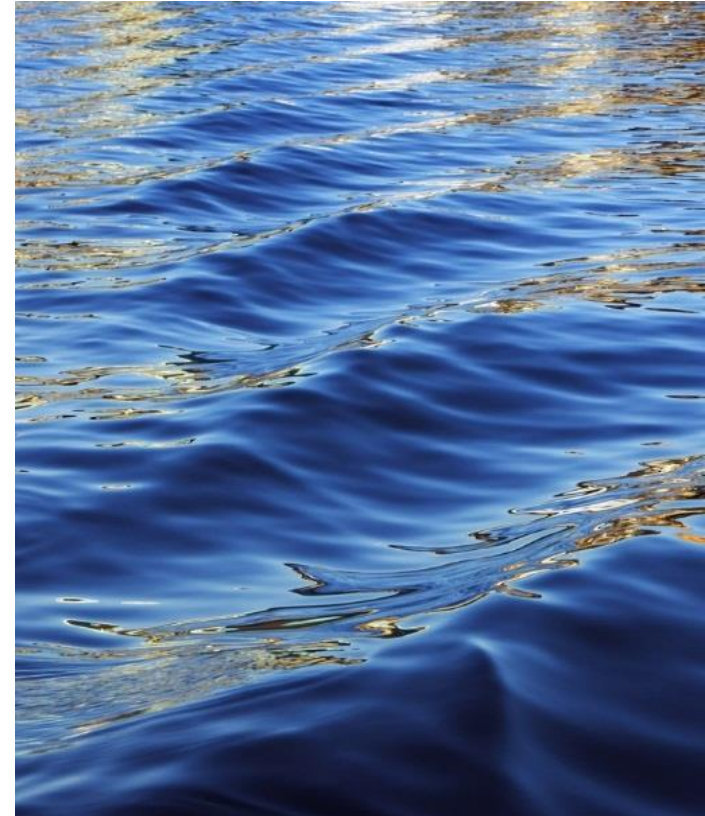


Moveable Factories

for Combining
Production and
Logistics



Contents

- Types
- Why
- How
- References





1. Types

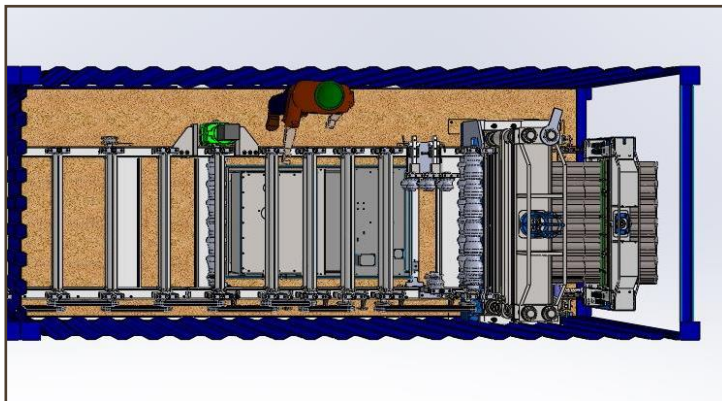
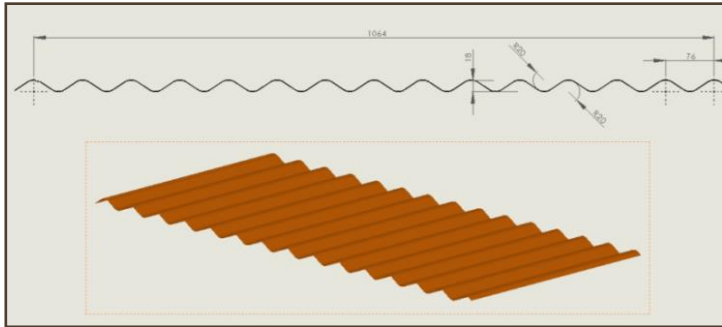


