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IMPROVING TRANSPORT EFFICIENCY IN THE CONSTRUCTION SUPPLY CHAIN

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Triple F Autumn Conference

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Agenda

- Background and Purpose
- Scope
- Data Collection
- Findings
- Contributions
- Limitations and Future research

How Does Construction Transport Work?

pre
zero

4
RANDERS
RANDERS

Reg nr VIKTIGT
Vecka
Datum
2710
2720
2730
2740
2750
2760
Extrabil tim
Chaufförens namn

Purpose and Research Questions (RQs)

"To investigate how to improve construction transport efficiency by using logistics services, digital tools and information sharing to add value for the involved actors"

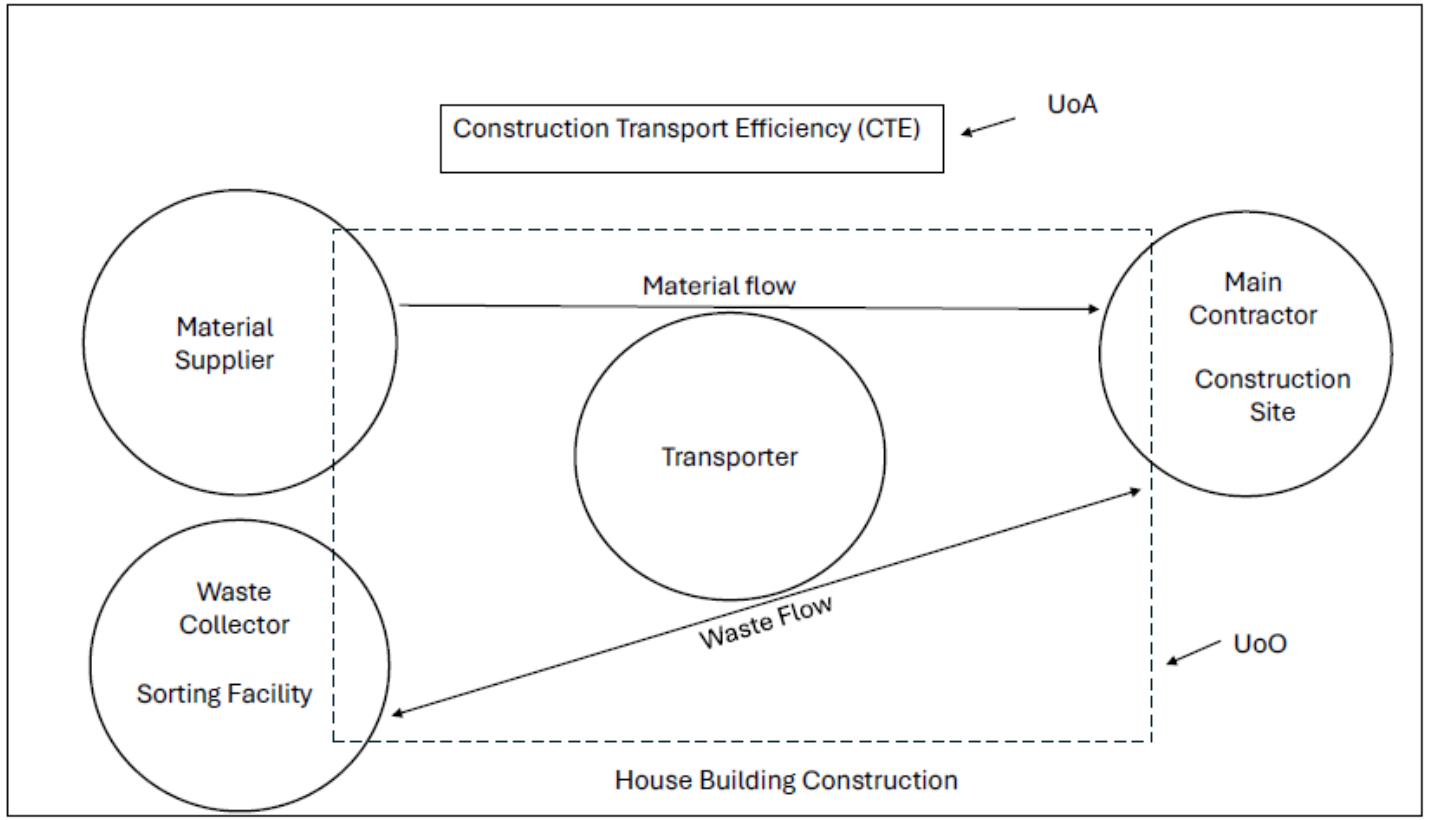
RQ1a: What activities constitute construction transport?

RQ1b: What are the challenges in improving construction transport efficiency?

RQ2: How can logistics services, digital tools and information sharing improve construction transport efficiency?

RQ3: How does improving construction transport efficiency add value for the involved actors?

Scope


Construction Transport Efficiency (CTE)
UoA
Material Supplier
Material flow
Transporter
Main Contractor
Construction Site
Waste Collector
Sorting Facility
Waste Flow
UoO
House Building Construction

Method

Study	Case	Year	Data collection	Case selection criteria
Study I	- Performance Measurement Case - School Case - Office Case	From 2019 to 2022, followed by a shift in focus from 2022 to 2024	- Descriptive statistics - Observations - Structured interviews - Unstructured interviews - Workshops - Project documents	- Relevance - Accessibility - Data richness
Study II	- Material Delivery Case - Waste Material Case	From 2020 to 2022, with further development extending from 2023 to 2024	- Observations - Unstructured interviews	- Relevance - Accessibility - Data richness
Study III	- House Case	From 2020 to 2024	- Interviews - Workshops - Study visit	- Relevance
Study IV	- School Case	From 2022 to 2023	- Observations - Unstructured interviews	- Accessibility - Data richness
Study V	- Digitalization Case	From 2022 to 2023	- Observations - Unstructured interviews	- Relevance

Findings

Finding I:

- Due to lack of centralized data gathering and the reliance on manual processes, significant information asymmetry and coordination issues exist within construction transport.
- Highlights the need for improved digital solutions and communication protocols.

