2021_S02_PGE_M2_OPS_0636_E_L_BOD

SUPPLY CHAIN MODELLING & SIMULATION

2nd Semester, 2020-2021

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OFFICE HOURS	on demand

COURSE DELIVERABLE	DUE DATE	WEIGHT ON FINAL GRADE
Continuous Control	During the course	50%
Exam	End of the module	50%

Kedge Business School and its professors, encourage you to use your Pro-Acts, company projects and internships as privileged opportunities to apply the reflections, theories, concepts and tools presented during this course

SUPPLY CHAIN MODELLING & SIMULATION

INTRODUCTION AND OBJECTIVES

Course Purpose & Objectives

Decades after the introduction of Supply Chain Management (SCM) term, it is still a subject undergoing intense study. SCM is intended to globally optimize the SC performance. For this purpose, the performance of its operations, processes and flows as well as its results (e.g. product quality) should be studied where the lack of visibility is a primary challenge in the current SCs. This lack of visibility is mainly due to the complexity of the current Supply Chains. The aforementioned complexity can be due to the current social, business and technological evolutions affecting: the variety of the components' nature and their behavior (human and machine); the numerous interactions of these components; internally, between enterprise resources and externally with the environment, customers, suppliers and competitors; automation and new data exchange technologies and developments in the global market; the excessive data and information … In such a complex environment, modeling techniques, based on formal (mathematical) or graphical languages, can be applied as preliminary managerial supports providing an abstract representation of the Supply Chain, for both existing processes and the one to be developed. Nevertheless, these models provide solely a static view. To go further, simulation can be necessary for providing a dynamic view and a better understanding of the Supply Chain behavior. Therefore, Modeling and Simulation (M&S) are complementary methods necessary for enterprise management, and by extension SCM. In other words, enterprises are gradually integrating M&S to understand and evaluate their processes to eventually keep themselves competitive in the market.

"*There are several reasons why M&S techniques can support decision-making: they provide better understanding of the real system and its behavior, reveals previously hidden relationships, performs a systematic analyze of the situation, facilitates communication and provide a basis for discussions, allows the decision-maker to test the different alternative scenarios without having to make changes in the real system*"

The aim of this course is to provide information and knowledge to students to understand the basics of M&S, while making them aware of the need for such solutions, their benefits as well as their limits. This course will also help them better understand the essence of Supply Chain and its processes. Both product- and service-based processes will be addressed.

Considering the plethora of existing M&S solutions, a number of complementary techniques have been selected to be addressed in this course. Regarding the modelling part, graphical process modelling based on Enterprise Modelling techniques has been selected. Their main advantage is their simplicity while being applicable in any managerial context. Concerning the simulation part, two types of simulation are selected. The first one is an immersive business game where the students make decisions and manage Supply Chain operations in a pseudo-real environment. The second type of simulation is supported by simulation software, where the students both model and simulate a process (e.g. supply chain operations) with preset parameters and decisions. This type of simulation allows managers to understand or predict the dynamic behavior of a process without really engaging the process resources. It should be mentioned that the students will work on the simulation part starting from the models elaborated using taught modelling techniques during the course.

Courses contribution to program objectives (Learning Goals (LG)) of PGE program)

SUPPLY CHAIN MODELLING & SIMULATION

1) ***PGE1 - Understand and integrate core*** Supply Chain ***management disciplines*** in the context of a manufacturing or service Supply Chain (SC). The first objective of this course is to make students able to:

- Understand the need for Modelling & Simulation (M&S) in the Supply Chain context
- Recognize the adopted M&S methods or tools, and be able to respond to certain challenges of SCM using those solutions while considering the benefits and limits of these methods
- Apply a Modelling & Simulation (M&S) method or tool supporting SCM or Operations Management
- Apply M&S solutions for elaborating and testing Supply Chain processes `
- Understand SCM processes and their challenges as well as the notions of Supply Chain planning and performance

Course description:

Supply Chain; Supply Chain Management; Logistics; Operations; Business Process; Physical and Information Flows; Performance; Decision; Modelling & Simulation; Product; Service.

COURSE MATERIAL

Course materials available on Learn (https://learn.kedgebs.com)

- PowerPoint presentations for theoretical sessions

- Exercises and projects

****** Modelling and simulation tools and the installation instructions will be provided before the class.***

Additional references

Zeigler, B.P., Praehofer, H. and Kim, T.G. (2000). "Theory of modeling and Simulation", NY.

Chen, D. and Doumeingts, G., (1996), The GRAI-GIM reference model, architecture and methodology, in "Architectures for Enterprise Integration", Bernus P., Nemes L., J. Williams T. (Ed), IFIP Advances in Information and Communication Technology 1996.

Doumeingts, G. & Ducq, Y., (2001). Enterprise Modeling techniques to improve efficiency of enterprises" in. International Journal of Production Planning and Control , 12(2), pp. 146-163.