Mobile Factories for when optimum production location changes daily or weekly



- e.g. processing and packaging at farms of livestock, milk, vegetables, fruit, etc.
- bringing processing to location of natural resources can eliminate typical waste due to:
 - Bovine Respiratory Disease (“shipping fever”); bruising of livestock that is caused by conventional industrial transportation; post-harvest losses caused by conventional industrial collection, transportation, and processing of crops
- also many people’s backyard fruit and vegetables can be processed instead of fruit and vegetables from only large farms

Mobile Factories for when optimum production location changes monthly or yearly



- e.g. local production of wall blocks, roof sheeting, solar panels, water tanks, etc.
- several moveable factories can be used together, for example, to bring efficiency and precision to the in-situ production of components and systems for rapid building construction

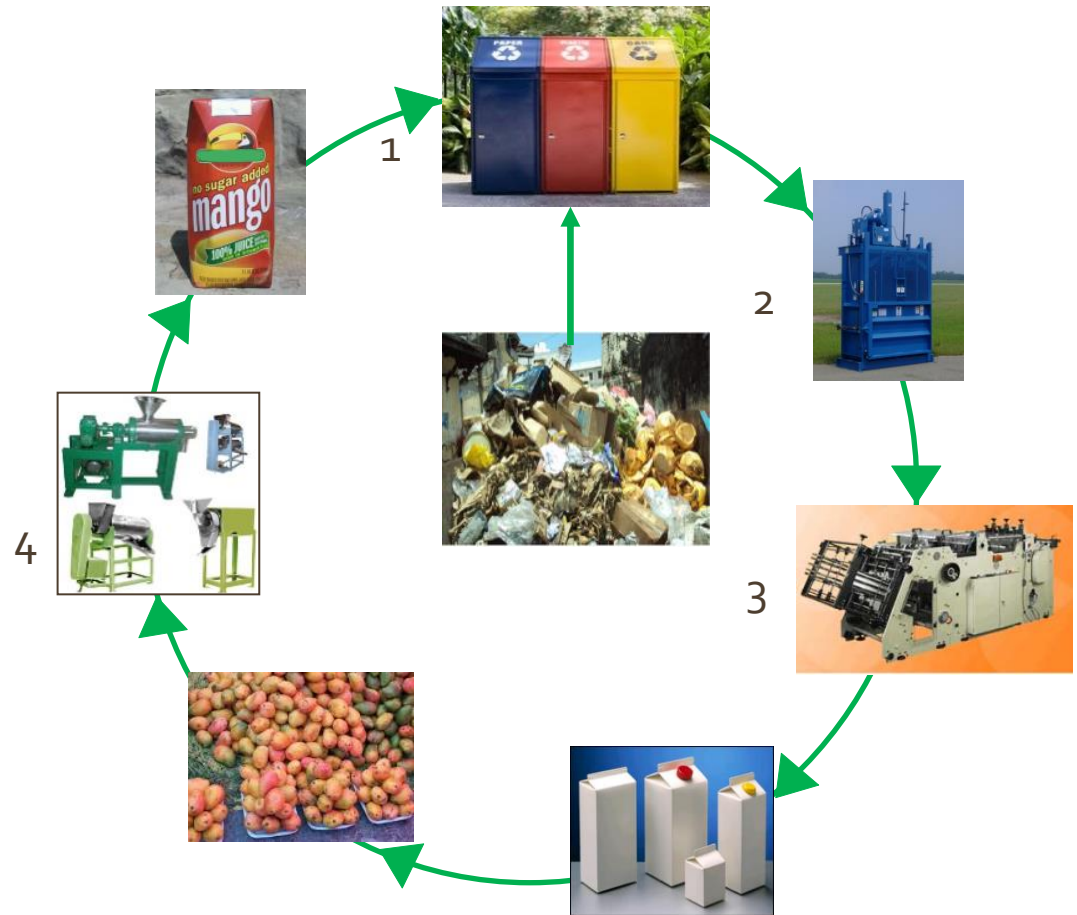
Modular Factories for when optimum production **location changes less often** and when there is need for **special internal environments**

- e.g. local production of consumer electronics, medical goods, etc.



