# A basic understanding about Additive Manufacturing (AM)

By

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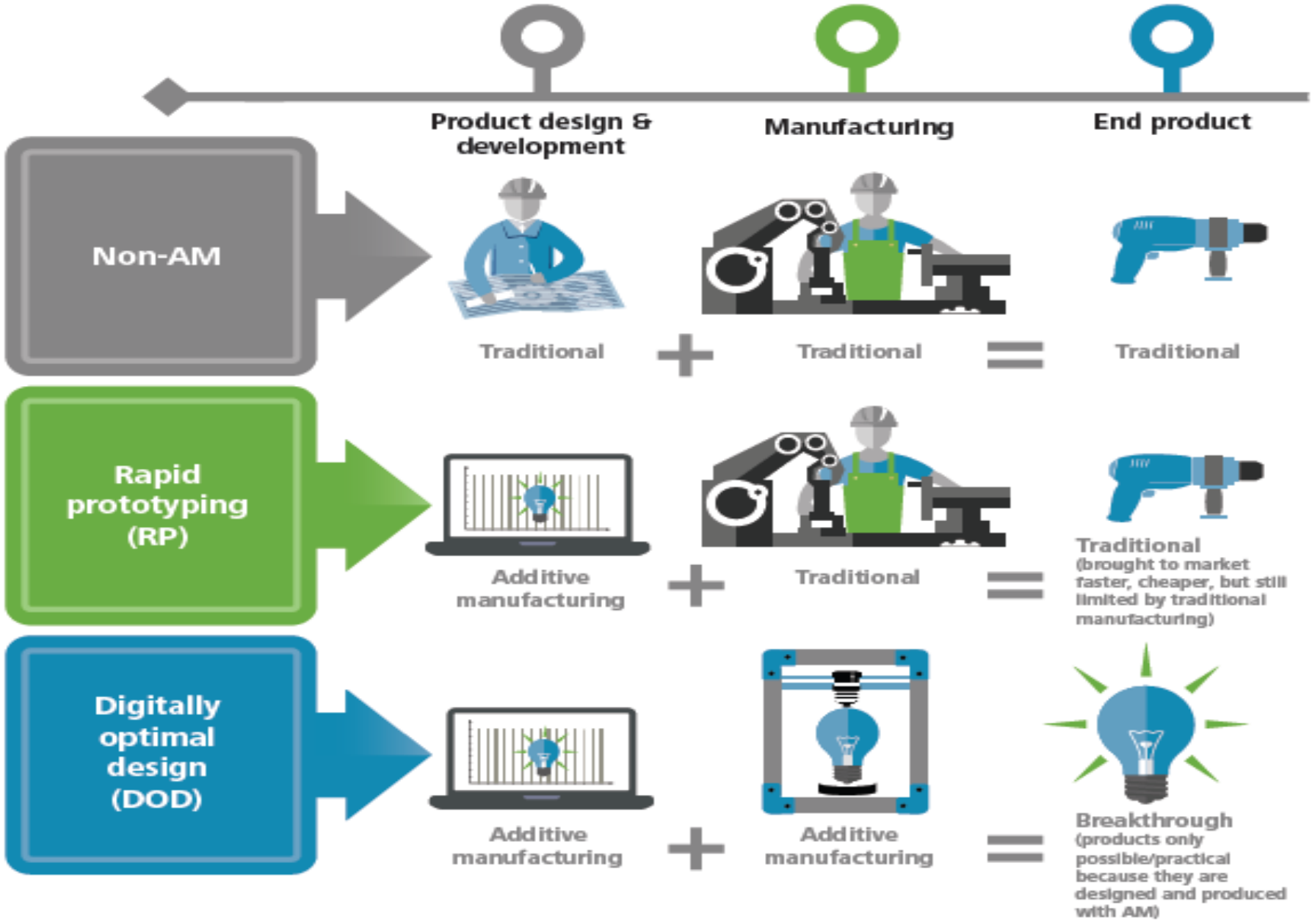
# Introduction

- Prototypes/Models had to be constructed by skilled model makers from 2D engineering drawings
- This is a time-consuming and expensive process
- With the advent of new layer manufacturing and CAD/CAM technologies, prototypes build up by adding materials one layer at a time based on a computerized 3D solid model
- It does not require the use of fixtures, cutting tools, coolants, and other auxiliary resources
- AM technology is contributing to a decrease in the experience and training requirements for designers, thus opening the field to automation as well as to entry by non-professionals

# Comparison of SM (non-AM), AM (RP), and DOD



# Comparing SM (Non AM), AM & DoD

- **Subtractive Manufacturing** is a process in which a part is produced by skilled model makers from 2D engineering drawings. Final product is subtracted from the same
- **AM (or rapid prototyping)** is a process in which a part is produced using layer-by-layer addition of the material
- Compared to other manufacturing process, AM can offer several benefits in creating prototypes and models, bolstering a product's value by increasing the efficiency and effectiveness of the design process