Ducq, Y., & Vallespir, B. (2005), Performance evaluation using decisional modeling. In 4th international conference on decision (pp. 15–30).

Archibald, G., Karabakal, N. and Karlsson, P. Supply Chain vs. Supply Chain: Using Simulation to Compete Beyond the Four Walls, Proc. 1999 Winter Simulation Conference, pp 1207-1214, IEEE Piscataway, New Jersey

M. Jahangirian, T. Eldabi, A. Naseer, L. K. Stergioulas, T. Young, "Simulation in manufacturing and business: A review", European Journal of Operational Research, Vol. 203, pp. 1–13, 2010.

SUPPLY CHAIN MODELLING & SIMULATION

M. Semini, H. Fauske, J. O. Strandhagen, "Applications of discrete-event simulation to support manufacturing logistics decision-making: a survey", Proceedings of the 38th conference on Winter simulation, 2006, pp. 1946-1953

Websites

http://www.idef.com/

https://www.simio.com/index.php

https://www.anylogic.com/

https://www.cipe.fr/jeux-et-formations/logistique-supply-chain/logistica-le-jeu-de-la-supply-chain/
www.supplychain-forum.com

SUPPLY CHAIN MODELLING & SIMULATION

COURSE CONTENTS AND TIMETABLE

SESSIONS	TOPIC	PRELIMINARY READING(S) AND ASSIGNMENTS
1	Enterprise Modelling: Principles and approach Flows' Modelling (Business Process Modelling)	Session slides form LEARN
2	GRAI Modelling method and its combination with SCOR Model	Session slides form LEARN
3	Modelling exercises	Exercises and projects from LEARN
4	Supply Chain Simulation Game (Logistica – part 1)	Session slides form LEARN
5	Supply Chain Simulation Game (Logistica – part 2)	To be distributed during the game
6	Tool-Based Simulation	Session slides form LEARN
7	Supply Chain Simulation Tool (Simio / AnyLogic * – part 1)	Project description form LEARN
8	Supply Chain Simulation Tool (Simio / AnyLogic – part 2)	n.a.
9	Supply Chain Simulation Tool (Simio / AnyLogic – part 3)	n.a.
10	Exam	-

** Considering the particular situation of the current academic year and lack of access to school computers, this software will be also included in the course for Mac users.*

SUPPLY CHAIN MODELLING & SIMULATION

TEACHING APPROACH/ INSTRUCTIONAL METHODS

Teaching Philosophy

Message of course coordinator: Education involves developing habits, developing skills and gaining understanding. Two philosophies guide everything I do when designing and teaching a course:

- *Tell me and I will forget, show me and I may remember; involve me and I will understand.*- Confucius
- *We are what we repeatedly do. Excellence, then, is not an act, but a habit*.- Aristotle

Our goal is to help you gain the understanding, skills and habits necessary to become skilled thinkers and decision makers in the Supply Chain area.

A Word of Advice

This course will address Supply Chain Management and usage of Modelling & Simulation techniques to support that. The main target are learners who have preliminary understanding of SCM. This is why the learners are advised to carefully prepare each session and study SCM fundamentals in advance.

Therefore, we expect from you as a learner to be a collaborator and contributor, prepared and engaged in all classroom activities throughout the course.

Organization of the sessions

This course combines classroom lectures, exercises, games and computer-based experiences. There will also be individual / group assignments to be delivered by the students. Students must use commercial or academic terminology (in English) to present their work in a credible way to an informed business audience.

Office Hours Policy

We encourage you to meet us throughout the semester. However, we expect you to come prepared while informing me in advance to fix an appointment. Appointments allow us to discuss any issue you may have about the course or to answer any relevant question (e.g. career choices). You can come see us after class or contact us by e-mail on the relevant subject.

EVALUATION OF STUDENT PERFORMANCE

A	Modelling exercises	Continuous Control - Individual Assignment	10%
B	Business Game	Continuous Control - Collective Assignment	10%
C	Simulation project	Continuous Control - Collective Assignment	30%
C	Examen final	Individual Assignment	50%

SUPPLY CHAIN MODELLING & SIMULATION

Methods Used to Evaluate Student Performance

A) Modelling exercises (10%): This work will be evaluated individually or on the basis of the performance of the groups of students during the third session (Enterprise Modelling). Some HomeWorks will be also requested.

Evaluation Criteria: selection of the right modelling techniques, accuracy and correctness of the models.

B) Groupe work – simulation through business game (10%): This Supply Chain game is a type of immersive simulation which invites participants to set up a whole supply chain: from component suppliers (on different continents) to customers spread across the world. The students will play the role of the Supply Chain team at a company (several student teams will work on the same company), responsible for defining the supply chain for the marketing of a new range of products. For this, they define and follow a methodology, based on the sequence of a dozen organized steps: establish forecasts, plan production and supply, select transportation mode, model the distribution network, up to the reverse logistics (after-sales service, maintenance, end of product life).