1. Types

Combining Moveable Factories

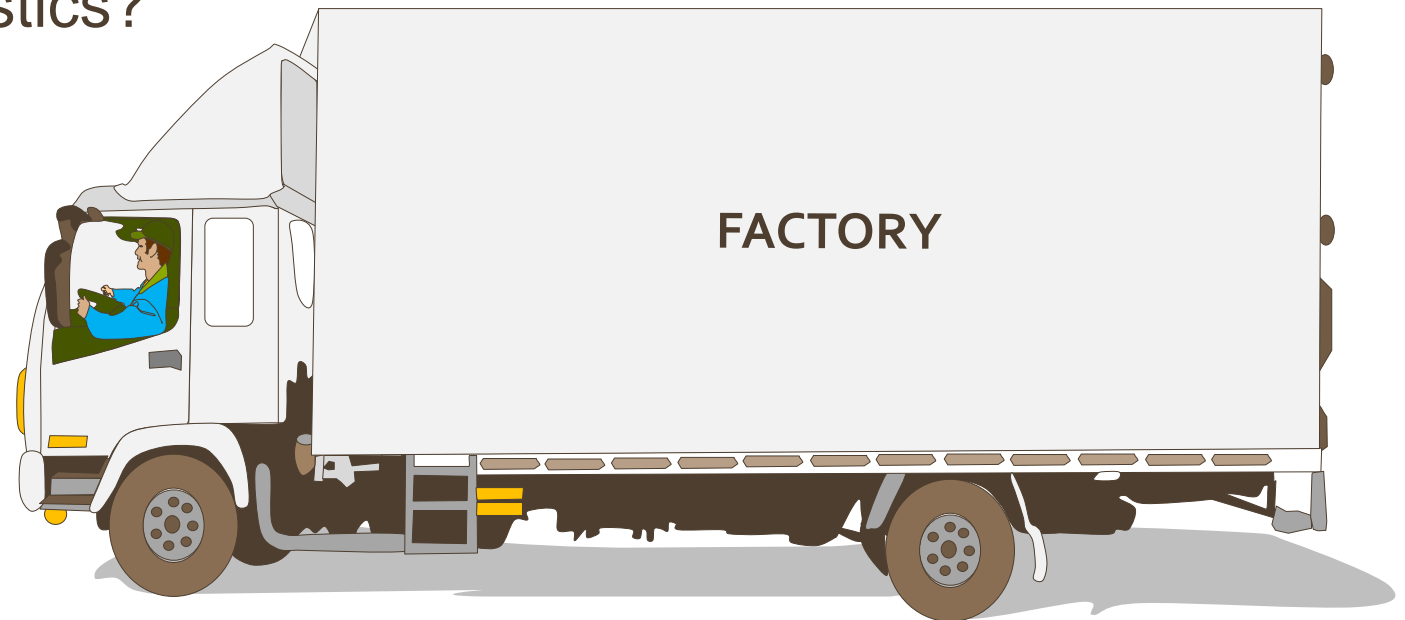


- can enable production and distribution of different types of equipment / goods to enable a value network for example:

1. sorting bins for packaging waste
2. recycling machines
3. carton making machines
4. juicing machines

