



MANUFACTURING

WHAT IS MANUFACTURING?

- Manufacturing is the production of a product by processing raw materials. This is accomplished through human labor, the use of machinery and/or other tools and often a biological or chemical process. Manufacturing can be on a large scale, or it can make the pieces that are assembled to build automobiles, airplanes, household appliances and more.
- During the manufacturing process, these raw materials are modified to deliver the finished goods. There is, obviously, not one manufacturing process to take you from beginning to end. There are many. Some processes are intermediate and make components that undergo another manufacturing process to build the finished product.
- Among the most important manufacturing industries are those that produce aircraft, automobiles, chemicals, clothing, computers, consumer electronics, electrical equipment, furniture, heavy machinery, refined petroleum products, ships, steel, and tools and dies.

The background is a dark gray gradient. In the corners, there are white line art illustrations of circuit boards or electronic components, consisting of lines and small circles.

STEPS OF THE MANUFACTURING PROCESS

DEVELOP THE PRODUCT VISION

The product vision is the seed the finished goods will grow from. Even if you don't have an idea, you can develop one by brainstorming with your team.

Things you'll want to discuss include:

- ✓ Who is the target audience?
- ✓ What size is the market?
- ✓ Is there a need for the product or does it solve a problem?
- ✓ Are there competitors and, if so, who are they?
- ✓ Are there trends around similar products?
- ✓ Do you have the funding necessary to make the product?
- ✓ What's your product roadmap?

DESIGN THE PRODUCT

With the idea and the research behind you, next is product development. You should always keep the end user's needs at the forefront and make sure your product is user-friendly.

Some things to keep in mind during this step are the function of your product, such as how it'll be used, what resources are needed to make it and its lifespan.

Along those lines, will you have a warranty, how much will it cost to manufacture while allowing you to make a profit and will it need accessories or batteries?

Also, don't forget about designing the packaging, too

FINALIZE THE DESIGN

- Once you've answered the questions in the previous step, you can begin to create a final design of your product.
- At this point, there can't be any gray areas. If you still have questions or user stories that have not been fully answered, then it's here where you'll need to come up with concrete answers to them.
- At this point, you'll also need to marshal the resources necessary for manufacturing your project or a working prototype.

TEST THE PROTOTYPE

- Before you can move into manufacturing the product at scale, you need to test your prototype to make sure it works and meets the needs of your target audience.
- Better to find the kinks in the design and smooth them out at this point

MANUFACTURE THE PRODUCT

- Once testing has been completed to your satisfaction, you can begin to manufacture the product in earnest.
- This is when you'll develop pricing strategies for the product and calculate your manufacturing costs. You'll need to decide on the raw materials necessary to make your product, and how long it will take to assemble them into the finished goods.

