Clusters 2.0

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TALENT HUB FOR SUPPLY CHAIN

THE WIDER IMPACT OF CLUSTERS 2.0 INNOVATIONS

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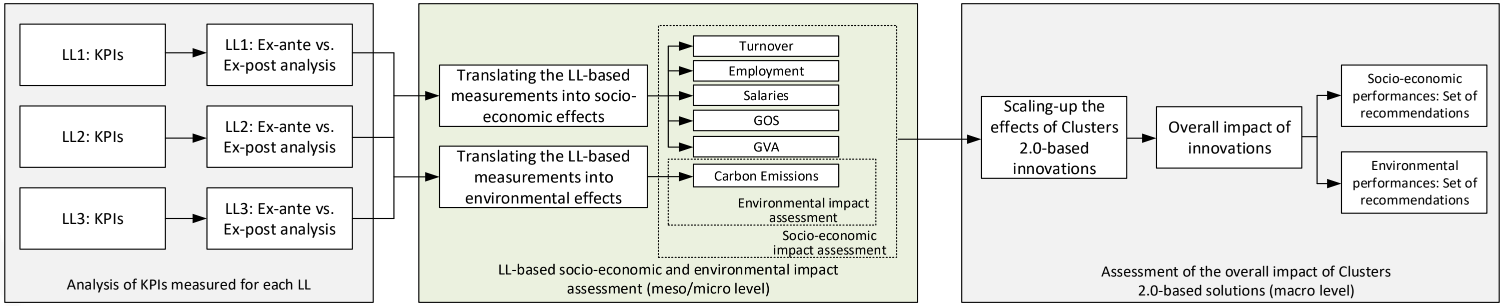
Summary

- The aim of the work;
- Methodological framework;
- Cooperation and coordination synergies at Cluster’s level;
- Logistics cluster integration at network level;
- Innovative modular solutions and transshipment optimization.

- The aim of the work
  - A strategic assessment of Clusters 2.0 based innovations from the perspective of socio-economic and environmental effects on local and global scale.
- Methodological framework



Cooperation and coordination synergies at Cluster's level

- **Socio-economic impact**
  - **Increase in freight volumes** implies a higher level of activities of the firms located in the cluster and surrounding area, which means **a higher level of activities of cluster based companies.**
  - **Shift to intermodal (25% vs. 5%)** leads to a **decrease of logistics costs** and therefore affects the prices of goods and services of firms located in the cluster which further contributed to an **increase in production and attraction of the cluster for new business.**
  - **Additional SWL traffic** may **contribute to savings in logistics costs** for those market segments which are traditional users of road transport.
  - **Increased freight activities** <=> increased volume of freight handled in terminals and **higher number of employees** (12.5% more) as well as increased exploitation of terminal surface <=> **higher turnover of terminals**.

Cooperation and coordination synergies at Cluster's level

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Environmental impact

LL1-4 Emissions saved on current freight transport activities (2018)					
Transport mode	Handled freight volume (tonnes)	Average distance (Km)	Ton*Km	gCO2 per ton*Km	CO2 emissions (tonnes)
	2018		2018		2018
Road transport	12,738,000	400	5,095,200,000	62	315,902
Rail transport	1,196,291		478,516,400	22	10,527
Simulation	1,196,291	400	478,516,400	62	29,668
Lower CO2 emissions (tonnes) by railway transport					19,141

LL1-4 Emissions saved on current freight transport activities (2019)					
Transport mode	Handled freight volume (tonnes)	Average distance (Km)	Ton*Km	gCO2 per ton*Km	CO2 emissions (tonnes)
	2019		2019		2019
Road transport	13,389,548	400	5,355,819,200	62	332,061
Rail transport	1,492,599		597,039,600	22	13,135
Simulation	1,492,599	400	597,039,600	62	37,017
Lower CO2 emissions (tonnes) by railway transport					23,882