1. Types - Q & A

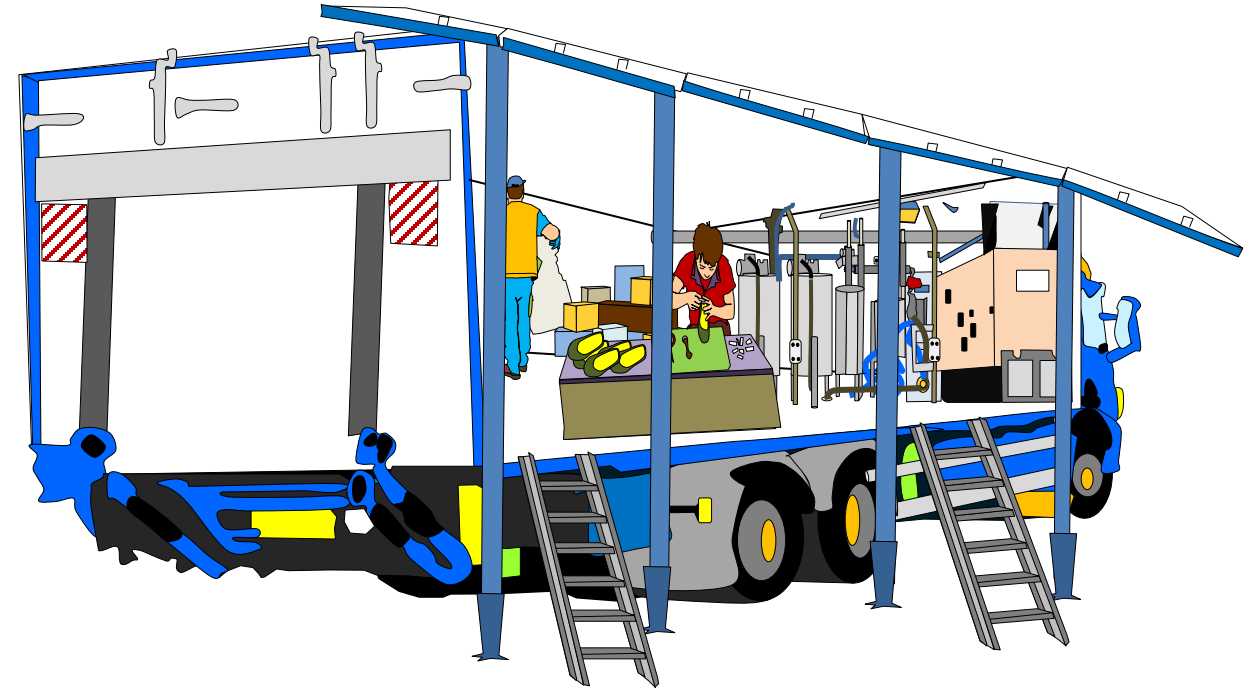
- Q.** What are the different types of factories that can be combined to enable combination of production and logistics?



