IMT Mines Albi-Carmaux
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Design of a Simulation-Based Experiment for Assessing the Relevance of the Physical Internet Concept for Humanitarian Supply Chains

Manon Grest, Metin Inan, Yaarit Cohen, Ali Barenji, Mathieu Dahan, Matthieu Lauras & Benoit Montreuil

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1 EXPERIMENT OBJECTIVE

Observations & challenges

Humanitarian missions

Health assistance

Relief item supply

Development programs

Humanitarian logistics

"Since disaster relief is about 80% logistics it would follow then that the only way to achieve this is through slick, efficient and effective logistics operations and more precisely, supply chain management." [1]

Humanitarian logistics issues

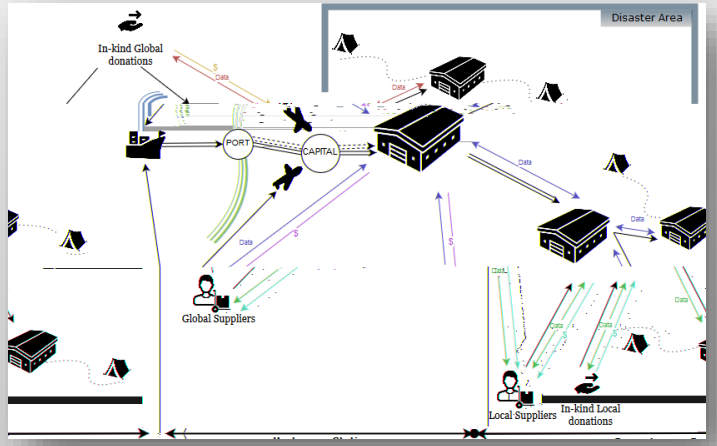
"However, it has been observed from the literature, that most humanitarian supply chains are unstable, unpredictable, and slow to respond to the needs of affected people (Yadav and Barve 2015), especially when related to those disasters" [2]

[1] LN Van Wassenhove, Humanitarian aid logistics: supply chain management in high gear, 2006

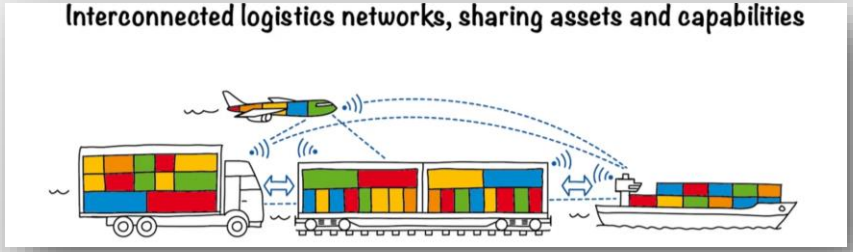
[2] An analysis of the literature on humanitarian logistics and supply chain management: paving the way for future studies, Jabbour 2017

1 EXPERIMENT OBJECTIVE

Humanitarian supply chain



The Physical Internet



"Transforming the way physical objects are handled, moved, stored, realized, supplied and used, aiming towards global logistics efficiency and sustainability."

Hyperconnected Humanitarian supply chain

Does it have interests? Is it relevant? What are the benefits and drawbacks?

Assessment and analysis of the Physical Internet principles applied to humanitarian supply chain levers