Evaluation Criteria: This work will be evaluated on the basis of the performance of the teams, the results submitted by them and their participation.

C) Groupe work – simulation using a tool (30%): this work will be evaluated on the basis of the performance of the groups of students delivering simulation projects using a tool (Simio for Windows users and AnyLogic for Mac users); the deadlines will be defined accordingly, groups will be formed and trained and the instructions will be given in class.

This year, in each group, we will have both Simio and AnyLogic users to allow students see both tools.

Evaluation Criteria: the evaluation will be based on the validity of the simulation models and their results, the quality of the written report and performed analyses as well as the cooperative behavior of the students.

D) Final exam (50%): The exam verifies the knowledge of terminology and concepts as well as the application of these concepts to respond to real business situations.

- Exam Part 1 (25%): Modelling

Evaluation Criteria: See criteria 1 & 2 in the table found on the next page.

- Exam Part 2 (35%): Simulation

Evaluation Criteria: See criteria 3 & 4 in the table found on the next page.

➔ See the evaluation criteria on the next page.

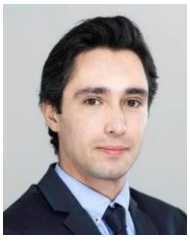
The final exam will be both paper-based (see criteria 1 and 2) and computer-based (see criteria 3 and 4). Both parts will be held at the final session.

SUPPLY CHAIN MODELLING & SIMULATION

Evaluation criteria (Final Exam)

Criteria	BELOW EXPECTATIONS / NOT GOOD ENOUGH	MEETS EXPECTATIONS / GOOD ENOUGH	
	0-1.75 point	**2-3.5 points**	
1) Ability to cite, define, and exemplify Modelling concepts associated with Supply Chain context and to explain their role in Supply Chain Management	*> The student is not able to define Modelling & Simulation concepts.* *> He / She is not able to explain the need for such solutions in SCM.* *> The written expression is not well-formulated or the terminology is not adapted.*	*> The student is able to define Modelling & Simulation concepts but the expression / interpretation of those concepts is limited and indicates a lack of vocabulary.* *> The examples provided are either limited or irrelevant.* *> There is a lack of structure in the expressions.*	*> > ca > te*
	0-1.75 point	**2-3.5 points**	
2) Ability to analyze Modelling methods / languages / tools and to highlight the challenges / benefits / limits of these solutions, in a generic or given situation	*> The student is not able to name a single challenge / benefit / limit.* *> He / She cannot analyze a given challenge or explain its implications nor explain the need for a solution* *> He / She cannot detect a challenge in a given situation,* *> The student's expression is not well formulated or the terminology is inappropriate.*	*> The student can highlight the main challenges / benefits / limits.* *> He / She is able to provide some basic examples.* *> He / She is not able to analyze in depth a given situation and to identify the need / usefulness of a solution.* *> Expressions could be improved (in terms of structure or terminology).*	*> be > re > (m > fo*
	0-1.75 point	**2-3.5 points**	
3) Ability to apply Simulation methods / tools in support of SCM / Operations Management	*> The student cannot explain the purpose of the method(s) / tool(s).* *> He / She is unable to propose a method (existing, mixed or personalized) or to apply the given method(s) / tool(s)* *> The expressions / results are not correct.* *> The requested comparative analysis is not carried out. (if applicable).*	*> He / She can explain the generic purpose of the method(s) / tool(s)* *> He / She is not able to propose a complementary method / tool (existing, mixed or personalized).* *> The method(s) is (are) applied but the arguments or the final results are not completely correct.* *> The comparison made is not complete (if applicable).*	*> ac > > qu pe > >*
	0-1.75 point	**2-3.5 points**	
4) Ability to analyze Simulation results in support of SCM / Operations Management or to perform a comparative analysis of given scenarios	*> He / She is unable to get the simulation results* *> The expressions / results are not correct.* *> The requested comparative analysis is not carried out. (if applicable).*	*> The simulation results are partially correct.* *> He / She is not able to perform an analysis on the simulation results.* *> The comparison made is not complete (if applicable).* *> Expressions could be improved (in terms of structure or terminology).*	*> sc > > te >*

BIOGRAPHIES



Amir Pirayesh is Assistant Professor in Operations & Supply Chain Management. He received his Ph.D. in Industrial and Mechanical Engineering from Ecole Nationale Supérieure d'Arts et Métiers (ENSAM) where he was also Research Assistant and Lecturer (ATER). Before joining KEDGE, he was involved in several European projects, in the frame of H2020 programme and Factories of Future (FoF) initiative, as researcher of InterOP-VLab (the International Virtual Laboratory for Enterprise Interoperability). His teaching and research interests include the analysis of Manufacturing and Supply Chain Operations using Enterprise Modelling and Process Simulation (M&S Driven Enterprise Management), Interoperability Evaluation, Performance Measurement, and Risk Assessment. His research revolves also around various aspects of Servitization and Cyber Physical Production Systems (CPPS). He has contributed to several scientific publications.