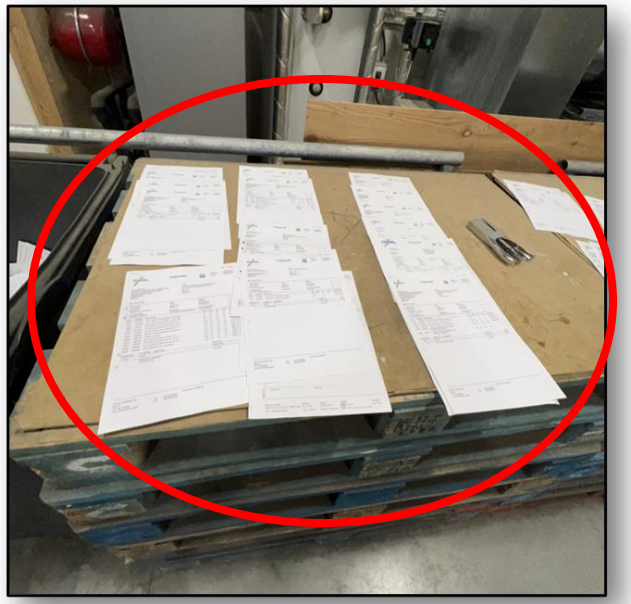
Study I: Construction Transport (In)Efficiency – An Effect of Information Asymmetry Among Construction Actors

Data collection: Project documents, Observations and unstructured interviews (64 hrs), Structured interview (13), workshops (5).

Data analysis: Thematic coding

Contribution: RQ2 and RQ3

Finding I



Performance measures	Data required to calculate	Dataset 1	Dataset 2	Dataset 3	Dataset 4
Delivery lead time	Time order placed	X	X	X	X
	Date order placed	✓	X	X	X
	Time order delivered	X	X	✓	X
	Date order delivered	✓	X	✓	✓
Perfect order fulfilment	Correct order no.	✓	X	X	X
	Correct order quantity	X	X	X	X
	Correct material type	X	X	X	X
	Correct material code	X	X	X	X
	Correct order value	X	X	X	X
	Correct address	X	X	X	X
Delivery reliability/On-time delivery/Late deliveries	Requested delivery time	X	X	X	X
	Requested delivery date	✓	X	X	X
	Time actually delivered	X	✓	✓	X
	Date actually delivered	✓	✓	✓	✓
Vehicle capacity utilization/Fill rate	Utilized load capacity	X	X	X	X
	Available load capacity	X	X	X	X
	Utilized space capacity	X	X	X	X
	Available space capacity	X	X	X	X
No. of transports per day	No. of deliveries	✓	✓	✓	✓
	Date of deliveries	✓	✓	✓	✓
No. of damaged deliveries	No. of damaged goods per delivery	X	X	X	X
	Total no. of goods per delivery	✓	X	✓	X
Planned vs unplanned delivery	No. of planned deliveries	X	X	✓	X
	No. of unplanned deliveries	X	X	✓	X
Vehicle turnaround time	Arrival time	X	✓	✓	X
	Waiting time	X	X	X	X
	Loading/unloading time	X	X	X	X
	Time in truck inspection	X	X	X	X
	Time in document completion	X	X	X	X
	Departure time	X	✓	✓	X
No. of empty miles driven per vehicle	No. of miles driven empty	X	X	X	X
CO_2 emission per trip per vehicle	Fuel consumption	X	X	X	✓
	No. of kilometres travelled	X	X	X	✓

Findings (Cntd.)

Finding II:

- There exists lack of efficiency and challenges in the transport flows for goods delivery and waste material, particularly due to wrong addresses, undefined unloading places, waiting times, and misrouting.
- Highlights the need for better planning and the adoption of digital tools for communication and coordination.

Study II: The Potential of Improving Construction Transport Time Efficiency – A Freight Forwarder Perspective.

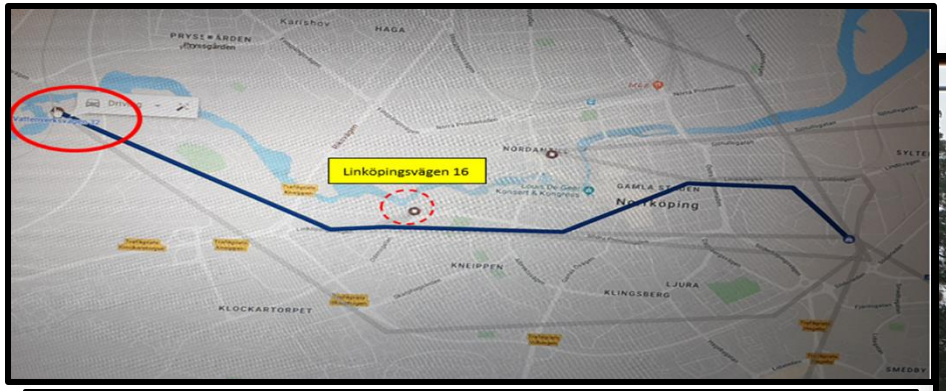
Data collection: Observations and unstructured interviews (18 hrs), Structured interview (1), Workshop (2), Picture and Notes, Google maps

Data analysis: Value stream mapping

Contribution: RQ1 and RQ3

Finding II

Not specific unloading zone,
no markings


Linköpingsvägen 16
Norrköping
HAGA
KNEIPPEN
LJURA
KLINGSBERG
KLOCKARTORPET

WILSSONS
013-35 36 30
wilssons.se
XKS 939

GLOBETROTTER

Findings (Cntd.)

Finding III:

- While logistics services offer significant benefits such as potential time savings for workers and improved site management, there are challenges related to organization, actor roles, and IT system support that needs to be addressed.