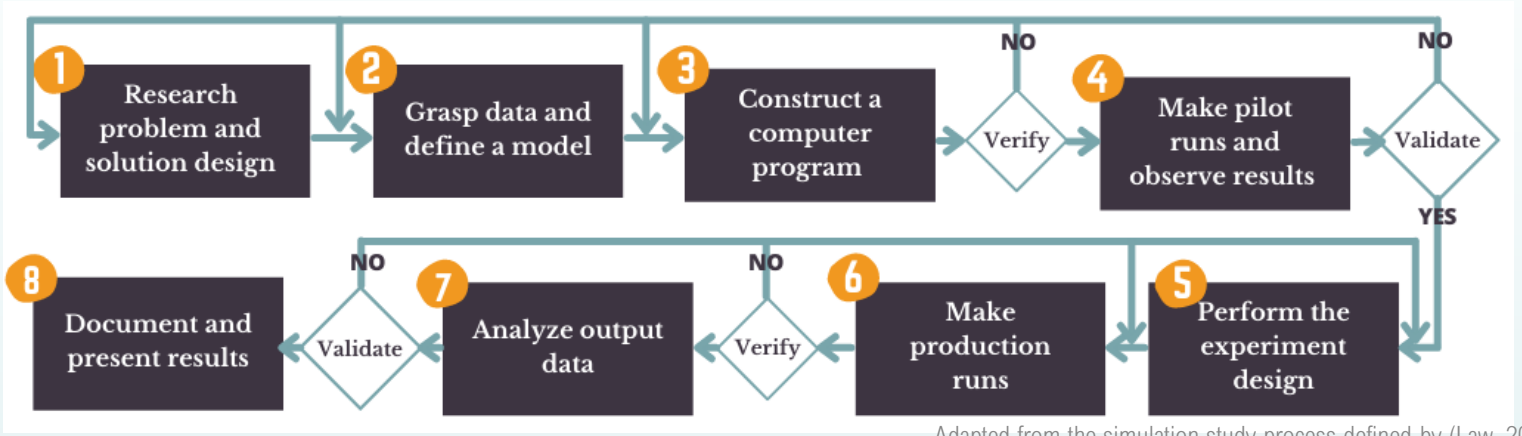
Understudied to date!

2 EXPERIMENT PROPOSITION

Functional Framework

8 steps simulation oriented methodology

Including verification and validation steps for developing the simulation



Adapted from the simulation study process defined by (Law, 2014)

Technological Framework

Prototypical agent-oriented discrete-events simulator

Including 3 interrelated systems for supporting the experiment

Prototypical agent-oriented discrete-events simulator (Grest et al, 2021)

3 EXPERIMENT CONDUCT

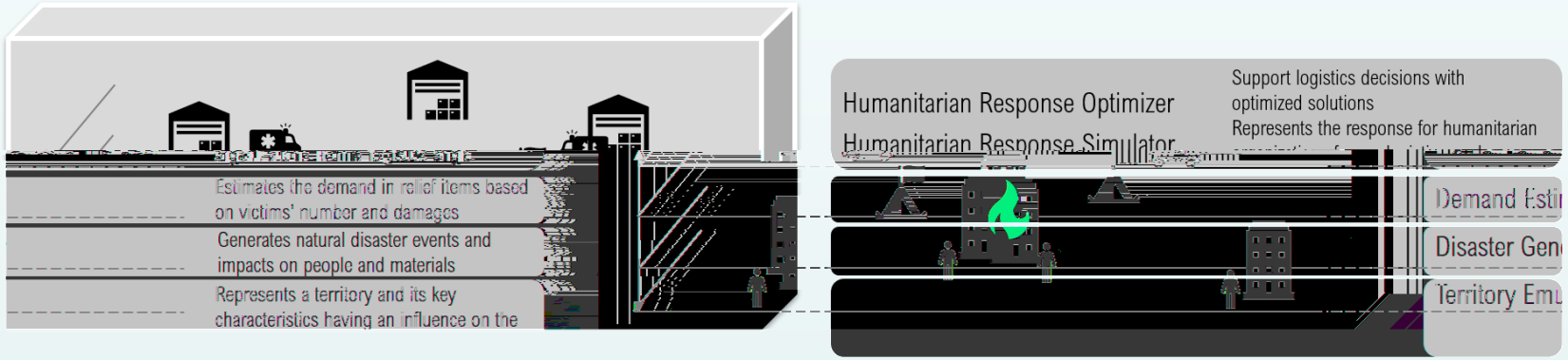
1. Research problem and solution design

HHSC assessment
- Comparison between a baseline scenario and hyperconnected alternatives through performance results
- Use of simulation