1. Types - Q & A

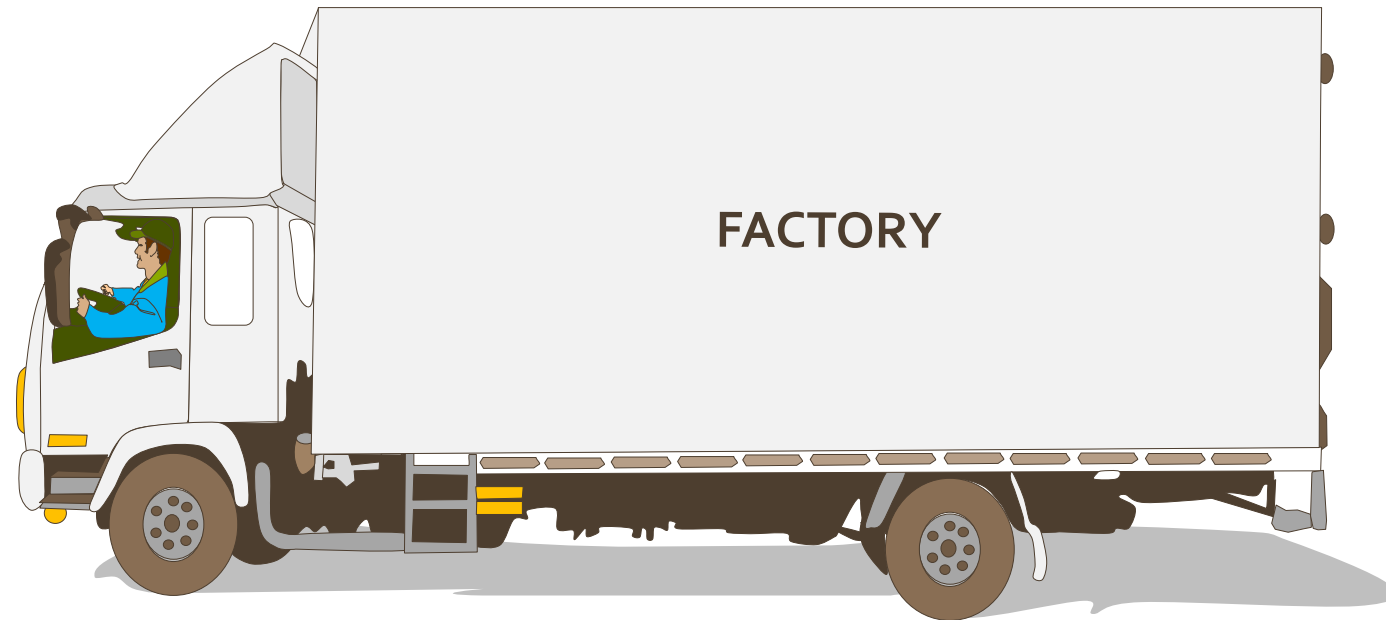
Q. What are the different types of factories that can be combined to enable combination of production and logistics?

A. Mobile, moveable, and modular factories



1. Types - Q & A

- Q.** When should mobile, moveable, and modular factories be used?



1. Types - Q & A

Q) When should mobile, moveable, and modular factories be used?

A)

- Mobile when optimum production location changes daily or weekly
- Moveable when optimum production location changes monthly or yearly
- Modular when optimum production location changes less frequently



2. Why



2. Why

Centralized industrial infrastructures can have

high cultural costs

- e.g. centralized originated in old European cultures when production had to be at fixed locations

high environmental costs

- e.g. unsustainable over exploitation of raw materials to keep big factories operating

high financial costs

- e.g. depends on expensive repeat transportation of materials and goods

high opportunity costs

- e.g. very large fixed capital investment limits business flexibility

high social costs

- e.g. leads to rural depopulation and urban overcrowding



2. Why

By contrast, moveable factories can have many advantages

cultural compatibility

- e.g. compatible with cultures based on seasonal patterns of work and movement

environmental sustainability

- e.g. avoids the unmanageable concentration of waste in a few centralized locations