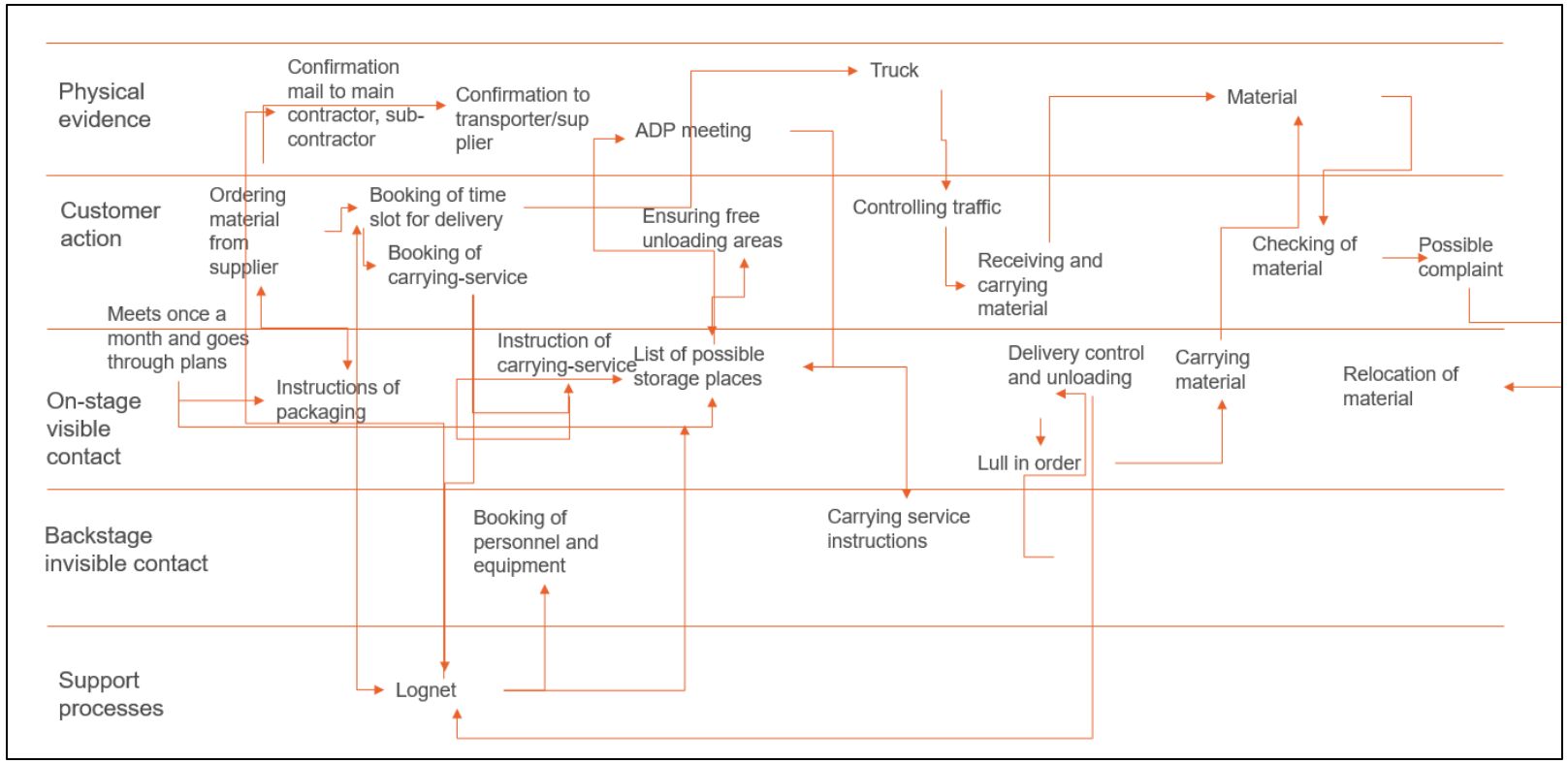
Study III: Creating Logistics Service Value in Construction – A quest of coordinating modules in a loosely coupled system.

Data collection: Project documents, Structured interviews (5), Workshops (4)

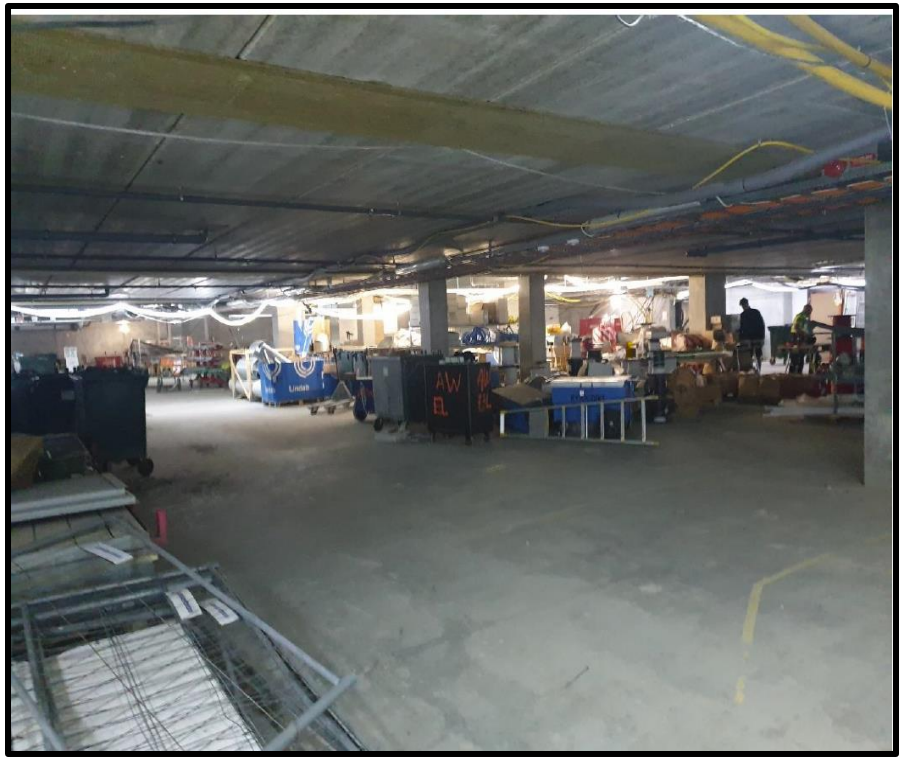
Data analysis: Service blueprints to understand logistics service modules

Contribution: RQ2 and RQ3

Finding III



Material management service blue print



Material storage at site

Findings (Cntd.)

