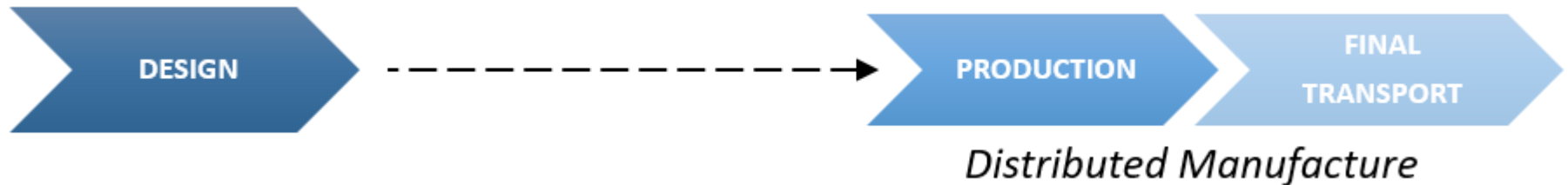




*MSc. Thesis Proposal*

# Analysis of the Impact of 3D Printing in Make-To-Order Production



*A.A. 2019/2020*

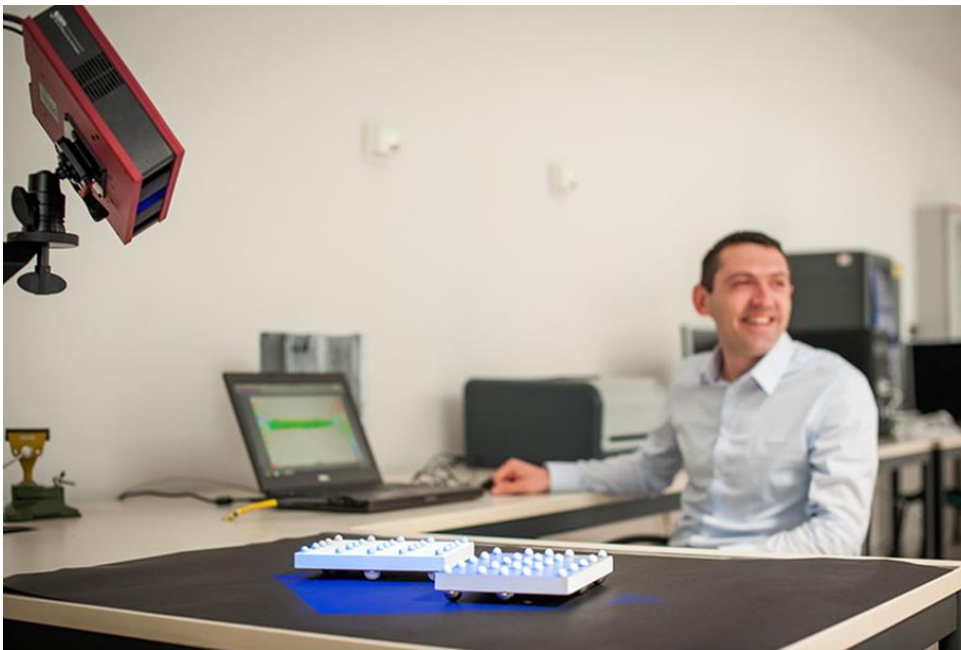
*Prof. Paolo Minetola*

# *Supervisor of the Thesis*

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PhD. Production Systems Engineering



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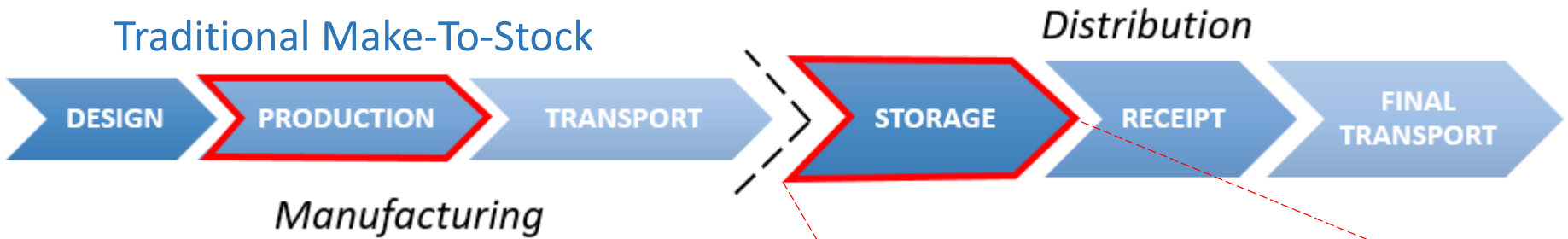


