

External Research Activity Report

Ph.D. Visiting at Delft University of Technology (The Netherlands)

September 07 – December 20, 2021

Summary

I spent the period from September 07, 2021, to December 20, 2021, at the Delft University of Technology (TU Delft), Faculty of Technology, Policy and Management, Department of Engineering Systems and Services, Section Transport & Logistics. During my stay, I have been working under the supervision of [Prof. Lóránt Tavasszy](#) and [Dr. Yousef Maknoon](#). Moreover, I started collaborating with [Dr. Stefano Fazi](#), [Dr. Alessandro Bombelli](#), and [Dr. Wenhua Qu](#). The visit was an excellent opportunity for networking and working in strict contact with experts in Operations Research and Logistics. During my stay, I tried to focus on different problems compared to what I had studied before. That required extra effort to check the relevant literature review for the three projects described below. Since the time spent in TU Delft was limited, I focused on starting new international collaborations and planning the objectives to achieve in each project. In this report, I present an overview of the projects and the details of the activities performed during my stay. The rest of the work required to complete the projects will continue long-distance.

Projects

- *Shipment planning problem*: We consider a logistics network with transshipment terminals and transport services, in which a logistics service provider (LSP) should decide how to ship containers for many customers. The LSP aims to minimize the operations' total costs and ensure as much as possible that the shipments arrive on time. Decisions are made in two steps. First, the LSP should decide the shipments assignment to the available services and if some of the service schedules need to be adjusted within a specific range. Those decisions are made in an uncertain environment since the outcomes of the operations are not known in advance but can only be estimated. Then, the LSP should decide the re-planning procedures to adopt during the execution of the operations to respond to any disturbance appropriately. We decided to model the problem through the Stochastic Programming paradigm and adopt a solution methodology based on a rolling horizon approach. The work greatly focuses on the operations and congestions within terminals that are not well addressed in the literature regarding shipment planning problems, even though significant bottlenecks happen.
- *Container stacking problem*: We consider a terminal that requires positioning containers within stacks a day before operations. The terminal aims to minimize the

handling to retrieve containers during the operations, considering the limited resources of cranes and vehicles for moving containers within the terminal. Containers are piled, and many more handling operations are required if containers on the bottom must be retrieved before the ones above. That can easily lead to congestions, especially in small terminals. Moreover, freight logistics is becoming more dynamic, implying that containers are often shipped with different transport modes than planned ones. That can lead to even more delays in terminal operations since the loading points for the different modes can be far from each other. In this work, we propose a two-stage Stochastic Programming model. The decision on where to stack containers is made considering that the transport modes assigned to containers can change. This work is based on a case study regarding a problem faced by the terminal BTT Multimodal Container Solutions B.V., Tilburg (Netherlands).

- *Horizon Europe 2020 project ORCHESTRA*: I got involved in the [2020 Project ORCHESTRA \(No 953618\)](#) that started a few months ago and will last for three years. The project aims to design a multimodal traffic management ecosystem to handle common and exceptional situations (e.g., COVID-19). This new system aims to provide efficient and reliable coordination of stakeholders to improve the traffic management of all modes both in rural and urban areas to transport people and goods. The concept will be tested on two case studies. The former involves Milano Malpensa airport (Italy). Its focus is on coordinating the door-to-gate passenger flow defining the route for each passenger considering their preferences (e.g., fastest trip, cheapest path) and the traffic situation. The latter involves Herøya Industrial Park (Norway) and focuses on a synchronization system to manage the traffic of autonomous vehicles within the industrial site.

Activities performed during my stay

- *Shipment planning problem*: Besides the literature related to this problem, I studied the literature related to congestion in terminals to understand how to integrate it within the shipment planning problem. After that, we discuss which characteristics to include in our study based on realistic assumptions, and we start to introduce the notation for the problem. Then, we define the modeling approach and the methodology to solve the problem. For this work, we plan to have one publication.
- *Container stacking problem*: I study the literature regarding the stacking problem, and we discuss how to integrate into the problem features of modern logistics not considered yet. I also had a meeting with BTT Multimodal Container Solutions B.V. They explained in detail how they perform daily operations and the issues causing delays. The meeting helped me define a case study to test a new model for the stacking problem and evaluate if it can solve the current congestion problem faced in the Tilburg terminal. We plan to make one publication to present the new model and the Tilburg Terminal case study tests.
- *Horizon Europe 2020 project ORCHESTRA*: This project is still early, and my contribution until now is limited. At the time being, I am helping to do a literature review on relevant topics, and we plan to have a publication on that. In the future, we

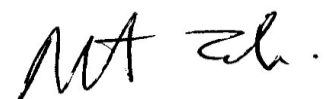
are planning to have at least two technical publications on the methodologies used in the two case studies.

- *Freight & Logistics Lab*: I joined the [Freight & Logistics Lab](#) formed by researchers of 6 different faculties of TU Delft. Attending the weekly meetings allowed me to discuss my research with experts of various fields and have valuable insights on interesting future developments. Moreover, I had the chance to follow exciting presentations on the ongoing research carried out at TU Delft on logistics-related topics.
- *Visit the Port of Rotterdam*: I participated in the guided visit of the port of Rotterdam organized within the 29th Conference of the International Association of Maritime Economists, Rotterdam, The Netherlands, November 25-27, 2021. That was an exciting opportunity to see one of the world's largest and most technological ports. This experience helped me understand how the logistics operations are performed and the challenges of such big ports.

