

Potential of 3D Printing and Opportunities

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Brunel University London

- ✓ Founded in 1966
 - ❖ 54 years (relatively young university)
- ✓ Located in Uxbridge, West London
- ✓ ~14,000 students and 2,500 staff
- ✓ Top 400 universities in the world
 - ❖ QS World University Rankings 2021
 - ❖ Times Higher Education World University Rankings 2021
- ✓ 9th for Research Intensity in the UK
 - ❖ University League Table 2021



Digital fabrication laboratory at Brunel University

- ✓ 3D Printers
- ✓ 3D Scanners
- ✓ Turn computer-aided design
(CAD) models into working
prototypes or finished products



Source: <https://www.brunel.ac.uk/virtualtour/?filter=academic&content=10&frompin=10>

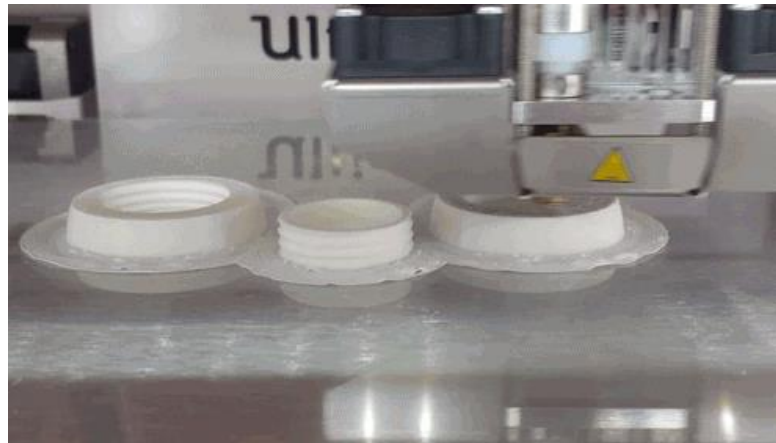
Outline

- ✓ What is 3D Printing and Why ?
- ✓ Potential of 3D Printing
- ✓ Opportunities

What is 3D Printing and Why ?

