. Work out arguments based on models and quantitative techniques

Content

THEORY

DM.T.1: Introduction to Decision Making:

- DM in LSCM:
  - SCM modeling
  - Advanced Planning
- Quantitative methods
  Planning and scheduling
  Forecasting

DM.T.2: Optimization methods:

- Linear and integer programming
- Constraint programming
- AI methods

DM.T.3: Production planning:

- Types of constraints
- Modeling structures

DM.T.4: Optimization of scheduling problems:

- Job sequencing
- Resource allocation
- Job and resource scheduling

DM.T.5: Heuristics and evolutionary methods:

- Introduction to evolutionary algorithms
- Heuristics in planning problems

DM.T.6: Heuristics and evolutionary methods

- Heuristics in Transport Planning

PROBLEMS

DM.P.1: Examples:

- Demand forecasting
- Production mix

DM.P.2: MILP modeling exercises

DM.P.3: Production planning models

DM.P.4: Production scheduling models

DM.P.5: Distribution: warehouses & inventory

DM.P.6: Transport network models

PRACTISE

DM.L.1: Introduction to OPL:

- S/W installation
- IDE overview

DM.L.2: OPL:

- MILP programming
- CP programming

DM.L.3: Productionplanning

DM.L.4: Production planning

DM.L.5: Heuristics and evolutionary methods

- Introduction to HeuristicLab
- Solving Job Shop Scheduling Problem in HeuristicLab

DM.L.6: Solving Transport and VRP problems

SEMINARS

Management Information Systems in Business: Role of IT in modern business

Methodology

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

- Theory lectures
- Problem sessions
- Practise sessions: computer lab, teamwork and oral presentation
- Autonomous work

Practical case studies and optimization tools are used for promoting students hand on skills.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Problem sessions	8.5	0.34	1, 5, 7, 13
Seminars	10	0.4	4, 7, 11
Theory lectures	31.5	1.26	10, 11, 13
Type: Supervised			
Practise sessions	18	0.72	1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 13
Type: Autonomous			
Personal study	50	2	1, 5, 7, 10, 11, 13

Problem solving and report writing	107	4.28	2, 3, 4, 6, 8, 9

Evaluation

The final grade will be calculated from the assessment of different evaluation activities:

- **B1**: Small project report related to the introduction to IT seminars.
- **B2**: Combines an **assay** or small project (team work) and the solution reports of four **practical exercises** (individual work) in therfield of Planning & Scheduling, where MILP and CP optimization methods are used to solve the problem.
- **B3**: Solution reports of two cases where heuristics methods are used to solve the problem.

In order to average all the evaluation activities, the mark of each of them must be above 5 points (out of 10). All the report-based activities must be submitted within the due dates specified by the professor. If a report-based activity is failed, the student will be asked to re-submit its report according to the corrections/indications provided by the professor.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
B1-Introduction to IT project	10%	0	0	3, 4, 8
B2-Planning & Scheduling practical cases	70%	0	0	1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13
B3-Heuristics practical cases	20%	0	0	1, 2, 3, 5, 6, 7, 10, 11, 13

Bibliography

Hartmurt Stadlert and Cristoph Kilger (Eds.) Supply Chain Management and Advanced Planning. Third Edition. Springer, 2005. (Electronic version available at the university library)

Ioannis T. Christou. Quantitative Methods in Supply Chain Management. Models and Algorithms. Springer, 2012. (Electronic version available at the university library)

H. Paul Williams. Model Building in Mathematical Programming. Wiley. 2013 (5^{th} edition)

Further readings

Joseph Geunes, Panos M. Pardalos and H. Edwin Romeijn (Eds.) Supply Chain Management: Models, Applications, and Research Directions. Kluwer Academic Publishers, 2002. (Electronic version available at the university library)

F. Robert Jacobs, William L. Berry, D. Clay Waybark and Thomas E. Vollmann. Manufacturing Planning and Control for Supply Chain Management. McGraw-Hill, 2011 (6^{th} edition)

F. Robert Jacobs and Richard B. Chase. Operations and Supply Chain management. McGraw-Hill Irwing, 2011 (13^{th} edition)

Other relevant literature can be provided during the lecturing period.