Turin, 26/01/2022

Ph.D. Student
Riccardo Giusti

Supervisor
Roberto Tadei



Date 12 July 2021
Contact person Prof. dr.ir. L.A. Tavasszy
Telephone +31 15 2782679
E-mail l.a.tavasszy@tudelft.nl
Subject INVITATION

To: Riccardo Giusti
Ph.D. student
Politecnico di Torino – DAUIN
Turin, Italy

Fac. Technology, Policy & Management
Dept. ESS/ Section TLO
P.O. Box 5048
2600 GA Delft
The Netherlands

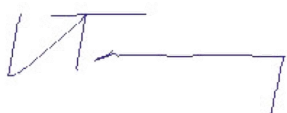
Dear Riccardo Giusti,

Herewith I have the pleasure to invite you as visiting Ph.D. scholar for a period of three months at the Delft University of Technology (TU Delft), Faculty of Technology, Policy and Management, Department of Engineering Systems and Services, Section Transport & Logistics. Your visit is now planned to take place in the period between September and December 2021.

During your stay at TU Delft, you will be working under the supervision of Dr. Yousef Maknoon and myself on research related to optimization in synchromodal logistics. One of our objectives will be to produce a joint scientific paper published in an ISI indexed journal. We will be happy to support you with your visit arrangements and to provide you with access to the necessary facilities at our campus.

We look forward to welcoming you in Delft.

Yours sincerely,



Professor Lóránt Tavasszy
Professor, Freight & Logistics
Faculty CEG/TPM
Delft University of Technology
L.A.Tavasszy@tudelft.nl

cc. Dr. Yousef Maknoon, Dr. Jafar Rezaei

Dati Richiesta			
Numero richiesta: 2070740		Data registrazione: 27/08/2021	Numero missione: 2133440
Richiedente			
Cognome: GIUSTI		Nome: RICCARDO	
Codice fiscale: GSTRCR89T14E290B		Qualifica: DR - Dottorati di Ricerca	
Missione			
Destinazione			
Luogo	Data e ora inizio	Data e ora fine	Sospensione
Delft	07/09/2021 00:00	20/12/2021 23:59	NO
Luogo Partenza: TORINO		Tipo Richiesta: FPROG FONDI DI PROGETTO	
Responsabile progetto: TADEI Roberto		Progetto: 50_DIM34_GIUSTI DAUIN - 34° CICLO - GIUSTI	
Unità di lavoro:		Regolamento: Regolamento di Ateneo	
Modalità rimborso: Elenco spese sostenute (Piè di lista)		Missione senza Spese: No	
Motivazione: Delft 07/09/2021 -20/12/2021 Visita per collaborazione scientifica a Delft University of Technology		Note: Si richiede di utilizzare il fondo 50_DIM_34_GIUSTI fino a esaurimento e di integrare la parte restante con il fondo 50_RBA17TR01. Vedere mail in allegato per verificare l'autorizzazione all'utilizzo del secondo fondo.	

Spese a preventivo							
Tipo	Valuta	Importo	Importo in Euro	Modalità sostenimento	Note		
PERNT PERNOTTAMENTO	EUR	3.278,47	3.278,47	Richiedente			
AEREO AEREO	EUR	233,39	233,39	Richiedente			
Richiesta anticipo: No							
Costi Presunti della missione:							
Costo Presunto Spese a Preventivo:		3.511,86	Costo Presunto Spese Prepagate:		0,00		
Costo Presunto Indennità Forfettaria:		0,00	Costo presunto Totale:		3.511,86		
Spese a consuntivo							
Tipo	Data sostenimen	Valuta	Importo	Importo in Euro	Modalità sostenimento	Note	
AEREO AEREO	07/09/2021	EUR	231,47	231,47	Richiedente		
PERNT PERNOTTAMENTO	07/09/2021	EUR	4.680,00	4.680,00	Richiedente		
Totale spese richieste a rimborso: 4.911,47							
Totale spese prepagate Ente: 0,00							
Spese rimborsate							
Tipo	Data sostenimento	Valuta	Importo	Importo in Euro	Importo rimborsato	Autorizzazion e	Note autorizzatore
AEREO	07/09/2021	EUR	231,47	231,47	231,47	Non necessita	
PERNT	07/09/2021	EUR	4.680,00	4.680,00	4.680,00	Non necessita	

Netto:	4.911,47
Totale Imponibile:	4.911,47
Contributi e ritenute a carico del percipiente:	0,00
Anticipi recuperati:	0,00

Autorizzazioni				
Tipo autorizzazione	Autorizzatore	Stato	Data	Note
Fondi Progetto	TADEI Roberto	Autorizzata	27/08/2021	
Svolgimento	SONZA REORDA MATTEO	Autorizzata	02/09/2021	Fatto salvo il rispetto delle procedure di accesso al luogo di lavoro nel rispetto delle misure di prevenzione finalizzate al contenimento della diffusione di COVID-19