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Decision support models for managing physical assets sharing in and between supply chains

Motivation

VUCA context: Volatility, Uncertainty, Complexity & Ambiguity

A shift towards new inter-organizational settings for collaboration

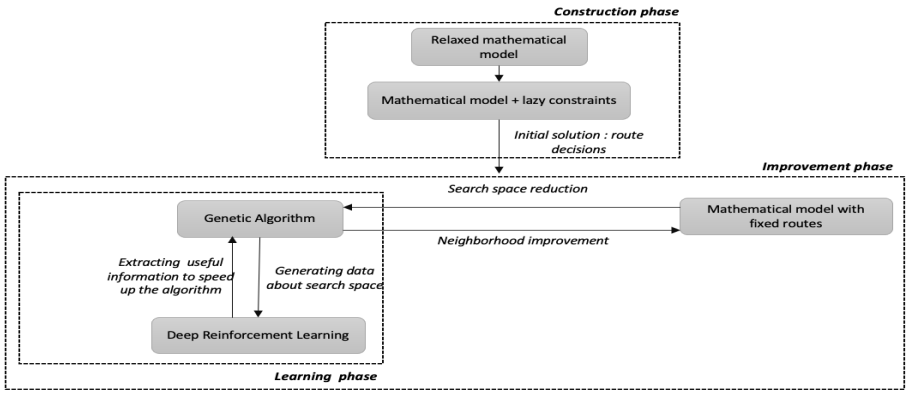
Covid 19

Emergence of new technologies and cyber-physical systems

Sharing of physical assets between different actors: inventory, RTI, machines, etc.

Development of tools to assist in managing and monitoring given the industrial contexts

Matheuristics



References

1. Coelho, L. C. and Laporte, G. (2013). A branch-and-cut algorithm for the multi-product multi-vehicle inventory-routing problem. International Journal of Production Research, 51(23-24):7156–7169
2. Coelho, L., Cordeau, J.-F., and Laporte, G. (2014). Heuristics for dynamic and stochastic inventory-routing. Computers Operations Research, 52:55–67.
3. Pan, S., Trentesaux, D., Ballot, E., & Huang, G. Q. (2019). Horizontal collaborative transport: survey of solutions and practical implementation issues. International Journal of Production Research, 57(15–16), 5340–5361.
4. Qiu, X., Luo, H., Xu, G., Zhong, R., & Huang, G. Q. (2015). Physical assets and service sharing for IoT-enabled Supply Hub in Industrial Park (SHIP). International Journal of Production Economics, 159, 4–15.

Modelling inventory and RTI sharing

Inventory Routing Problem in two-level supply chain (a set of suppliers delivering products to a set of customers/retailers/plants)
Objective: minimization of costs (vehicle routing, inventory holding, shortage, sharing, etc.)

- IRP with inventory sharing
  - Deterministic
  - Dynamic and stochastic
- IRP with RTI sharing
  - Mixed pickup and delivery

Results and future works

Managerial insights:

1- For both assets and for all settings, compared to the traditional configuration, sharing helps to considerably reduce total costs.

2- Sharing can only be of such interest as long as the cost it incurs can be offset by the savings it brings to reduce transportation, lost sales and inventory holding costs.

Matheuristic performance:

1- Deterministic context: tested on 460 best known benchmark instances and compared to the best-known algorithms, the matheuristic is able to find optimal solutions for all small instances and enhance 156 upper bounds for large instances.

2- Stochastic context: tested on 150 best known benchmark instances, the matheuristic outperforms the best-known algorithm in terms of solution quality and runtime.

3- Closed loop context: tested on randomly generated instances and compared to results obtained using CPLEX and other metaheuristics such as simulated annealing and artificial immune system, the matheuristic proved to be efficient.

- Future works
  - Inventory sharing in decentralised SC
  - Physical Internet (PI-hubs, PI-containers, etc.)
  - Machine sharing

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