# Comparing SM (Non AM), AM & DoD

- Digitally optimal design (DOD) enables transformative changes to existing product development and design processes, such as the ability to easily and cheaply redesign products and the ability to use non-traditional sources of design information, including 3D scanning
- DOD enables new products, features that take advantage of the AM process's capabilities
- DOD adoption is still nascent, under research
- In 2014, about AM Gartner stated, "Design reuse, faster product launch and introduction, better aftermarket services, improved product quality, and greater consistency between contract manufacturers all indicate [the] high competitive value"

# Product manufacturing industry is facing two important challenging tasks

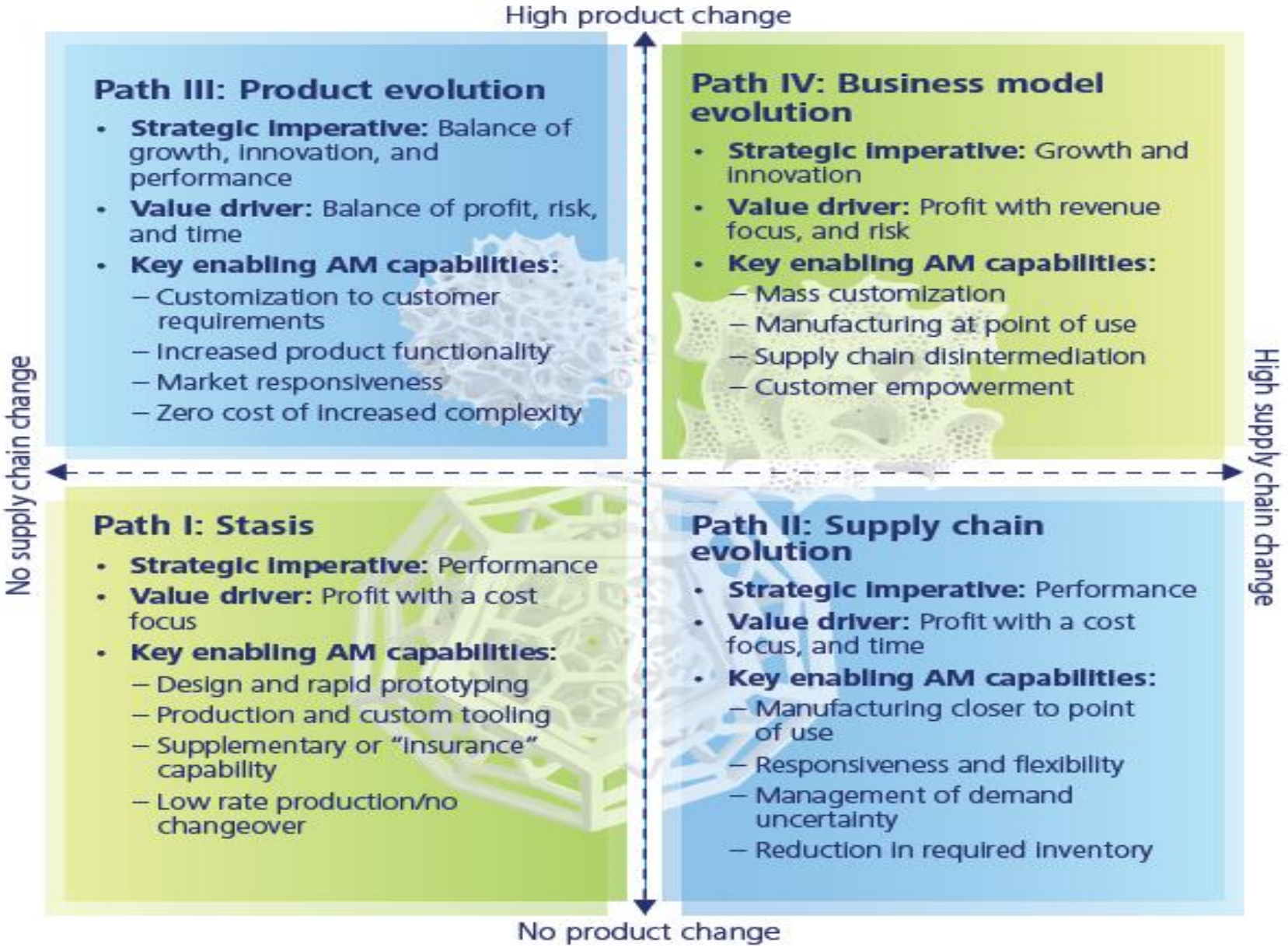
- Substantial product development time
- Need for flexibility for manufacturing small batch size products and a variety of types of products
- Producing the biological products with new materials
- Complete product in one go
- Complex shapes

# Importance of AM

AM is an important technological innovation that helps manufacturers break existing performance tradeoffs in two fundamental ways:

- First, AM helps reduces the capital involved in achieving economies of scale
- Capital versus scale: AM has the potential to reduce the capital required to reach minimum efficient scale for production, thus lowering the barriers to entry for manufacturing in a given location
- Second, it can increase flexibility and reduce the capital needed to achieve scope
- Capital versus scope: Flexibility of AM can facilitate an increase in the variety of products a unit of capital can produce; reducing the costs typically associated with production changeovers and customization and/or the overall amount of necessary capital

# Understanding AM paths & potential value



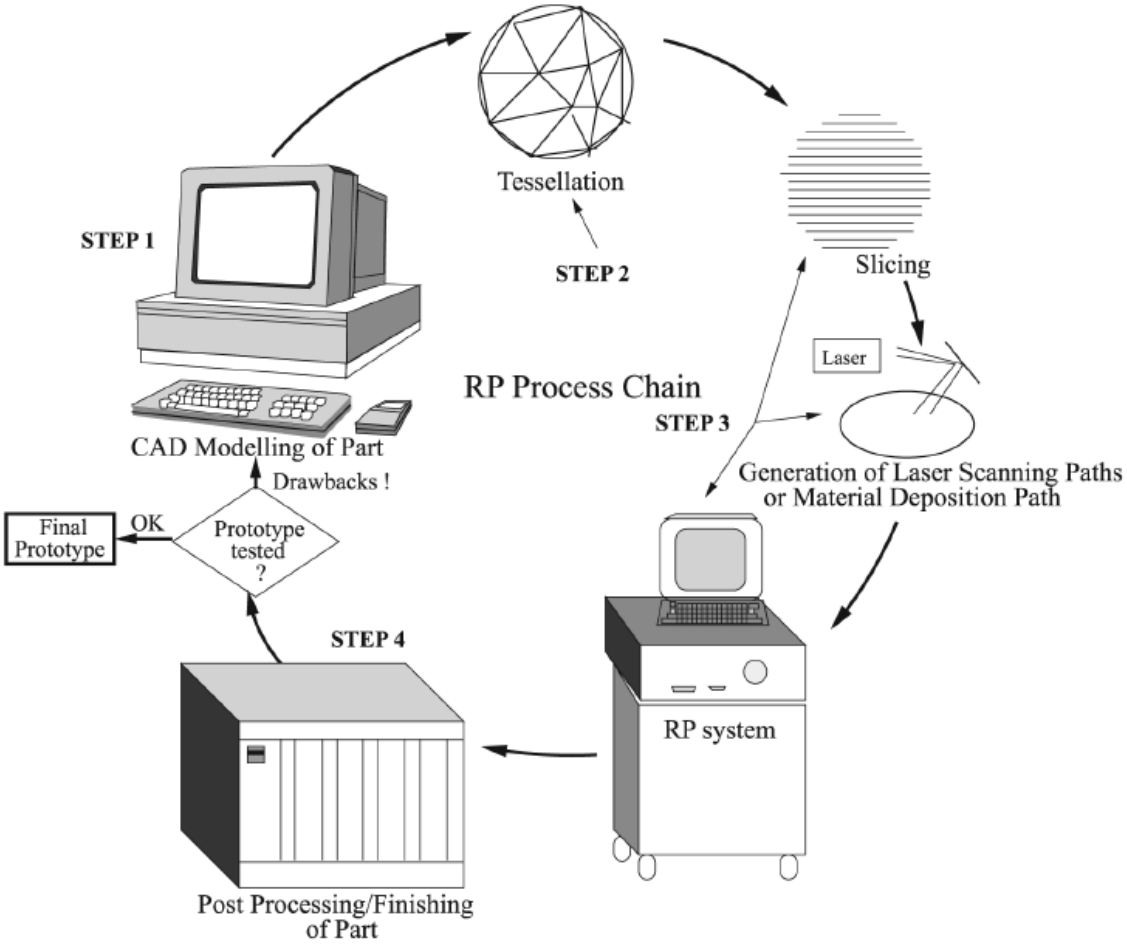
# AM processes have the following perceived advantages over Non AM processes

- Quick part manufacturing
- Material efficiency, new materials
- Manufacturing biological parts
- Part flexibility
- Product flexibility
- Saving time in product development cycle
- Reducing costs in development/improvement cycle
- Enhancing the final product's quality and design
- Towards single piece manufacturing

# The basic process of part Printing

- Creation of the CAD model of Design
- Conversion of CAD model into STL (Standard Tessellation Language) format
- Slicing of STL file in to thin sections
- Building parts layer by layer
- Post processing/finishing and the joining processes

# AM (RP) process chain



# Rapid Prototyping technologies (printing) are based on the following five main processes

- **Curing process:** a photo-sensitive polymer is exposed to a light source in order to harden the polymer
- **Sheet process:** where thin sheets of a material are cut to shape and stacked on top of each other
- **Dispensing process:** where a material is melted and then deposited either as a hot filament or as individual hot droplets
- **Sintering process:** where a powdered material is sintered together using a heat source, typically a laser beam
- **Binding process:** a liquid binder is deposited onto a powdered material to bind the powder together

We need your support in developing **AM platform that moves to manufacture bio products**

# thank you

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