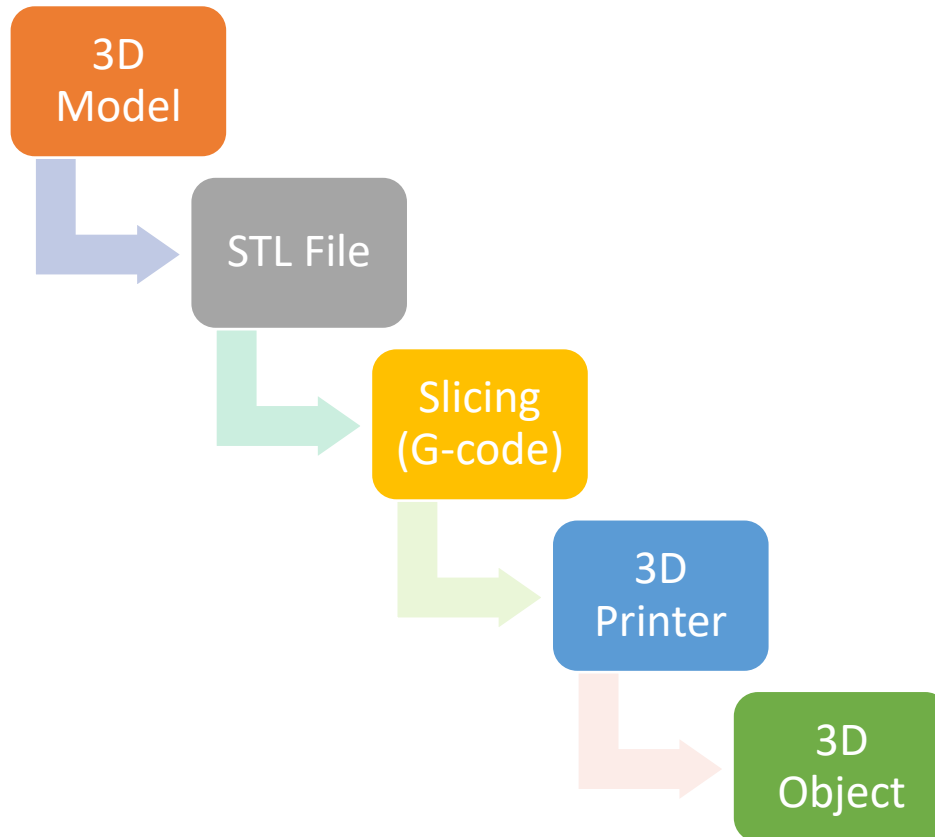
What is 3D printing

- ✓ 3D Printing (also called Additive Manufacturing (AM) ***often used interchangeably***)
 - ❖ Design a 3D Model of an object with a CAD software
 - ❖ Convert the model into a format (called an STL file) that the 3D printer understands
 - ❖ Build the object by adding (not subtracting) materials layer by layer with a 3D printer



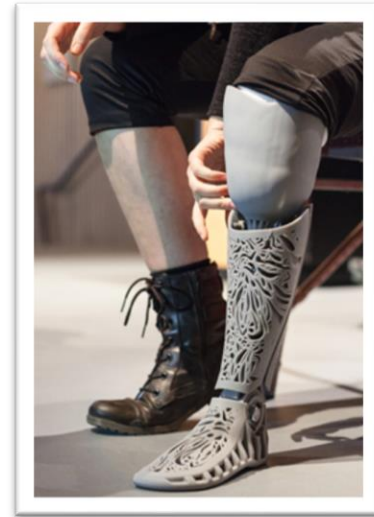
Source: giphy (2020)

3D Printing process



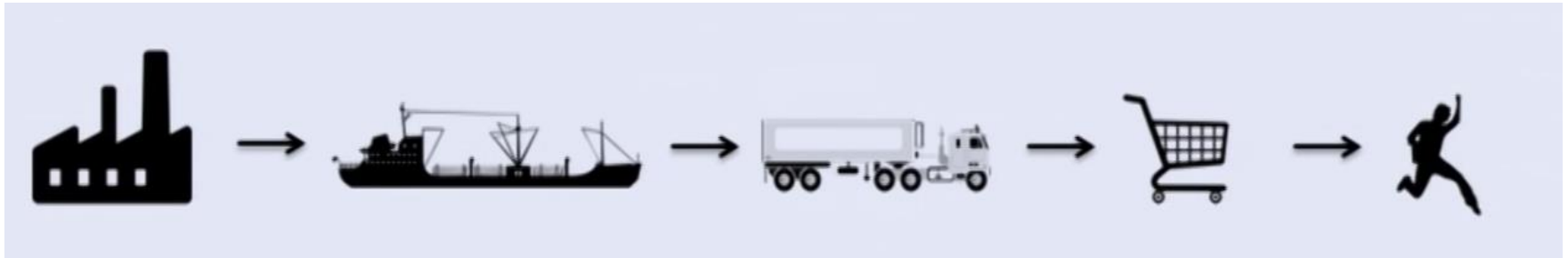
Why 3D Printing

- ✓ Less waste
 - ❖ Use the right amount of amount of material with little or no material wasted
- ✓ Customisation
 - ❖ Each design can be different, and suited to what you want
- ✓ Complex geometries
 - ❖ 3D Printing can help create complex designs compared to traditional types of manufacturing
- ✓ Fast production
 - ❖ 3D Printing can make objects within a minutes or hours (depending on the complexity)
 - ❖ You need the **3D Model** and a **3D Printer**



Source: 3D Printing industry (2020)

Put into context



Source: How 3D printing is enabling the '4th Industrial Revolution' | Dr. Tim Minshall | TEDxOxBridge <https://youtu.be/IsJLZ1UYxGc> and <https://openclipart.org/>