2. Grasp data & Define a model

Grasp data
- Field visits & practitioners interviews (IFRC Malaysia, Indonesian Red Cross)
- Past disasters statistics analysis

Define a model



3 EXPERIMENT CONDUCT

3 Construct a computer program & verify

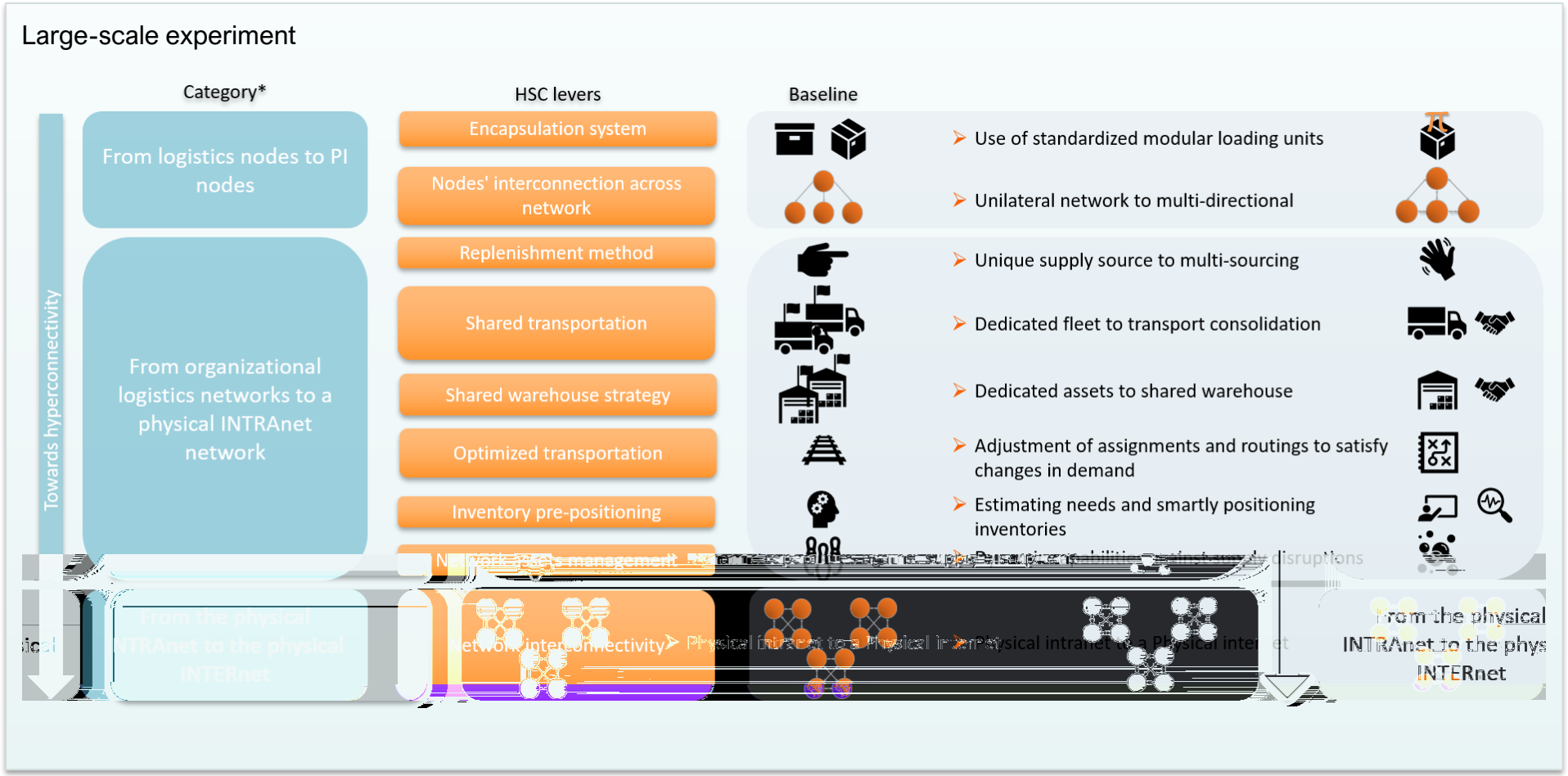
4 Make pilot runs, observe results, and validate

