Supply Chain Management and Business Analytics

Main Track

Master in Business Engineering

Business Engineering

Supply Chain Management and Business Analytics

Main Track

This master's degree program covers two major tracks:

> Main Track: **Supply Chain Management and Business Analytics**

> Second Track: **Digital Business**

For more information about the second track, please see the corresponding brochure.

Business Engineering

Introduction

Supply chain management and business analytics are broad domains designed to improve operational performance and certainly not reserved to a handful of production engineers, freight transport specialists, or computer geeks. Supply chain management is:

- **a central concern for all the enterprises and organizations that deliver goods and services.**

- **a fundamental component of the enterprise strategy,** which procures competitive, decisive, and inimitable advantages: enterprises like Toyota, Colruyt, Amazon, Zara,... are able to establish leadership in their respective markets thanks to improved operations and supply chain management practices.

- **a set of activities carried out in conjunction** with all business functions (marketing, finance, human resources) and in close relationship with clients and suppliers.

- **a field that is constantly evolving** in order to cope with the opportunities and challenges of globalization (distant markets, humanitarian aid, etc.), advanced information and communication technologies (E-business, ERP, etc.), environmental concerns (recycling, green logistics, etc.), and increased efficiency concerns of organizations.

- **closely connected with one of the main competitive strengths of Wallonia:** in particular, the Port of Liège is the largest inland port in Belgium and the third leading one in Europe, and Liège Airport is the eighth leading cargo airport in Europe.

Business analytics allows organizations and managers

- **to cope with ever increasing amounts of data and information** generated in all kinds of formats and representations, both internally and externally – so-called Big Data;

- **to acquire more knowledge** of their customers, of their economic environment and of their own internal operations;

- **to take full advantage of available data** for making smarter decisions, for creating value, and for making better use of scarce resources.;

- **to support business insights and to move to fact-based management** by relying on data and on analytical disciplines.

Both supply chain management and business analytics rely on a common set of tools and methods, and are being simultaneously transformed by the ongoing digital revolution.

Objectives

The master's degree program with a specialization in Supply Chain Management and Business Analytics is aimed at students who want to expand their understanding of the management processes put in place by enterprises and organizations in order to best achieve their most fundamental mission, which is the production and distribution of goods and services. Analyzing data collected from a variety of sources with the aim of uncovering valuable information and insights, and making decisions informed by data analysis and supported by optimization techniques enable enterprises and organizations to improve their service levels and operational efficiency.

This master's degree program aims to provide future managers with analytical skills needed for efficient and informed decision making, in particular **in the context of supply chain and logistics management**. A range of in-depth courses introduces students to production and inventory management, transport and distribution, quality management, questions and opportunities linked to environmental concerns, optimization techniques, Enterprise Resource Planning (ERP) systems, E-commerce, text analytics, etc.

The core curriculum courses focusing on data analysis and data management systems, like **information technology management, business analytics, and statistics**, contribute to develop problem-solving skills.

Besides, the program deepens students' basic knowledge of the different management functions and strategies which underpin and interact with supply chain management processes, **especially corporate finance, marketing, and human resource management**. Throughout their course of study, students are brought to reflect about ethical, societal and sustainability issues encountered in business environments.

Career opportunities

The master's degree program with a specialization in Supply Chain Management and Business Analytics prepares students for careers in organizations that face complex decision problems in their supply chain and logistics management processes. The multidisciplinary profile leads to positions with a high level of responsibility in a wide variety of organizations, ranging from large-, medium-, and small-scale industrial companies, to consultancy firms, non-profit organizations and governmental agencies. The competencies and skills developed in the program are in high demand both in the national and international job markets, and will undoubtedly be needed even more in the future due to globalization and to the increasing importance of operational efficiency.

A non-exhaustive list of career opportunities and activity sectors reads as follows:

- Operations manager, supply chain manager, production manager/planner, logistics and distribution manager, purchasing manager, sales manager, transport manager/planner, warehouse manager, customer service manager, contract and supplier manager, quality manager, import/export manager, supply chain consultant, etc.

- ERP specialist, business analyst, data analyst, researcher and developer (R&D), etc.
- **Industries:** pharmaceutical, chemical and petrochemical, iron and steel, automobile, food and beverage, cosmetics, electronics, aeronautic, computer and communications, retailing, internet-based companies, software developers, etc.
- **Services:** road carriers, air carriers, sea carriers, 3rd and 4th party logistics service providers (3PL & 4PL), package carriers, hotel chains, consultancy firms, etc.
- **Non-profit:** hospitals, public sector (seaport, airport, railway authorities, etc.), humanitarian organizations, etc.