Omid Fatahi Valilai is Lecturer in Industrial Engineering in the Departments of Mathematics & Logistics, Jacobs University Bremen. He received his Ph.D. in Industrial Engineering from Sharif University of Technology where he had also worked as an Assistant/Associate Professor for six years. His research expertise is in area of Computer Integrated Manufacturing and Cloud manufacturing. His teaching and research interests include the Design of advanced manufacturing system and Supply Chain analysis. His research revolves also around smart factory design and Industry 4.0 paradigm. He has contributed to several scientific publications.

Frédéric Hauser is a logistic organisation and Supply Chain strategy consultant. He graduated as engineer from IMT Mines Albi (1999) and holder of a bank and financial engineering specialized master from Toulouse BS (2000). He has successively practiced in production, investment and remachining management, enterprise management, transition management and Supply Chain projects. He has worked equally in SMEs and international groups of several branches of activity. This allows him to help his customers to optimize their SCM by harmonizing the products flow, the processes and the Legacy Systems.

Yves DUCQ is full Professor and vice-President of University of Bordeaux in charge of continuous improvement and documentation. Yves Ducq is a Doctor from University Bordeaux 1 in Production Management and Enterprise Modelling. He received his PhD degree at the University Bordeaux 1 in 1999 and received his Accreditation to Supervise Research in 2007. He is working on Performance Measurement, Enterprise Modelling, Production Management and Interoperability and has published more than 40 papers in books and international journals and more than 100 papers in international conferences. He has been involved on several European projects for twenty years and particularly in the frame of IMS - GLOBEMAN 21 (FP4), Growth – EUROSHOE, IST – CENNET (cooperation with China) and IST - UEML of the FP5. He was strongly involved in INTEROP Network of Excellence, and is President of virtual laboratory on interoperability: INTEROP Vlab. He is also involved in many French research projects. He has also acted as research engineer on several contracts with industry on performance improvement and quality. In the frame of his vice-presidency, he is in charge of spur projects related to continuous improvements, quality, process simplification, accreditations and open science.

SUPPLY CHAIN MODELLING & SIMULATION

ACADEMIC FRAUD

Definition

Academic fraud is a breach of ethics.

"Is achieved using unfair means or deception, to obtain material or undue moral advantage, or with the intent to avoid the enforcement of laws". (Translated from the original source: Dictionnaire Juridique des Lois, 2010, available at: www.dictionnaire-juridique.com/definition/fraude/php)

Plagiarism consists of attributing authorship by (partial or total) copying, imitation or misappropriation.

The act of fraud is committed by one or more students/participants when they:

- appropriate written or oral work to themselves when they are not the author (in whole or in part) of the work, by omitting any references or quotations to the author or to the owner of the work;
- present any data that has been falsified or invented in any way;
- use the identity of the author, attributing the contents of and/or a resource to him/her, but without explicitly mentioning that they are not the author;
- appropriate the creative work of someone else and present it as their own;
- acquire exerts of texts, images, results etc. from external sources by including them in their own work without mentioning the origins of the exerts;
- summarise the original idea of an author by expressing it in their own words but omit quoting the source;
- cheat in an academic evaluation.

Plagiarism can occur in:

- an academic article or book;
- an exercise or a case study;
- a study or a report;
- a dissertation or a thesis;
- any document of which the student/participant is not, but purports to be the author.

Sanctions

Any student/participant having committed academic fraud, or having participated in it, will be sanctioned by the professor in charge of the course. The professor can apply 1st and 2nd level sanctions (detailed below). The professor will send a copy of the sanction to the student's/participant's programme. The student/participant will be informed/and or convoked by the programme director (or his/her representative) to a hearing prior to the possible convening of the Kedge Business School Disciplinary Council. In the case of a hearing of the Disciplinary Council, they can decide to apply 3rd and 4th level of sanctions.

Any student/participant guilty of academic fraud will receive one of the following sanctions:

- Applied by the professor in charge of the course, Kedge Business School faculty member (1st and 2nd level):
  - A grade of zero for the work concerned and a formal warning;
  - A grade of zero for the course or module concerned and a formal warning.

SUPPLY CHAIN MODELLING & SIMULATION

- Applied by Kedge Business School's Disciplinary Council (3rd and 4th level):
  - Suspension from the programme for one or two semesters;
  - Exclusion from the programme.

N.B.: Plagiarism within a partner institution can result in these sanctions being applied by Kedge Business School, notwithstanding partner's decision.