Finding IV:

- There are significant inefficiencies in site logistics due to unplanned deliveries, lack of adherence to standard operating procedures, and lack of designated parking and unloading zones, which contribute to site congestion and reduced productivity.

Study IV: Clarifying the interface between construction supply chain and site – A key to improved delivery efficiency.

Data collection: Observations and unstructured interviews (64 hrs), Workshop (1), Pictures and Notes

Data analysis: Process mapping

Contribution: RQ1 and RQ3

Finding IV

Findings (Cntd.)

Finding V:

- To reap the full potential of digitalization, it is important to effectively integrate digital tools into the system.
- Using digitalization just for the sake of using it will not help in achieving the desired benefits.

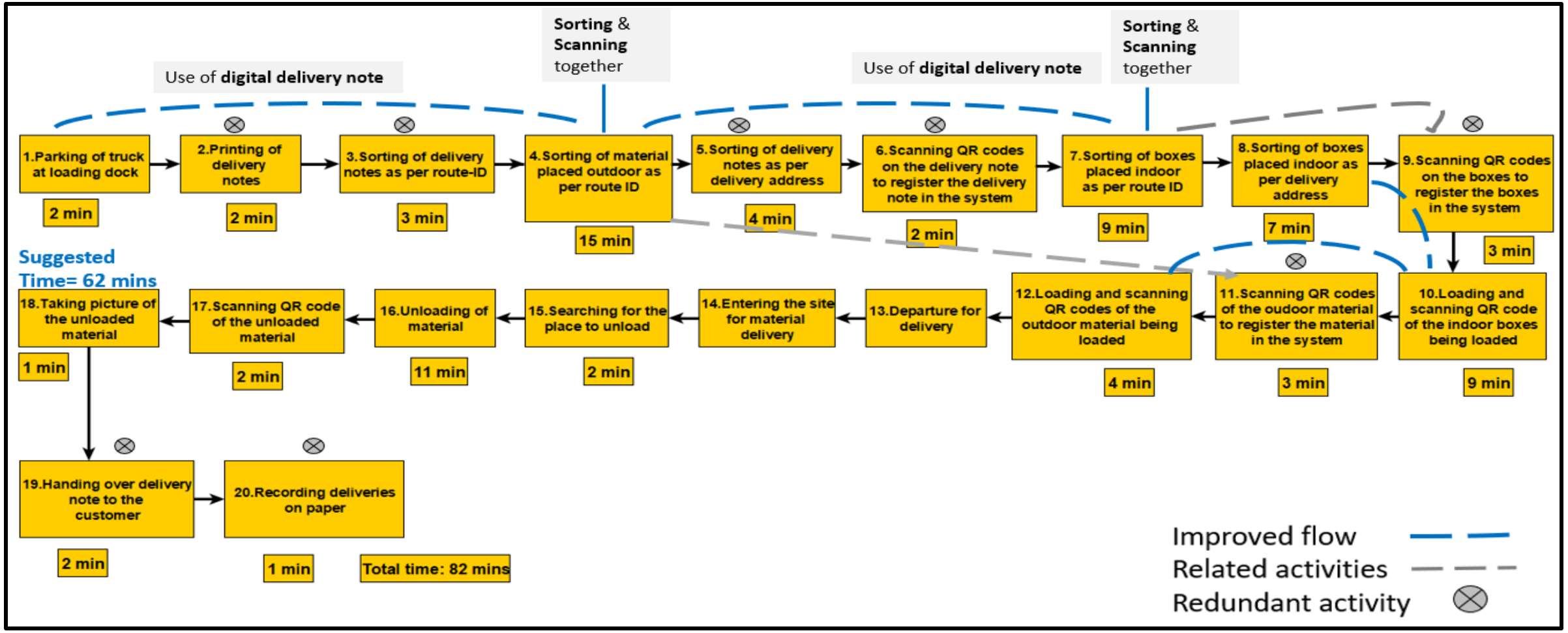
Study V: Improving construction transport efficiency by digitalization.

Data collection: Observations and unstructured interviews (20 hrs), Structured interviews (2), Workshop (1), Picture and Notes, Google maps