GET FEEDBACK AND DO MORE TESTING

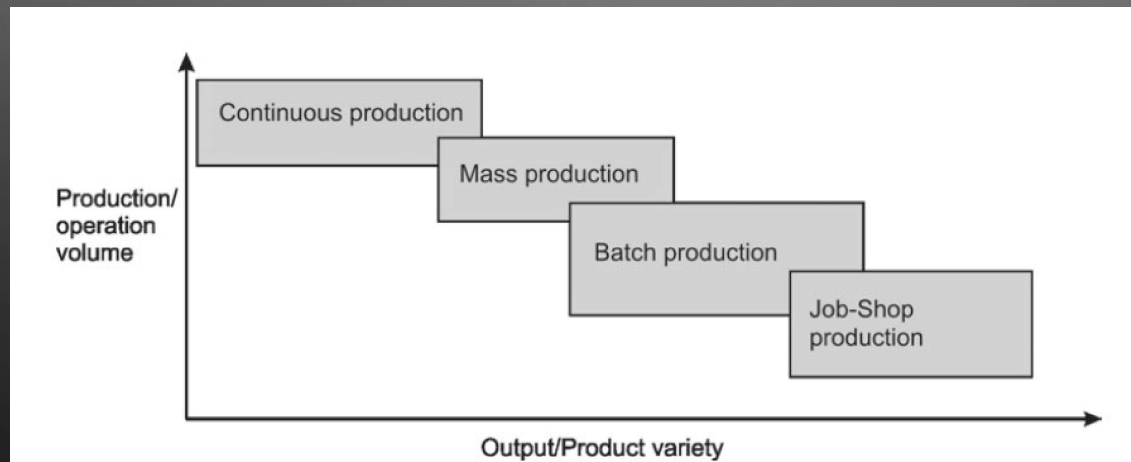
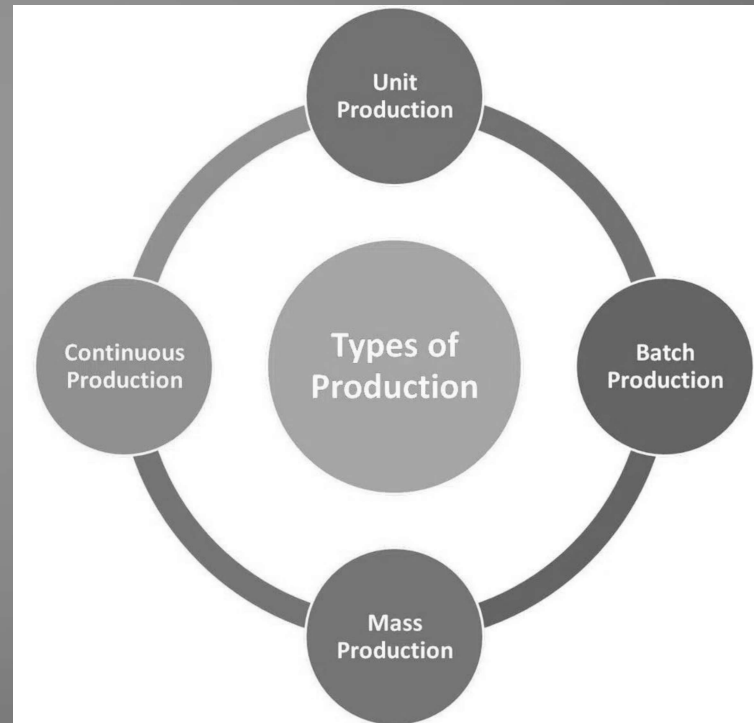
- Before you release your product on the marketplace, you need to get feedback or do further testing to ensure that you're delivering the best possible product.
- Feedback can come from focus groups, but also from your team, friends and family. The more, the better.
- If you can improve the product, do so before the official release. Be sure to listen and ask questions without leading people to get the most honest responses.

OFFICIAL RELEASE

- After all that work, you're ready to release the product on the market.
- This should be done with a product marketing campaign to let your customers know about your product and why they will want one.
- This can be done through various channels, from press releases to public launches, social media and more traditional media platforms

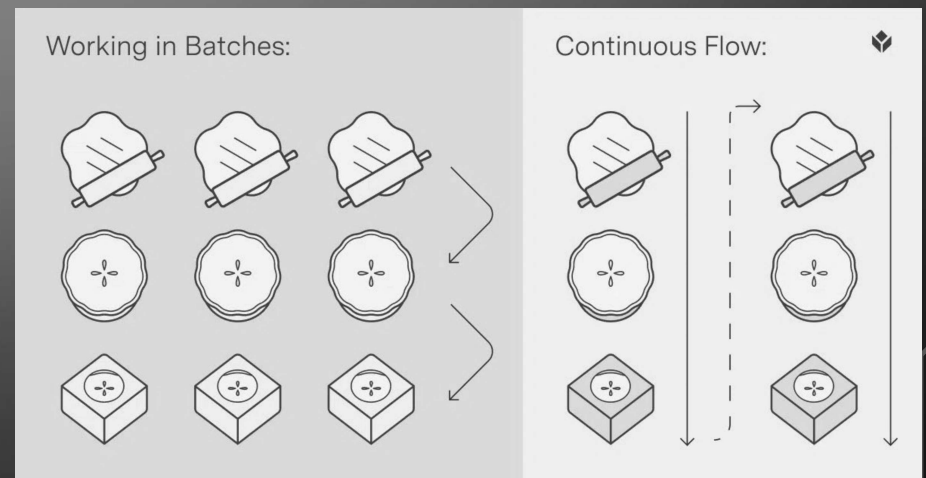
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TYPES OF MANUFACTURING PROCESSES