low financial costs

- e.g. does not depend upon repeated transportation of materials and goods

low opportunity costs

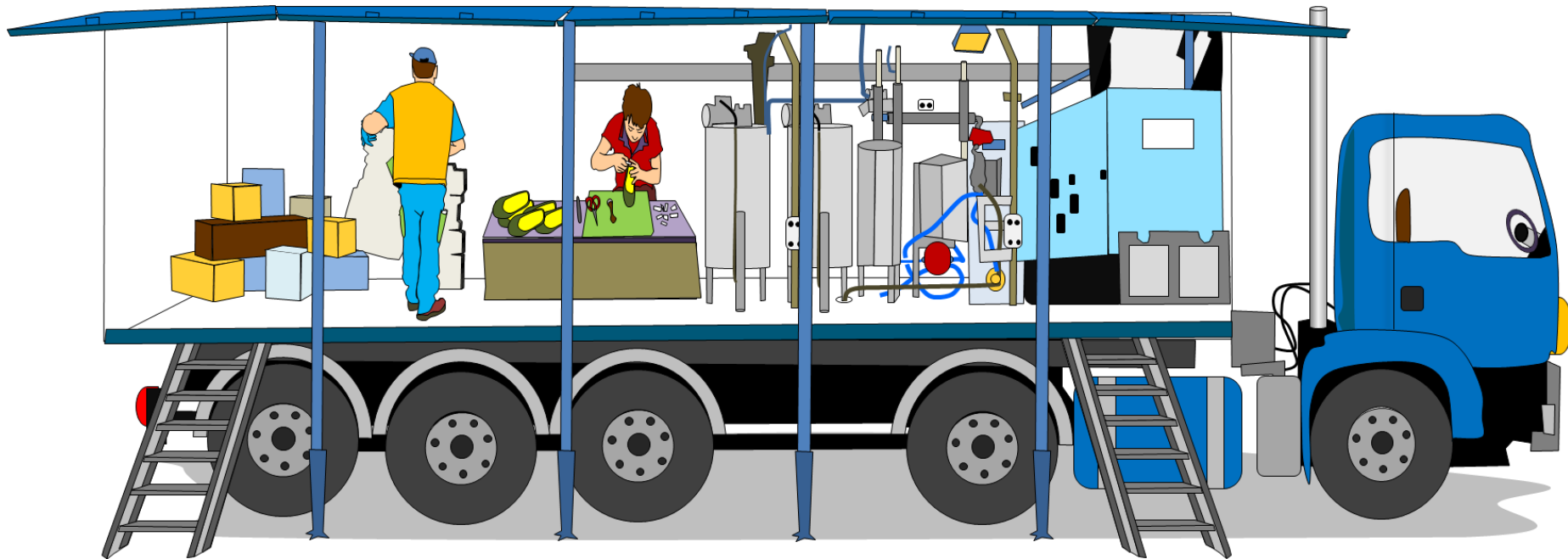
- e.g. much lower fixed capital investment costs increases business flexibility

socially sustainable

- e.g. local production by local people using local materials

2. Why - Q & A

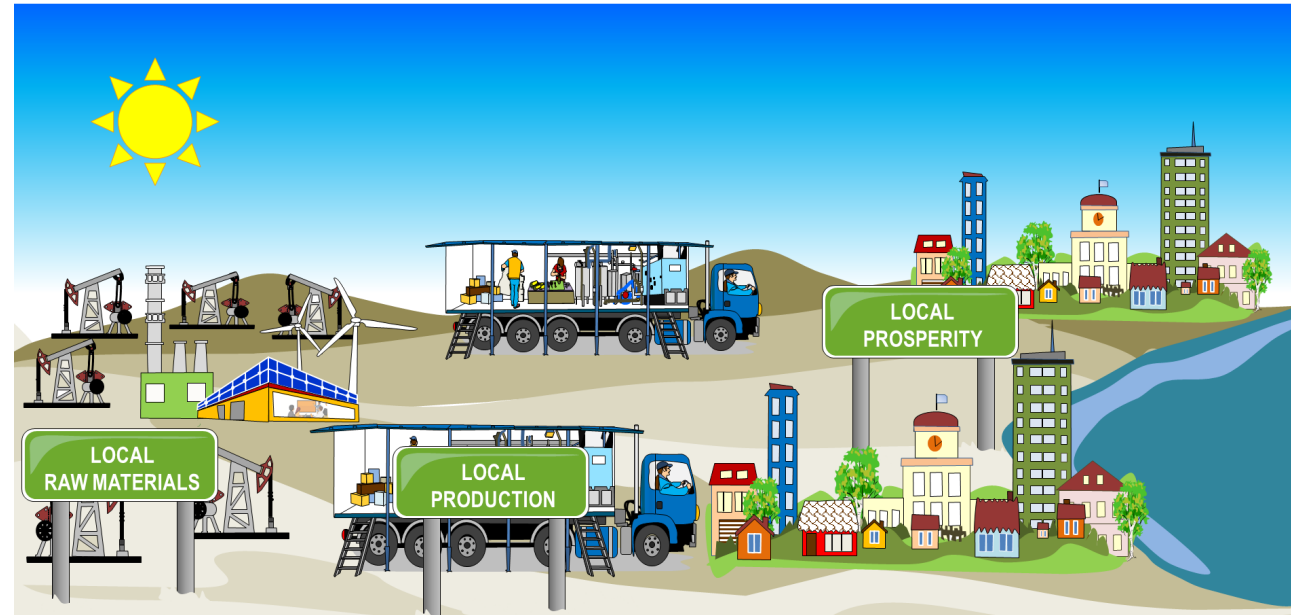
Q. Why use mobile, moveable, and/or modular factories?