Data analysis: Process mapping guided by HTO model

Contribution: RQ2 and RQ3

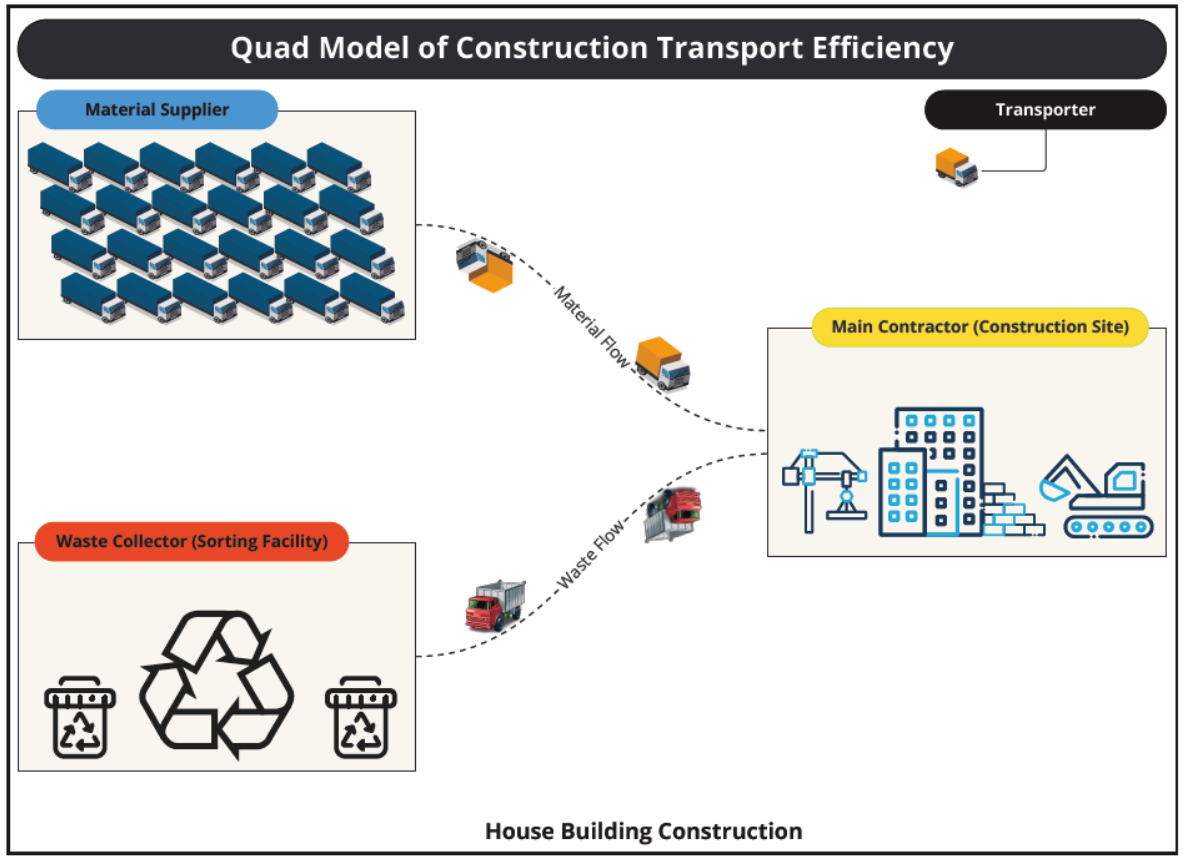
Finding V


Use of digital delivery note
Sorting & Scanning together
Use of digital delivery note
Sorting & Scanning together
1.Parking of truck at loading dock
2 min
2.Printing of delivery notes
2 min
3.Sorting of delivery notes as per route-ID
3 min
4.Sorting of material placed outdoor as per route ID
15 min
5.Sorting of delivery notes as per delivery address
4 min
6.Scanning QR codes on the delivery note to register the delivery note in the system
2 min
7.Sorting of boxes placed indoor as per route ID
9 min
8.Sorting of boxes placed indoor as per delivery address
7 min
9.Scanning QR codes on the boxes to register the boxes in the system
3 min
Suggested Time= 62 mins
18.Taking picture of the unloaded material
1 min
17.Scanning QR code of the unloaded material
2 min
16.Unloading of material
11 min
15.Searching for the place to unload
2 min
14.Entering the site for material delivery
13.Departure for delivery
12.Loading and scanning QR codes of the outdoor material being loaded
4 min
11.Scanning QR codes of the oudoor material to register the material in the system
3 min
10.Loading and scanning QR code of the indoor boxes being loaded
9 min
19.Handing over delivery note to the customer
2 min
20.Recording deliveries on paper
1 min
Total time: 82 mins
Improved flow
Related activities
Redundant activity