Logistics cluster integration at network level

- **Socio-economic impact**
  - The massification should contribute to more intensive collaboration between shippers, **improve transport efficiency and reduce transport cost** for inter-cluster transportation, it should indirectly contribute to **higher volume of production** which will lead to higher salaries, turnover, GOS and GVA.
    - Therefore, the effects will produce an impact on companies related in a gravitational area of a cluster (direct impact), companies-suppliers of the first one (indirect impact) as well as induced effect related to increased household revenue.
    - The macro level effect of massification initiative is proportional to the size of micro level effects, the number of clusters and inter-cluster connections.
      - Building of more inter-cluster links with high load factors in both directions can provide substantial effects on a macro scale level.
  - Modal shift to intermodal transport will create more jobs in total. The direct impact in terms of jobs for road operators will be negative.
- **Environmental impact**
  - Measurements of potential effects of massification initiative on a sample of ARGUSI' customers show significant CO_2 savings.
    - Based on estimation of potential collaboration, it is concluded **that 12000 of roundtrips could be eliminated** (88000 before collaboration against 76000 after collaboration).
    - An increase in loading capacity of the trucks of around 15% is expected.
    - This leads to a potential of 20,024,000 kgCO_2 saved.

Logistics cluster integration at network level

- Congestion costs **impact on** operating costs, wasted fuel, increased labour costs, safety costs and vehicle wear and tear.
- Secondary impacts of congestion costs include **inefficiencies in the supply chain** as pick up and delivery schedules are impacted by traffic delays.
- Measurements of potential effects of massification initiative on a sample of ARGUSI' customers **show significant reductions of congestion costs**.
- Congestion costs are calculated as follows:

$$CC = S \cdot CT * CH$$

CC: Congestion costs (EUR)

S: KM driven

CT: Congestion time lost per km in hours

CH: Cost per hour

- Congestion costs saved (€/roundtrip): 1.5 mill. EUR (for 176 mill. EUR of total transport costs)

Logistics cluster integration at network level

- Improved door-to-door logistics performances in air cargo supply chain
  - **Socio-economic impact:**
    - Increased competitiveness of transportation companies and the airport as well as a higher reliability and visibility for manufacturers.
    - Improved supply chain performance generates various socio-economic effects on local level.
      - Logistical cost savings (60-80 EUR/pallet) will positively impact **on production level**.
      - Impact on inventory carrying cost will exist due to **higher visibility and reliability** of supply chain.
      - Improved time performance of ground handlers will **positively impact on their productivity.**
      - **Decreased average waiting time** spent by trucks will improve productivity of trucks and truck drivers.
      - In total, these effects will have a positive impact on socio-economic variables on micro level.
        - Macro level effects depend on the possibility of multiplication of these innovations to other cargo airports in EU.

Innovative modular solutions and transshipment optimization

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- **Socio-economic impacts**
  - The warehousing service represents the most important component of the supply chain and logistics system.
  - An efficient warehouse has the ability to fulfill the needs of the supply chain quickly and increases the competitiveness of all actors involved in supply chain, especially shippers and LSPs.
    - On a local level, the total supply chain costs can take around 35% of a firm's turnover, whereas the warehousing costs take around 5%.
      - On a macro scale (national level) warehousing costs have a share from 10-30% in total logistics costs.
    - The use case "warehouse" reports positive effects of using the NMLUs in warehouses.
      - These effects are mainly reflected in workflow effectiveness and higher level of utilization of load carrier.
      - Using NMLUs saves both **time and effort in daily warehousing operations**.
        - **Reduced handling time at warehouse improves warehouse productivit**y (handling more volume per move) which enables higher quantity as well as quality of order fulfillment which leads to **higher revenue of warehouse, and eventually to lower costs (decreased labor costs).**
        - On the other side, these savings can be outbalanced by lower space utilization level. Land costs represent also one of the largest contributors to warehousing costs. Often, warehouse space is **15 to 20%** of the cost per order.