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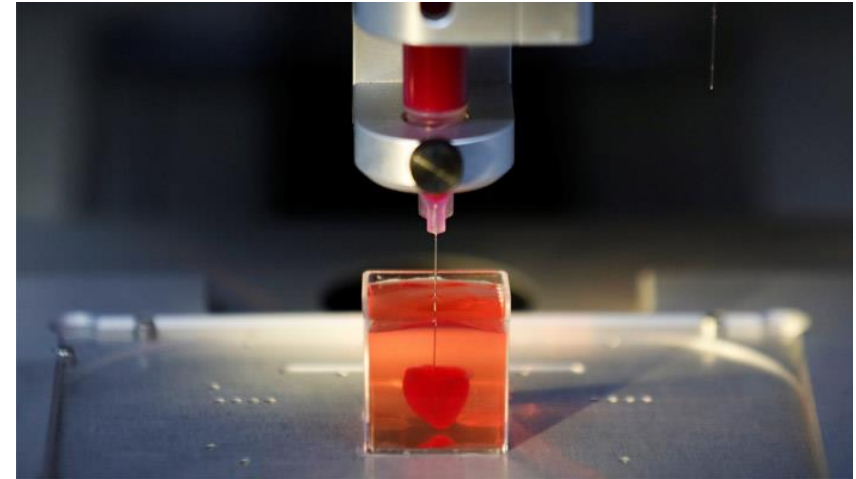
Potential of 3D Printing

Potential of 3D Printing

Cells, tissues, biomaterials

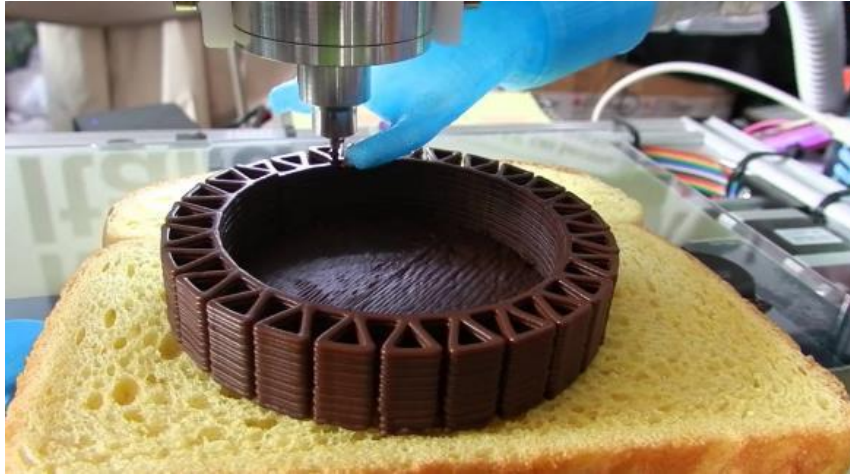


Source: 3Dnatives (2019)



Source: 3Dnatives (2020)

Potential of 3D Printing



Source: Fabbaloo (2018)

Food



Source: Fabbaloo (2019)