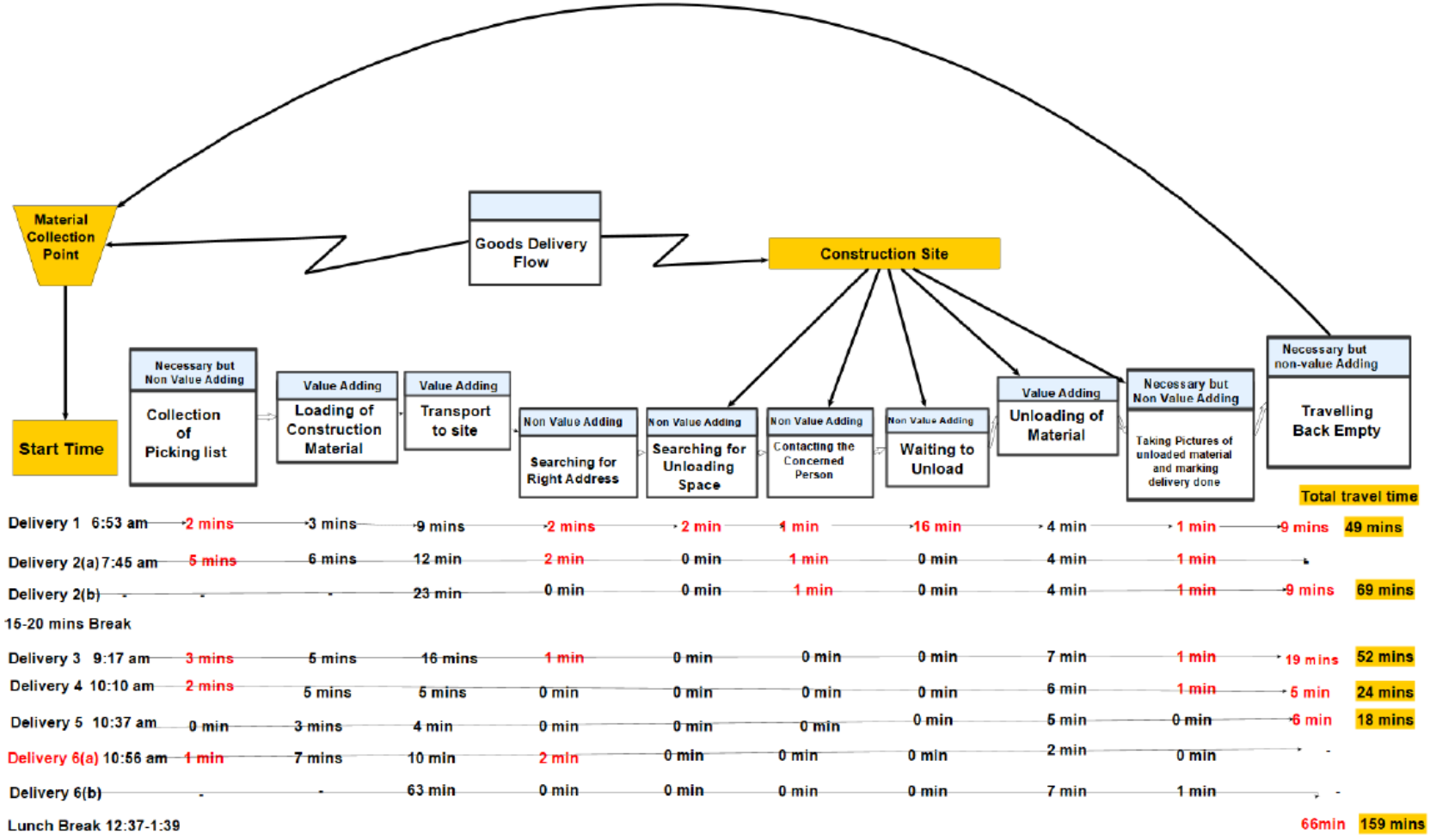
Contributions

- Demonstrated detailed understanding of construction transport by:
  - Identifying transport activities in particular to the construction context.
  - Investigated transport flows within construction from the perspectives of four actors: transporter, main contractor, material supplier, and waste collector. Hence termed as, “Quad model of construction transport efficiency”.

Quad Model of Construction Transport Efficiency

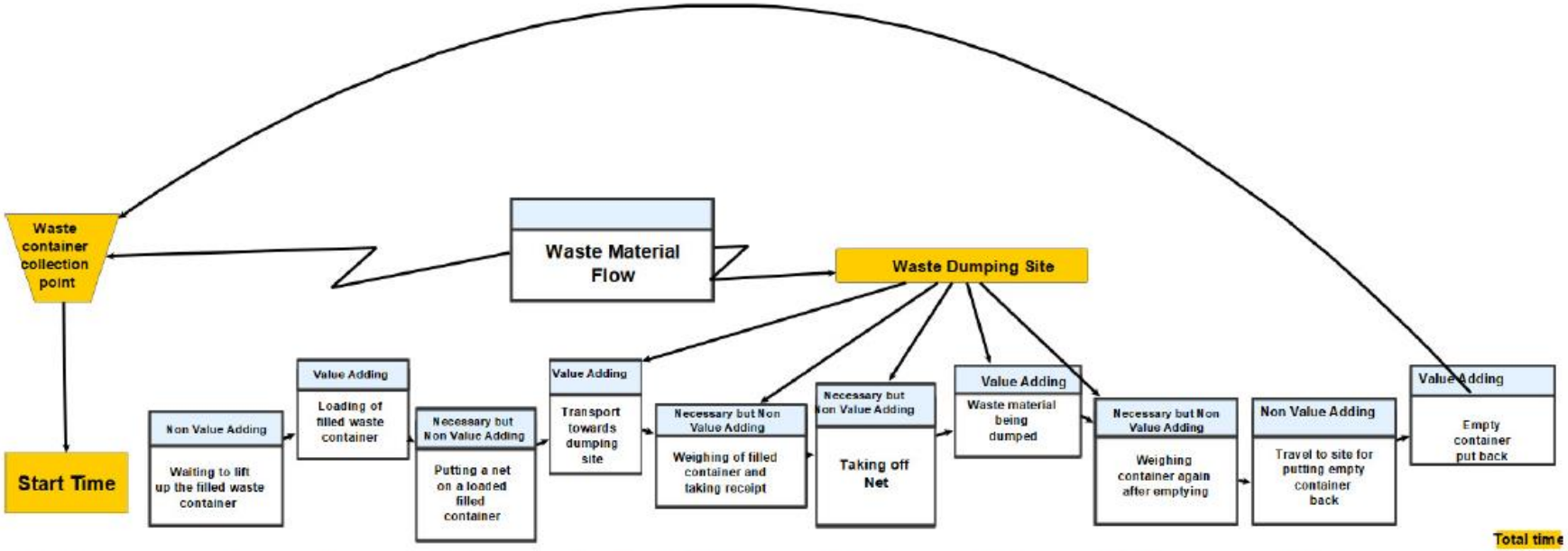


Transport flow – Goods delivery



Naz, F., Fredriksson, A. & Ivert, L. K. 2022. The Potential of Improving Construction Transport Time Efficiency—A Freight Forwarder Perspective. *Sustainability,* 14.