2. Why - Q & A

Q. Why use mobile, moveable, and/or modular factories ?

A. To leapfrog over-industrialization for cultural compatibility, environmental sustainability, low financial costs, low opportunity costs, and socially sustainability



3. How



3. How

- **Mobile Factories:** for when optimum production **location changes daily or weekly** *e.g. processing and packaging at farms of livestock, milk, vegetable, fruit, etc.*
- **Moveable Factories:** for when optimum production **location changes monthly or yearly** *e.g. local production of wall blocks, roof sheeting, solar panels, water tanks, etc.*
- **Modular Factories:** for when optimum production **location changes less often** and when **special internal environments** are needed *e.g. local production of consumer electronics, medical goods, etc.*
- **Mobile / Moveable / Modular factories can be operational within a few months**

3. How

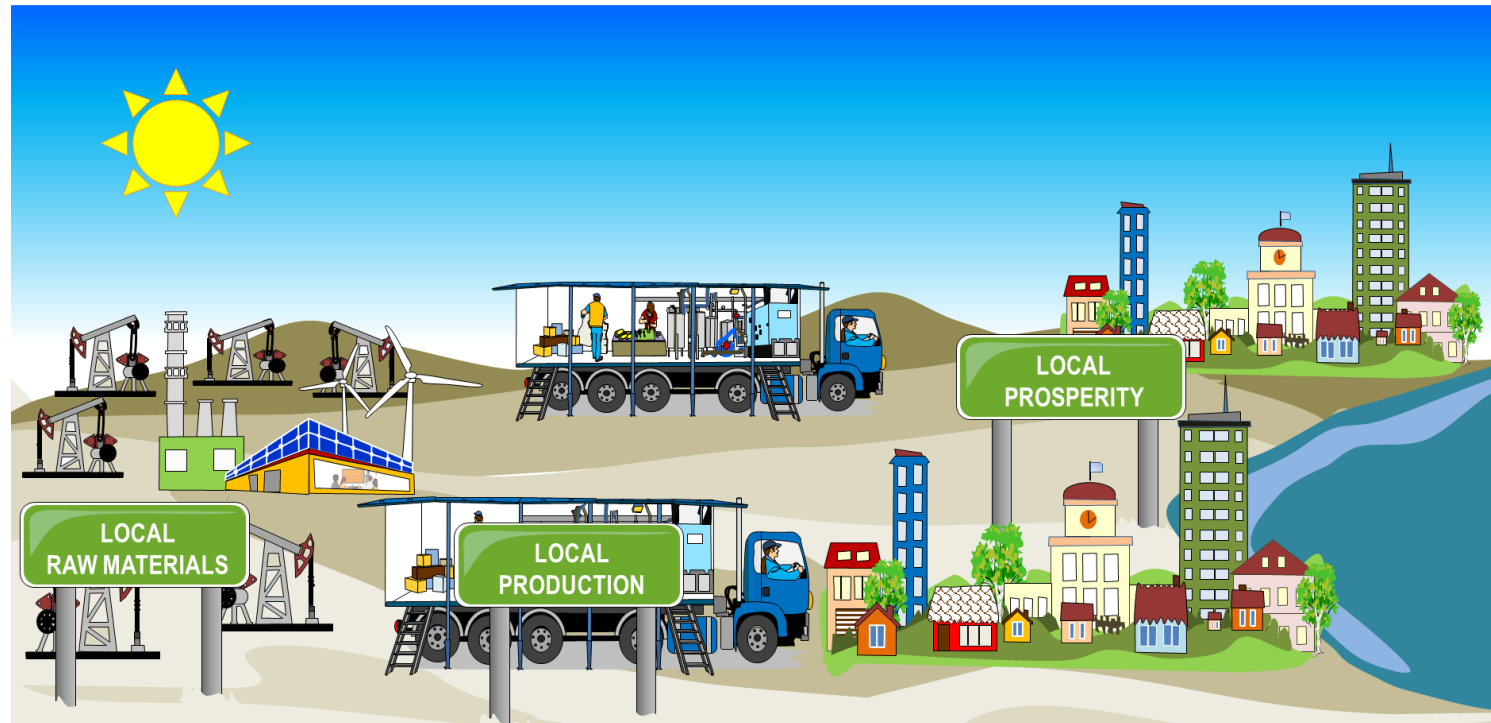
- **Design for Manufacture:** *components designed for use of manufacture using reliable manufacturing equipment that can be operated locally*
- **Design for Assembly:** *goods designed for simplicity of assembly by hand using also jigs, templates, tooling, and visual information*
- **Task Analysis & Job Design:** *production work analysed and organized for optimum sequencing, layout, safety, etc., in moveable / moveable / modular factories*
- **Fast Focused Training:** *fast training for specific tasks using specific tooling to produce specific goods in specific factory types and layouts*
- **Route Optimization:** *carry out joint optimization of production and routing master planning in mobile supply chains*