Potential of 3D Printing

Concrete



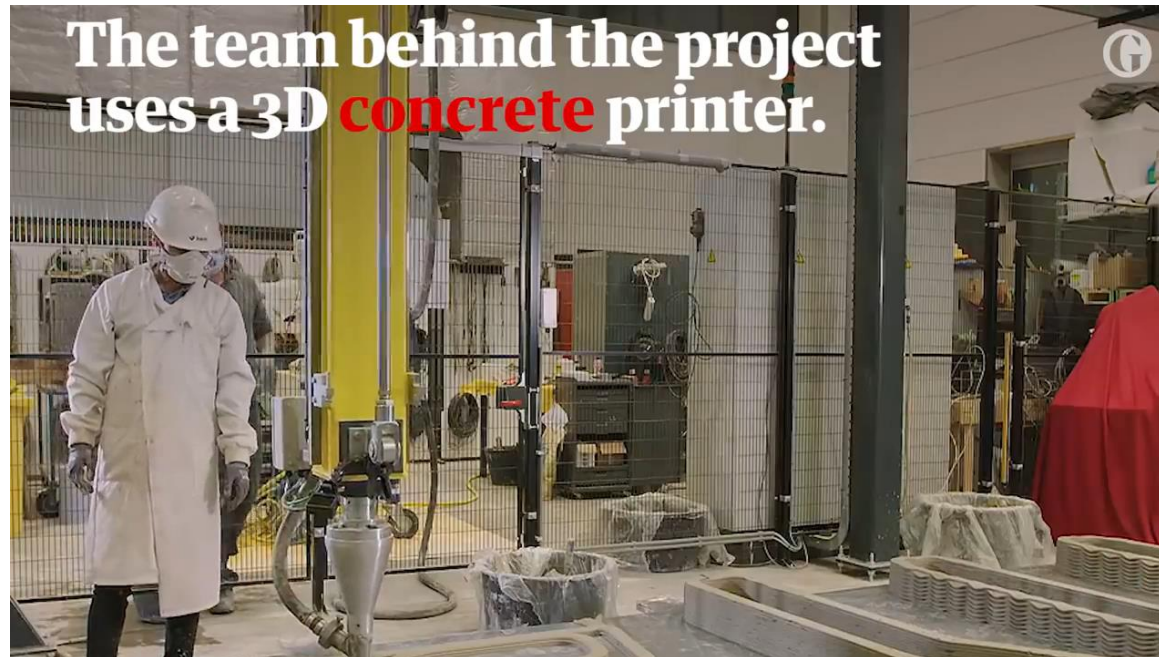
Source: de zeen (2018)



Source: m-tec (2020)

Potential of 3D Printing

Concrete



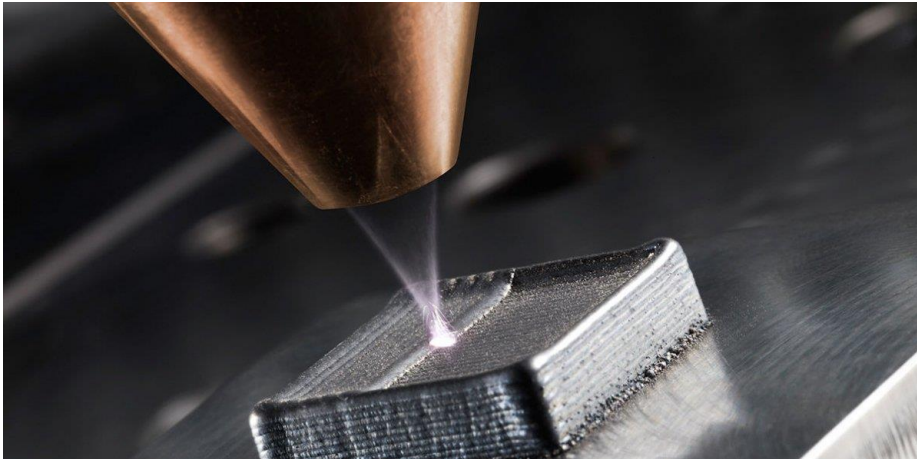
Source: The Guardian (2018) - <https://www.theguardian.com/artanddesign/2018/jun/06/netherlands-to-build-worlds-first-habitable-3d-printed-houses>

Potential of 3D Printing

Concrete

Source: The Guardian (2018) - <https://www.theguardian.com/artanddesign/2018/jun/06/netherlands-to-build-worlds-first-habitable-3d-printed-houses>

Potential of 3D Printing



Source: AMFG.ai (2019)