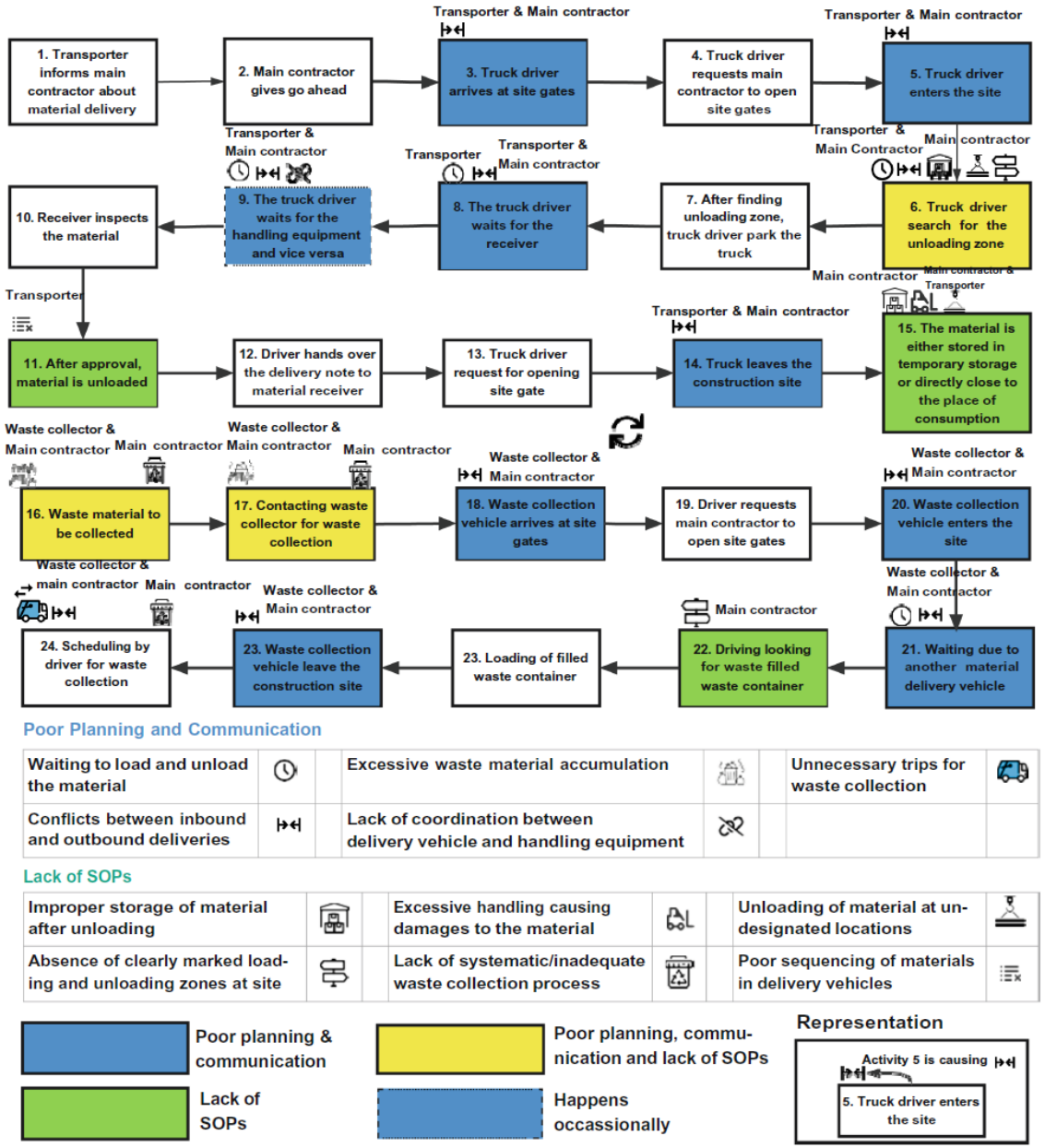
Transport flow – Waste material



											Total time
Dumping1 7:15am	0 min	3 mins	2 mins	10 mins	2 mins	2 min	3 min	2 min	9 min	10 mins	43 mins
Dumping2 8:02am	4 min	5 mins	1 min	7 min	1 min	1min	4 min	1 min	7 min	5 mins	36 mins
Dumping3 8:50am (10 min)	0 min	3 mins	1 min	7 mins	1 min	1 min	3 min	2 min	8 min	2 mins	38 mins
Dumping4 9:28am (8 min)	16 min	3 mins	1 min	16 min	1 min	2 min	6 min	1 min	18 min	2 mins	1 hr 14 mins
Lunch 10:43-11:40											
Dumping5 11:40am (10 min)	0 min	4 mins	1 mins	18 mins	2 min	2 min	3 min	2 min	20 min	3 min	65 mins
Searching for filled container 12:49- 12:57 (No container found)											
Dumping6 1:03pm	0 min	7 min	1 mins	10 min	1 min	2 min	4 min	1 min	9 min	4 min	39 mins

Naz, F., Fredriksson, A. & Ivert, L. K. 2022. The Potential of Improving Construction Transport Time Efficiency—A Freight Forwarder Perspective. *Sustainability,* 14.

Transport flow – Interface

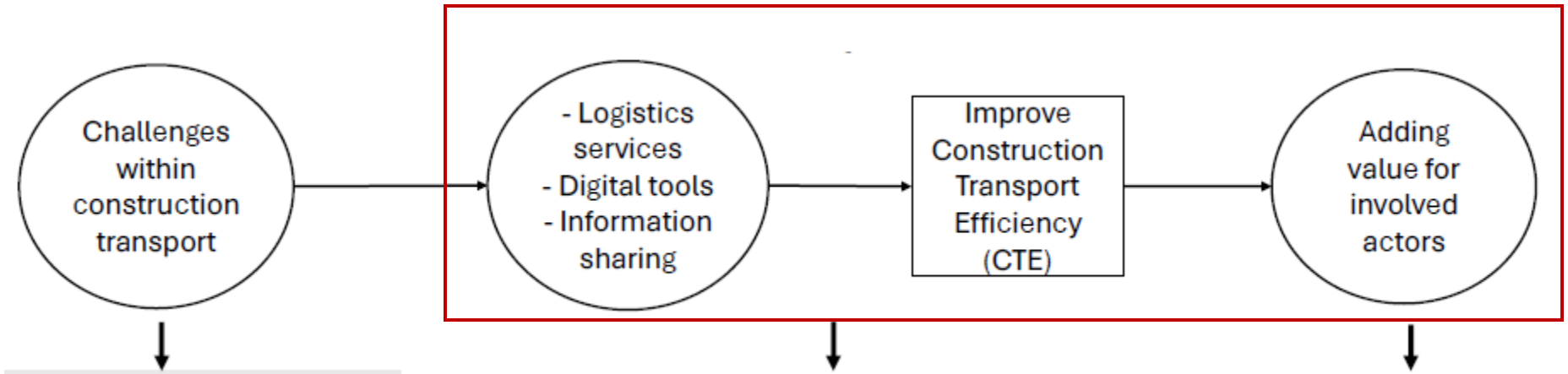


Naz, F., Fredriksson, A. (2023). Clarifying the Interface Between Construction Supply Chain and Site - A Key to Improved Delivery Efficiency. APMS 2023. IFIP Advances in Information and Communication Technology, vol 691. Springer, Cham.