3. How

- **Audit of Local Natural Resources:** analysis of availability for use in production and distribution of local natural resources, e.g. biomass, energy, minerals, water
- **Planning for Sustainable Use:** feasibility study for minimum use of resources throughout lifecycle of production, distribution, and use of goods
- **Design for Recycling Systems:** design of processes for the recycling of waste from production and distribution and down cycling / up cycling of goods after use
- **Sustainability Management:** sustainability assessment covering environmental, economic and societal issues such as maximising local employment

3. How - Q & A

Q) How can the combination of production and logistics be optimized?



3. How - Q & A

- Q.** How can the combination of production and logistics be optimized?
- A.** Use the most appropriate type of moveable factory; apply design for manufacture, design for assembly, task analysis, job design, fast focused training, route optimization; apply audit of local natural resources, planning for sustainable use, design for recycling systems, and sustainability management.



4. References



Some references

- Shahmoradi-Moghadam, H. and Schönberger, J. (2021) Joint optimization of production and routing master planning in mobile supply chains. *Operations Research Perspectives* 8: 100187
- Fox, S., Mubarak, Y. and Adam, A. (2020) Ecological analyses of social sustainability for international production with fixed and moveable technologies. *Sustainability* 12(20), 8476
- Fox, S. (2019) Moveable production systems for sustainable development and trade: Limitations, opportunities, and barriers. *Sustainability*, 11, 5154.
- Fox, S. and Mubarak, Y.M. (2017) Moveable social manufacturing: Making for shared peace and prosperity in fragile regions. *Technology in Society*, 51: 1-7.
- Fox, S. (2015) Moveable factories: how to enable sustainable widespread manufacturing by local people in regions without manufacturing skills and infrastructure. *Technology in Society*, 42: 49-60.
- Fox, S. (2014) Third Wave Do-It-Yourself (DIY): potential for prosumption, innovation, and entrepreneurship by local populations in regions without industrial manufacturing infrastructure. *Technology in Society*, 39(1), 18-30.
- Fox, S. and Li, L. (2012) Expanding the scope of prosumption: a framework for analysing potential contributions from advances in materials technologies. *Technology Forecasting and Social Change*, 79(4), 721-733.