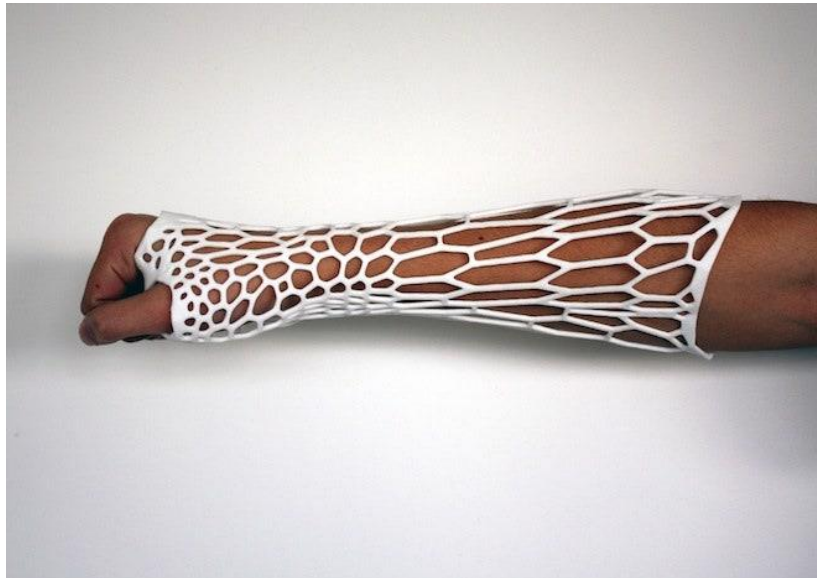
Metals



Source: AMFG.ai (2019)

Potential of 3D Printing

3D printed cast



Prosthetic hand



Source: pixabay (2020)

Potential of 3D Printing

Miniature human heart model



Source: The Week (2019)

3D printed denture



Source: Shutterstock (2020)

- ✓ Visualisation and training aid for abstract concepts
- ✓ Demonstrate complex human anatomy using accurate models

Case Study

3D Printing and covid-19

Case study – 3D Printing and covid-19

Issues due to covid-19 pandemic

- ✓ Increased number of cases and infections
- ✓ Panic buying of items
- ✓ Shortage of personal protection equipment (PPE) and medical devices
- ✓ Disruptions in supply chains
 - ❖ Logistical challenges
 - ❖ Transport restrictions

Case study – 3D Printing and covid-19

How 3D Printing is helping

- ✓ Decentralised manufacturing
 - ❖ Competitive advantage in unexpected situations
- ✓ Co-location of 3D Printing factories at hospitals
 - ❖ Remote accessibility and adaptability
- ✓ Students, researchers, manufacturers, designers, engineers, industries, universities and charities used 3D Printing to make PPE and medical devices to meet high demands
 - ❖ Face shields and masks
 - ❖ Test swabs
 - ❖ Part for ventilators

Brunel volunteers 3D-printing face shields for Guy's and St Thomas' medics

By Press Office
22 Apr 2020



Source: Brunel University - <https://www.brunel.ac.uk/news-and-events/news/articles/Brunel-volunteers-3D-printing-face-shields-for-Guy%27s-and-St-Thomas%27-medics>

Case study – 3D Printing and covid-19

3D models and open-source files (and modify/upload new files and designs) to support covid-19

- ✓ Thingiverse

www.thingiverse.com

- ✓ PRUSA PRO Face Shield (**Downloaded over 100,000 times in March 2020**)

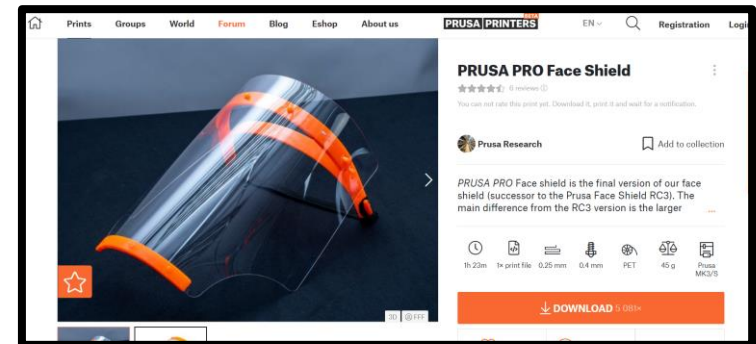
<https://www.prusaprinters.org/prints/32714-prusa-pro-face-shield/files>