Run pilots tests and observe result to ensure consistency and magnitude order respect

Workshops sessions organized to validate the model and results

3 EXPERIMENT CONDUCT

5 Experiment design



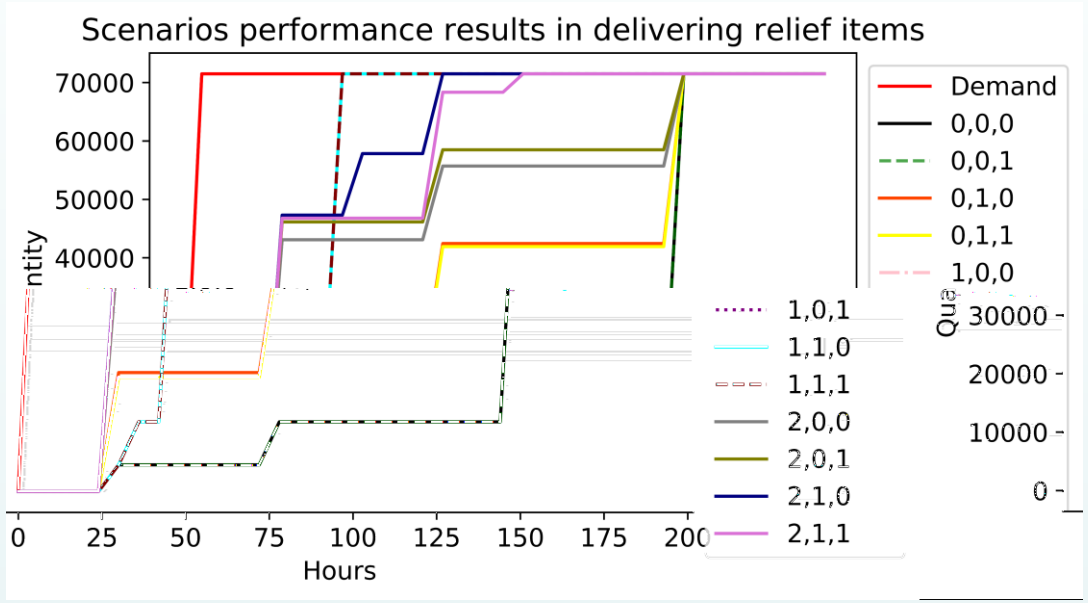
3 EXPERIMENT CONDUCT

6 Make production runs and verify

7 8 Analyze output data, validate, and present results

First experiment run with 12 scenarios

Interconnection & Sourcing		Shortage management		Stock dispatch	
A=0	Hierarchical	B=0	FIFO	C=0	Equal
A=1	Closest supplier	B=1	Equity	C=1	Risk proportional
A=2	Multiple sourcing				



Hyperconnected approaches regarding the sourcing factor have led to improve the delivery lead time and quantity served over time

4 CONCLUSION & PERSPECTIVES

1 Experiment Objective
- Need for improving humanitarian response
- Original investigation assessing PI application in the HSC realm

2 Experiment Proposition
- Functional framework (methodology)
- Technological framework (simulator)

3 Experiment Conduct
- Methodology application & Simulation platform development
- Results showing a relief performance improvement

4 Conclusion & Perspectives

Regarding this investigation,

Additional runs of experiments with hyperconnected oriented factors are still required to draw robust conclusions

Several avenues for future research,

Humanitarian perspective : At the different disaster phases, to better coordinate actors

Physical Internet perspective : More technical aspects such as protocols, encapsulation systems

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THANK YOU!