## *The Topic*

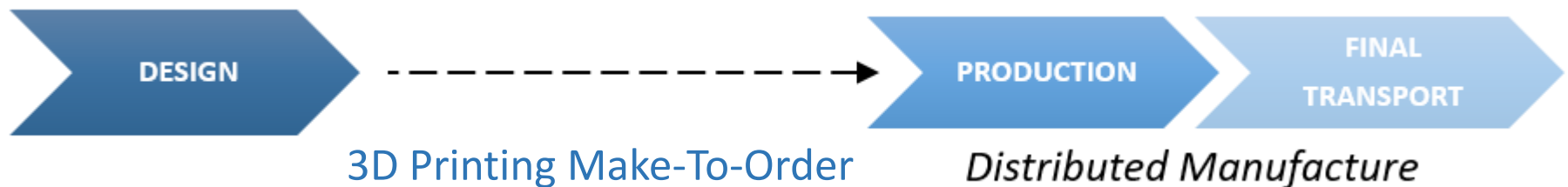
The potential to produce an infinite number of shapes without the need for equipment makes AM processes suitable for **Make-to-Order (MTO) manufacturing and distributed production**. All logistics activities are influenced positively because of simpler supply chains with shorter lead times and lower inventories.

On-demand production needs a much **more responsive manufacturing chain**, but the risks of overproduction and product obsolescence are avoided. The quantity of the **economic lot is moved towards the ideal limit of the single unit**, making mass customization economically viable.

# Analysis of supply chains for AM



- Demand-pull business models
- Distributed manufacture
- Stockless supply chains
- Manufacture at the point of consumption, short lead times
- Chainless supply chains (home manufacture)



## ***About Sustainability of 3D Printing***

Short lifecycle products demand a **societal commitment to tackle sustainability issues**, not only in the recycling phase but throughout the product lifecycle.

Contemporary 3D printing technologies enable a make-to-order production model and represent a **viable alternative** to traditionally forecast-driven make-to-stock manufacturing, which commonly generates overproduction and unsold waste products.

Nevertheless, **a change in the habits and attitudes of consumers** is needed for the adoption of 3D printing as a substitute for traditional mass production technologies in the circular economy context.



## *The Research Activity*

3D printing empowers the consumer with full control of the product lifecycle, transitioning them from user to prosumer.

The consumer can self-manufacture mass customized products as needed and manage the product disposal at end-of-life. Additionally, 3D printing allows for the **reshoring of goods**, bringing overseas supply closer to demand. Thus, **negative production externalities** are distributed in a fairer way worldwide.

For example, **CO2 emissions** related to product fabrication are not concentrated in a few manufacturing countries as often seen in the make-to-stock approach.

The aim of this thesis is the **development of a System Dynamic model** to account for the different aspects that 3D printing can modify with respect to traditional manufacturing models.

# Thesis development



## Evaluation of 3D Printing Impact:

- Environmental footprint (CO<sub>2</sub> emissions)
- Extension of the analysis to the recycling phase
- Definition of a more complex System Dynamics model:
  - Scenarios analysis
  - Evaluation of impact of consumer behaviour
  - Evaluation of impact of policies

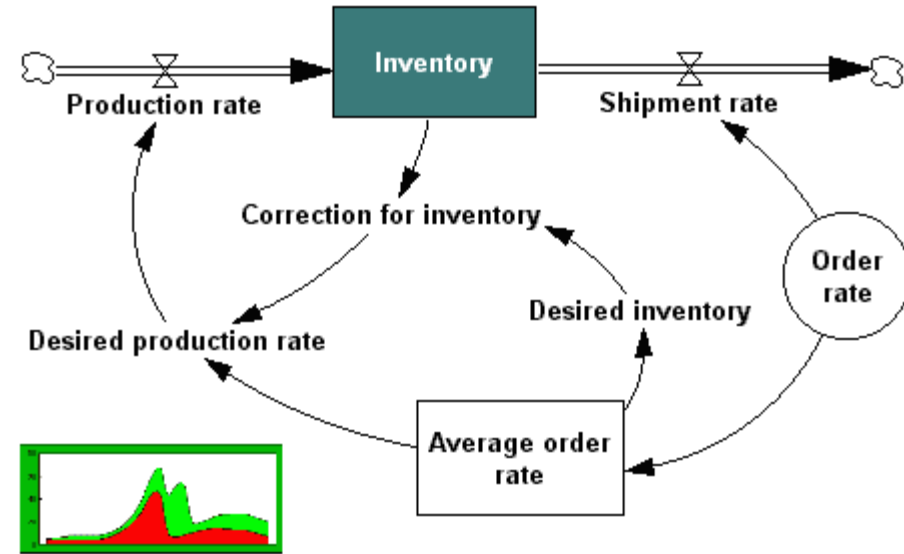


# Requirements

Good attitude for the use of PC and software.

VENSIM PLE software will be used.

Committment for a minimum period of 6 month.



## Important notice

The early handing in of the thesis draft is a strict requirement. In order to graduate in the desired session the student should hand in the draft to the supervisor at least two weeks before the deadline of the student office.