- ✓ 3D Systems

<https://www.3dsystems.com/covid-19-response>

- ✓ Farsoon Technologies

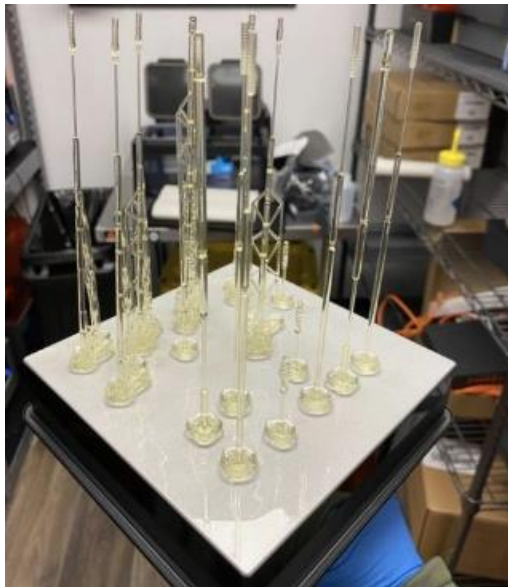
http://en.farsoon.com/yl_detail/productId=98.html



Case study – 3D Printing and covid-19

✓ 3D printed covid-19 test swabs

❖ Efficient manufacturing option to keep up with the demand for test swabs

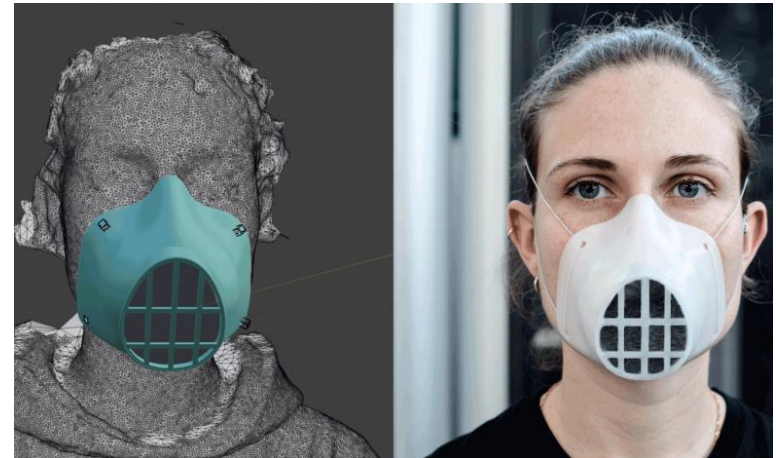


Source: 3Dprintingindustry (2020) Photo via Formlabs

Case study – 3D Printing and covid-19

✓ Personalised 3D printed face masks for covid-19

- ❖ Mass customisation
- ❖ Ergonomic fit (using 3D scanning)



Source: 3D Printing Media Network (2020) Davide Sher -
<https://www.3dprintingmedia.network/personalized-ppe-mask/>

Case study – 3D Printing and covid-19

- ✓ 3D printed visors for covid-19



Work by Giselle Loh – PhD researcher at Brunel University

Case study – 3D Printing and covid-19

3D printed ventilator valves



*Photo via CRP Technology.
Source: 3Dprintingindustry (2020)*



Source: AMFG (2020) - <https://amfg.ai/>

Case study – 3D Printing and covid-19

3D printed quarantine booths in China by Winsun Ltd



Photo by Winsun.

Source: 3Dnatives (2020) - <https://www.3dnatives.com/en/winsun-coronavirus-260220205/#/>!