Strengths

The master's degree program with a specialization in Supply Chain Management and Business Analytics

- prepares **cross-functional managers**, in accordance with the quantitative and multidisciplinary education provided to business engineers;
- leads to **a degree that is highly demanded** both in Belgium and internationally;
- is tightly connected to the **economic environment** and the **enterprises of its region**;
- is supported by the scientific expertise of a **high-level academic team**;
- is offered fully in English.

Double-degree programs

Students that follow a double-degree program obtain two master's degrees after following a specific two-year curriculum approved by both institutions.

Double master's degree program with Ghent University:

- **Master in Business Engineering – Operations Management**, from Ghent University, Faculty of Economics and Business Administration
- **Master in Business Engineering – Supply Chain Management and Business Analytics**, from the University of Liege, HEC Management School

Double master's degree program with the University of Hohenheim:

- **Master in Management – Interorganizational Management and Performance**, from the University of Hohenheim, Faculty of Business, Economics and Social Sciences
- **Master in Business Engineering – Supply Chain Management and Business Analytics**, from the University of Liege, HEC Management School

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Program

The professional focus in Supply Chain Management and Business Analytics is a specialization area of the master's degree program in Business Engineering. Besides the compulsory courses (60 credits) of this graduate program, students take **3 specialization courses** (each for 5 credits) in the first year, 3 specialization courses (each for 5 credits) in the second year, perform **an internship** (10 credits) and write **a master thesis** (20 credits) during the second and final year of their studies.

YEAR 1

Common Curriculum of the Master's Degree Program in
Business Engineering (45 credits)
+
Supply Chain Management and Business Analytics (15 credits)
· Logistics and Transportation
· Operations Planning
· Computational Optimization

YEAR 2

Common Curriculum of the Master's Degree Program in
Business Engineering (15 credits)
+
Supply Chain Management and Business Analytics (45 credits)
. Quality, Ethics and Sustainability in Supply Chain Management
. Internship (10 credits)
. Master Thesis (20 credits)

Choose two courses among the following:
. Distribution Management
. ERP Solutions for Supply Chains.
. E-Business and E-Commerce
. Web and Text Analytics

First Year: 3 compulsory courses

LOGISTICS AND TRANSPORTATION (COMPULSORY)

Today, a firm can't be competitive without a good transportation and logistics network. Our goal is to understand the role and importance of transportation in the supply chain and in the economy. An overview of the different transportation modes: Road, Rail, Sea, Air, Pipeline and Intermodal transportation, allows supply chain manager to be aware of the performance of these different transportation modes in terms of costs, responsiveness, land use and environment. This course treats the fundamental topics of transportation such as transport contracts, transport insurances, the incoterms, the cold chain, constraints related to the transport of dangerous goods and customs.

This course also covers urban freight transport since it is a significant issue in the economic, commercial, social, and environmental management of our cities. Indeed, changes in intensity of freight movements are occurring as a result of the growth in e-business, just-in-time manufacturing, and quick response systems for retailers. The environmental consequences of urban freight traffic, especially in terms of greenhouse gas and other air pollution, are of increasing concern to the community.

After these considerations, freight transport will be modeled using the traditional four-step transportation planning model, consisting of trip generation, trip distribution, modal split, and assignment stages. This last step involves fundamental network flow problems such as the shortest path problem. The traffic congestion problem, the transport mode choice decisions, and the impacts of transport infrastructure will be especially highlighted. Several case studies are analyzed.

OPERATIONS PLANNING (COMPULSORY)

This course concentrates on mathematical programming models and techniques of production and inventory management that are designed to achieve greater operational efficiency both in industrial and service organizations. The course starts with tactical level decision-making problems and presents advanced models of aggregate production planning that are at the heart of « Sales and Operations Planning » systems. The operational level lot-sizing problems, that are the core decision-making problems of all the Material Requirements Planning (MRP) systems, are considered just after. At the very operational level, scheduling deals with the allocation of resources to tasks over given time periods with the goal of optimizing one or more objectives. Scheduling is a decision-making process that is used on a regular basis in many manufacturing and service industries. The course presents many structurally different scheduling problems and exact and heuristic solution methods

for these problems. The course also gives a general overview of the Just-In-Time (JIT) philosophy and the pull production control techniques associated with JIT practices like Kanban policies. Compared to push production control systems (like MRP systems), pull production control systems tend to limit the maximum amount of work-in-process inventory in the system. Moreover, the course aims to familiarize students with real world production and material flow management problems through an industrial case that analyses the production planning problem of a multinational enterprise. Students are wanted to treat this logistical problem, conduct detailed analysis, drive conclusions, and propose original improvement opportunities. In a second project, students are wanted to propose solutions to a single machine scheduling problem. Both group projects are realized using the Julia programming language.