Innovative modular solutions and transshipment optimization

- Improved warehouse activities lead to an increased economic effect (direct impact) on the level of warehouse (meso level).
  - This contributes also to an effect on the level of logistics cluster.
    - Micro or cluster-based effect will depend on the number of warehouses in a cluster, their capacity, type, and utilization rate.
    - Indirect impact is reflected in economic activity across the supply chain for those firms that use a specific warehouse.
    - Induced impact is related to wages and salaries of warehouse employees.

- Use case “intermodal” resulted in a **more efficient cargo consolidation and cross docking**, **improved loading capacity utilization and reduced transshipment time**;
- The main socio-economic impacts of these outcomes are as follows:
  - Reduction in cross docking and bundling time increases throughput in distribution points. Increased throughput generates increment in financial flows of warehouse/distribution center (meso level).
  - On a micro level – an individual supply chain – reduced bundling and cross docking time positively impacts on lead time.
  - The most important effect can be achieved with **redesigned supply chain** by using NMLUs.
    - Picking up the NMLUs in one milk run and direct shipping onto the train, by skipping all handling at the warehouse can lead to a total time saving in a range from 11% to 43%.

Innovative modular solutions and transshipment optimization

- Resulting lead time reduction brings flexibility, competitive advantage, meeting deadlines consistently and easily, **increased cash flow due to increased order fulfillment**.
- On the other side, increased delivery time caused by shipment consolidation may lead to customer's order cancellation.
- The main motivation for shipment consolidation is decreased unit dispatch cost due **to economies of scale**.
  - According to experiments conducted in the truck that uses full capacity **saves up to 57% of transportation costs per unit compared to a truck with the load factors of 40%.**
- Decreased transportation costs lead to decreased logistics costs and therefore, improved logistics efficiency (the cost of logistics as a % of GDP).
- If we consider investment and operational costs, reduction of 47% can be expected when using ContainerMover instead of Reach Stacker.
  - This cost reduction relates to area preparation (asphalt instead of concrete), equipment purchase, fuel costs and tyres and maintenance.
  - Under the assumption that there are 70 moves per day, cost per one move of ContainerMover is 17.42 EUR less than for Reach Stacker (19.22 versus 36.64 EUR).
    - This cost reduction significantly contributes to the direct impact of horizontal transshipment technology.

Innovative modular solutions and transshipment optimization

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– Environmental impact
  - Increased truck load utilization directly impacts on reduction of CO2 emissions based on following expression:

$$CO_2 = EF \cdot \frac{FC}{LF \cdot CAP} \cdot TKM$$

EF: emissions factor (depends on type of fuel);
LF: load factor as a percentage of capacity in tones;
TKM: Tonne-kilometres realized;
CAP: Maximum transportation capacity.

  - With increase of LF there is a reduction of CO_2.
  - According to the analysis the vehicle that uses the full capacity emit up to 30% (0.072 kgCO_2) less CO_2 costs per unit than the vehicle with the load factor of 60%.
  - In order to reduce CO2 and other emissions and to avoid local and overall road congestion, it would be desirable to load and unload containers directly on the rail at a cluster point or even better, close to the point where the container is loaded or discharged with its cargo.
    – ContainerMover as a low investment/flexible alternative enables this. It needs **60% of less surface to operate**;
    – Surface **can be concrete instead of asphalt** (1.6 km of asphalt releases 7.400.000 more CO_2 than concrete over 40 years).
    – Based on an analysis (time horizon of 250 days per year/70 moves per day/10 container docking stations) **fuel costs** for ContainerMover are **66% lower** than for Reach Stacker.
      - More precisely, **Reach Stacker consumes 20 l/hour which is 64.600 kgCO2 (according to Table 1) whereas ContainerMover needs 7 l/hour (22610 kgCO2).**

Innovative modular solutions and transshipment optimization

- So by using NMLUs in a Container with Subframe concept with roller beds inside, there are **40-50% less kilometres in collecting**, because cargo/shipment can be prepared and squired by shipper on NMLU directly.
- NMLUs can be collected on a Milkrun one by one and by **bypassing the DC** there are extra CO2 savings (**no extra handling / no storage**) so it is fair to say that the CO2 savings are around **40%;**

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Thank You

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