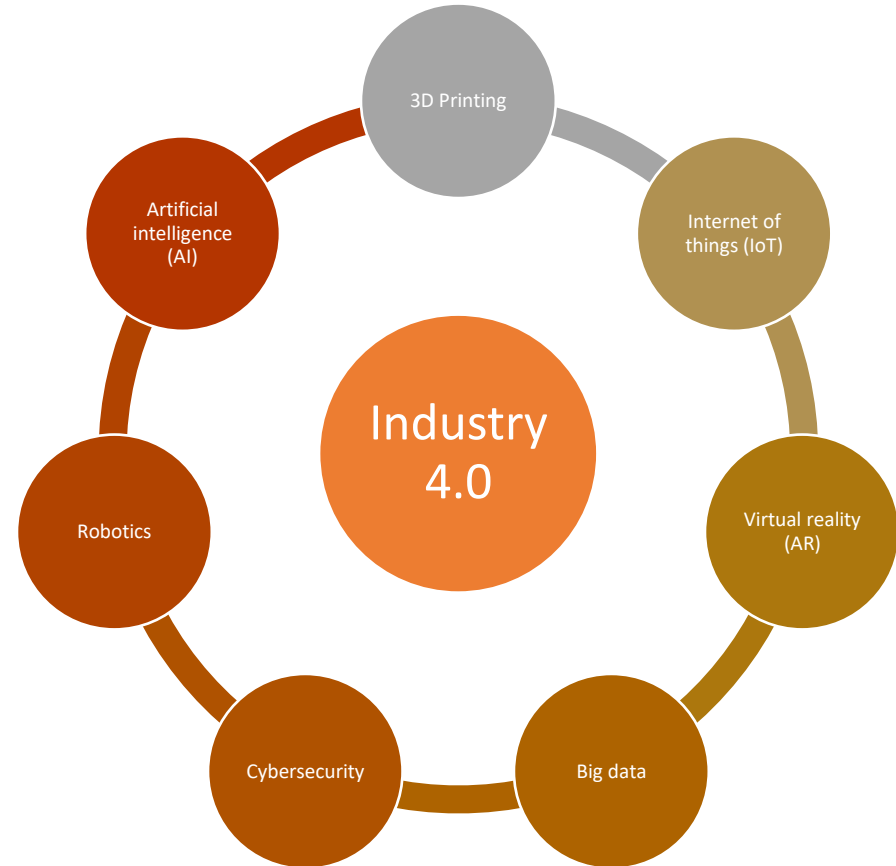
Opportunities

3D Printing and Industry 4.0

✓ Industry 4.0

- ✓ New phase of Industrial Revolution
- ✓ Digital transformation of manufacturing
- ✓ Interconnectivity and automation
- ✓ Increased productivity and efficiency

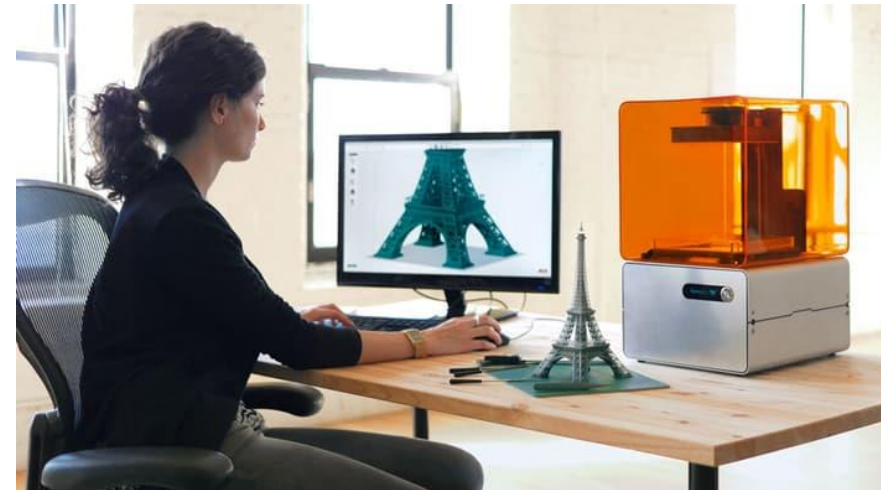
- ✓ **3D Printing** - vital digital manufacturing technology driving **Industry 4.0**



With Additive Manufacturing, you can become a...

Based on AM professionals in industry and recruitment advertisements in Europe

- ✓ AM Designer
- ✓ AM Process Engineer
- ✓ AM Inspector
- ✓ AM Supervisor
- ✓ AM Coordinator
- ✓ AM Operator and Technician
- ✓ AM Researcher and Scientist and **more.....**



Source: 3D Printing industry (2020)

****List is not exhaustive***

Recap

- What is 3D Printing and Why ?
- Potential of 3D Printing
- Opportunities

Any Questions ???