Title: Intelligent manufacturing process chains: how to create a green global industrial system?

How can we model, optimize and simulate an industrial system with regards to environmental friendly production facilities, and transport means?

Problem statement

Currently we are modelling the global Airbus industrial system as a knowledge base. This knowledge base can be used for further investigations. The knowledge base contains the available means of transportation as well as locations with their manufacturing capabilities.

The knowledge base could be extended to allow for investigations into an industrial system that has a less environmental impact than the one currently used. For that it might be necessary to complete the data in the knowledge base.

The knowledge base could be used to feed an optimisation algorithm that finds a "good" industrial system with regards to sustainability. To differentiate this from our current forays into optimization, a different solver should be used than the ones currently under investigation (Answer Set Programming, Evolutionary algorithm):
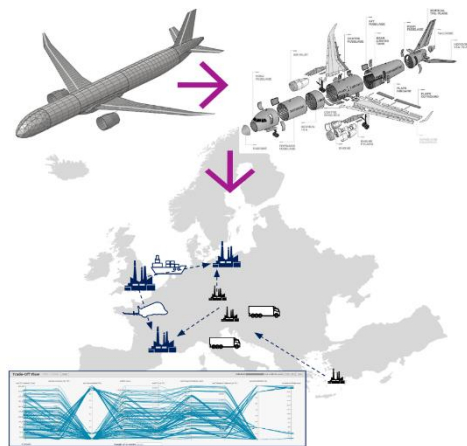
Research question(s)

1. What kind of concepts and meta data are missing to determine if an manufacturing location has less environmental impact than another?
2. What metrics are necessary to determine if one means of transportation is more environmental friendly than another?
3. What are efficient solver approaches to find promising industrial system network solutions that can be assumed to dominate large portions of the design space relative to relevant FoMs, including sustainability but also recurrent cost, lead time, and rate-adaptation capability, and that provides solutions that differ significantly from each other?

To optimize the industrial system, among others the following metrics could be applied:
● Ensure that the route uses as little resources as possible
● Find other alternative means of transportation (like using freight trains)
● Ensure that the transport means are loaded ideally
● That they are not empty on their return trip
● That they bring back resources that can be recycled reused at their destination

Possibly also:

Create an optimized way of transporting goods for the global Airbus industrial system. This includes:

- Define metrics to measure the current KPIs of transport means in the Airbus industrial system i.e. what are the used resources for transporting a certain part from A to B (CO_2 emissions, recurring costs etc.)
- Find optimal production facilities that can not only produce a given part but can also recycle the excess material, waste that is produced during the process, etc.
- Production facilities that produce less waste should be prioritized
- What is a good production facility? One with power produced by coal, gas, oil and good recycling capabilities or one that is powered by green energy but unable to recycle materials
- Are facilities in Europe better suited for a circular economy than the ones in Asia/America. If not, what is missing
- What would be the impact of Airbus developing its own transportation network of sustainable transport means (wind powered ships, electric trucks, etc.)
- How to model an industrial system that is not environment neutral today but maybe in 20 years (given the long lifetime of our products) and how to create a future proof and flexible way to adopt new technologies easily, swap around production places and capabilities as needed, etc.

Expected type of work

References

- Will be provided during the project

Commissioner details

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