Mangerial contributions

- To improve construction transport efficiency,
  - Identify and remove repetitive activities in transport flow.
  - There should be proper division of work so that the tasks are assigned and executed with precision and maximum efficiency.
  - Avoid relying on digital tools with limited functionalities as this may impede rather than facilitate the improvement process.
  - Communication and information sharing - a cornerstone for improving efficiency within construction transport.

Main contribution



Limitations and Future studies

- The thesis primarily relies on single case studies
  - Limits the ability to generalize the findings to a broader context.
  - Need for further research to explore the applicability of these results across different settings and contexts.
- Quad model provides a framework for further research aimed at improving CTE through targeted improvements specifically within actors and generally within collaborations.

Limitations and Future studies (Cntd.)

- The thesis has adopted a logistics perspective to improve CTE, it also acknowledges the significant potential within procurement strategies.
    - Exploration into procurement, focusing on aspects like route optimization and fleet management, could provide valuable insights for improving CTE.
- Future research should aim to explore coordination, power imbalances, dependencies and trust within construction transport to develop strategies that strengthen involved actors' relationships and improve CTE.

Thank You!

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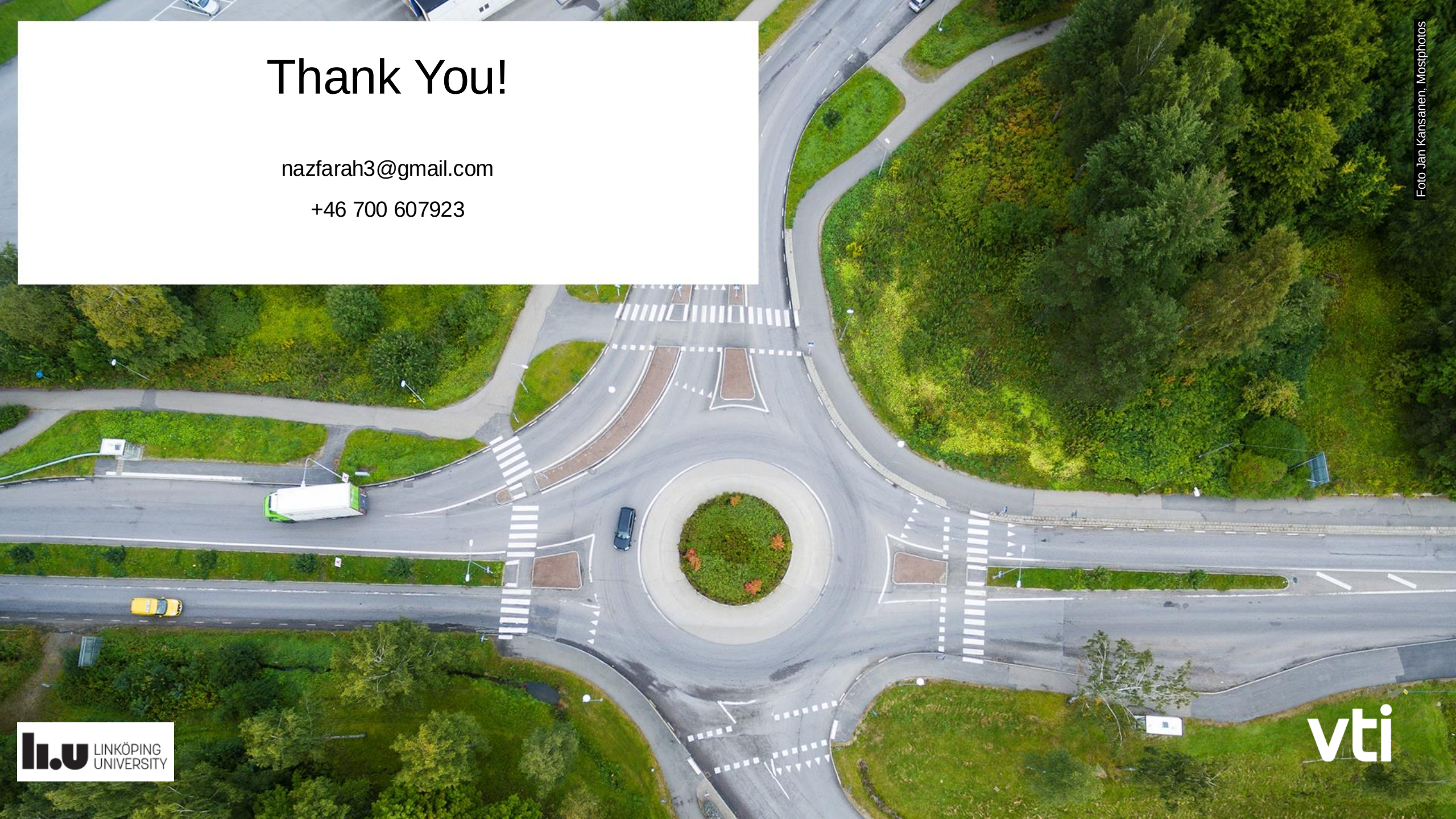

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