COMPUTATIONAL OPTIMIZATION (COMPULSORY)

The aim of this course is to present various aspects of mathematical modeling and of problem-solving strategies as they are used in operations research for the solution of realistic, large-scale, complex problems. The course contains several independent parts:

- General-purpose heuristic strategies for the solution of combinatorial optimization problems, such as simulated annealing, tabu search or genetic algorithms; the practical implementation of such methods is illustrated on a variety of optimization problems.

- Integer programming and network problems. Branch-and-bound method. Modeling and solution of large-scale models.

- As time allows: other numerical methods, such as Newton's method, gradient methods, neural networks, simulation, etc.

Prerequisites: INFO0934-8 Information Technology Management or equivalent

Business Engineering

Second Year: 1 compulsory course and 2 optional courses to choose among 4

QUALITY, ETHICS AND SUSTAINABILITY IN SUPPLY CHAIN MANAGEMENT (COMPULSORY)

This course focuses on a variety of concepts, methods and processes aimed at ensuring that the execution of supply chain management processes delivers results in line with the strategy, the objectives and the values of the organization. This involves, on the one hand, putting in place specific quality management processes (Total Quality Management, lean management, statistical process control, quality assurance, certification) and developing indicators of the performance of the supply chain. The course also investigates the implications of sustainable development concerns (be they environmental, social or economic) on supply chain issues: product design, production processes, transportation, facilities design and location, relations with suppliers, and so forth. Students are introduced to such fundamental concepts as the environmental footprint of products, closed-loop supply chains, and reverse logistics management. Finally, students are brought to reflect on ethical issues that are frequently faced by supply chain managers. The roles and limitations of regulatory mechanisms such as laws, normative statements, corporate policies and codes are examined. The course is illustrated by case studies and guest lectures.

DISTRIBUTION MANAGEMENT (OPTIONAL)

The course will provide students with both fundamental and more advanced knowledge about distribution management. The entire distribution network will be taken into consideration. The scope of the course is to highlight the most important theories, concepts, models and methods in order to identify, describe, analyze and design diverse solutions for physical distribution of goods. The course will furnish an understanding of the important role played by warehouses, facilities in the supply chain where product pauses and is handled. One goal of this lecture is to develop mathematical models to allow to reduce space and time requirements or to exchange one for the other. This course also treats the fundamental topics of distribution such as distribution network design, hub-and-spoke networks, terminals and distribution centers, the travelling salesman problem, the bin packing problem, pickup and delivery problem, the vehicle routing problem, third and fourth party logistics.
Finally, the increased concerns about the environmental impacts of industrial activities and the search for economic advantages have given birth to the concept of a closed-loop supply chain (CLSC). Therefore, this course aims at covering topics related to CLSC

such as returnable transport items, green logistics and return flow processes. The latter include the product acquisition from end-users, the reverse logistics to bring these back, the testing, sorting and disposition to determine the most economically attractive reuse option(s), as well as the remanufacturing and the remarketing to create and exploit new markets.

ERP SOLUTIONS FOR SUPPLY CHAINS (OPTIONAL)

The course aims at linking theoretical knowledge that students acquired during their master studies with practical aspects of international logistics and familiarizing students with the logistics modules of SAP, one of the main ERP management information systems. In the first part of the course, the case of a European manufacturer selling an end-product to a non-EU country is treated. Students are wanted to determine purchasing, production, and transportation plans of the company with the aim of satisfying the demand forecasts of the next three years. While establishing these plans, students face a wide range of practical supply chain decision-making problems, in each they are wanted to minimize the operational costs of the company. They determine the selling price of the end-product taking into account purchasing, production, and transportation costs. In the second part of the course, students get familiarize with the logistics modules of SAP through hands-on navigation, process cycle, and parameterization exercises. Accordingly, they are wanted to parameterize the ERP system of the manufacturing company studied in the first part of the course.

E-BUSINESS AND E-COMMERCE (OPTIONAL)

Business encompasses E-Commerce activities and also deals with processes that are internal to an organization, such as production and finance. E-Commerce and E-Business have important ramifications both for the business organizations and for consumers alike. For example, consumers have at their disposal a wide plethora of online shopping malls, electronic catalogues, and are able to rely on online decision-aids, such as ratings and the experience of previous consumers in blogs, forums and review sites before deciding to make a purchase. For business organizations, the issue is not whether to adopt E-Business/E-Commerce, but rather how to better leverage upon these technologies to differentiate themselves from competitors and to discover novel business opportunities that were previously not possible, such as the ability to continuously monitor the Voice-of-the-Customer (VOC) on Web 2.0 channels (blogs, forums, social media). The aforementioned issues are some of the subjects that will be addressed in this course. The main aim is to provide students with a solid background in E-Commerce and E-Business. In particular, the course focuses on how E-Commerce and E-Business are related to core business processes and information systems, such as supply chain management, sales and marketing. The impact of novel technologies and trends, including Web 2.0 and Social Networks will also be covered. Furthermore, the course also deals with the important topic of security and trust in online business transactions. In addition, this course also has a practical

component. The aim here is to expose students to the technical/technological concepts that underlie E-Commerce systems. Furthermore, the practical component will equip students with a set of fundamental skills for developing E-Commerce applications.

Prerequisites: INFO0934-8 Information Technology Management or equivalent

WEB AND TEXT ANALYTICS (OPTIONAL)

In recent years, we have witnessed the proliferation of data in text format. This proliferation has been substantially fuelled by the emergence of social media networks and online communities, which enable users to express themselves using natural language texts. Typical examples include messages on social networks like Facebooks, tweets on Twitter about important topics and events (such as political campaigns and elections) and users opinions on products, brands and companies available from review sites (such as Amazon). It is also worth mentioning that unstructured data (text, image, video) constitute of the "Vs" that are commonly used to describe Big Data, namely Variety. (In this course, however, our focus will be on text). Buried within these huge volumes of texts are meaningful information nuggets, which if detected and extracted can be exploited to support a wide range of activities, especially Business Intelligence. For instance, business organizations use the opinion of users on products from review sites to improve their brand images, products and services. However, the challenge lies in how to automatically process these huge text collections in order to detect and extract meaningful information from their contents?

This course will introduce students to the fundamentals of web and text analytics, with a strong focus on machine learning and (basic) natural language processing (NLP). Typical topics will include: web crawling, vector space representation, text similarity, sentiment analysis and social network analysis. Thus, the course contents will be highly technical and mathematical in nature. In addition, the theoretical foundations will be complemented by hands-on projects, requiring students to design, develop and implement simple algorithms for tasks related to web and text analytics, such as web crawling, text classification and sentiment detection.

Prerequisites: INFO2048-1 Business Analytics or equivalent

Business Engineering

Internship/Master Thesis

In order to fulfil the requirements of their training at HEC Management School of the University of Liège, all students of a 120-credits master program are to perform an internship in a company and to write a master thesis in the second year of their studies.

As concerns the practice-based thesis, the internship and the master thesis are strongly interrelated and defined within the scope of the student's chosen specialization.

As concerns the research thesis, the internship and the master thesis are defined within the scope of the student's chosen specialization but not necessarily interrelated.

Students choose one of the following two options

2 options

Internship
(10 ECTS)

Master thesis
(20 ECTS)

Practice-based thesis
(30 ECTS)
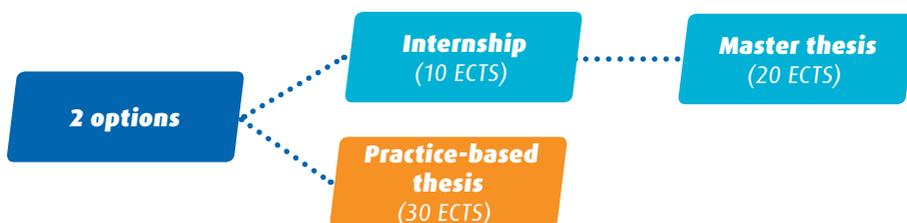
10-week Internship

Students do an internship in a company lasting over the first 10 weeks of the academic year (from mid-September to end-November).

The internship can be done within a private (either commercial, financial or industrial) or public enterprise, a semi public institution or an international organization. The internship is based in Belgium or abroad and is generally not remunerated.

Students choosing this internship option are bound to do a Research-Paper as an ESP (end-of-study project). Those choosing the internship as integrated within the Project-Paper are to refer to the last option detailed hereunder.

For more details: go to the «10-week internship» menu available on LOL@.

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Research thesis

Students are expected to deliver a master thesis treating an original research problem to be defined within the scope of their chosen specialization. The master thesis presents rigorous scientific analysis and constitutes a contribution to the field of research. It demonstrates the theoretical knowledge that students acquired during their master studies and their ability to apply this knowledge critically in order to build and propose some original, creative and viable solutions to a complex management problem.

For more details: go to the «Research Thesis» menu available on LOL@

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Practice-based thesis

Students writing a practice-based thesis analyze a complex management problem arising in a private or public organization located in Belgium or abroad. The studied problem must be original and related to their chosen specialization. The practice-based thesis makes use of rigorous scientific analysis in order to demonstrate the theoretical knowledge acquired by students during their training as well as their critical thinking and problem solving skills.
Students begin the practice-based thesis by working one day a week in the company during the first semester and deepen their analysis within the framework of a 10-week internship in the second semester of the second and final year of their studies.

For more details: go to the «Practice-based Thesis» menu available on LOL@.

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Notes

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http://progcours.ulg.ac.be/cocoon/programmes/G2UING01_C.html#3269579