CONTINUOUS PRODUCTION

- Production facilities are arranged as per the sequence of production operations from the first operations to the finished product. The items are made to flow through the sequence of operations through material handling devices such as conveyors, transfer devices, etc.



CONTINUOUS PRODUCTION

- Continuous Production is characterized by
 1. Dedicated plant and equipment with zero flexibility.
 2. Material handling is fully automated.
 3. Process follows a predetermined sequence of operations.
 4. Component materials cannot be readily identified with final product.
 5. Planning and scheduling is a routine action.

Advantages

1. Standardization of product and process sequence.
2. Higher rate of production with reduced cycle time.
3. Higher capacity utilization due to line balancing.
4. Manpower is not required for material handling as it is completely automatic.
5. Person with limited skills can be used on the production line.
6. Unit cost is lower due to high volume of production.

Limitations

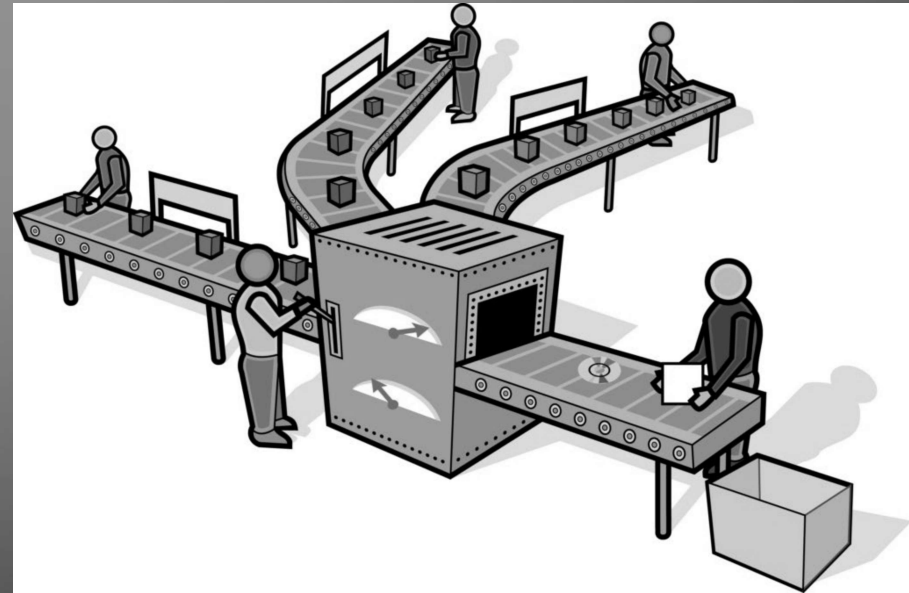
1. Flexibility to accommodate and process number of products does not exist.
2. Very high investment for setting flow lines.
3. Product differentiation is limited.

MASS PRODUCTION

- Manufacture of discrete parts or assemblies using a continuous process are called *Mass Production*.

This production system is justified by very large volume of production.

The machines are arranged in a line or product layout. Product and process standardization exists and all outputs follow the same path.



MASS PRODUCTION

- Mass Production is characterized by
 1. Standardization of product and process sequence.
 2. Dedicated special purpose machines having higher production capacities and output rates.
 3. Large volume of products.
 4. Shorter cycle time of production.
 5. Lower in process inventory.
 6. Perfectly balanced production lines.
 7. Flow of materials, components and parts is continuous and without any back tracking.
 8. Production planning and control is easy.
 9. Material handling can be completely automatic.

Advantages

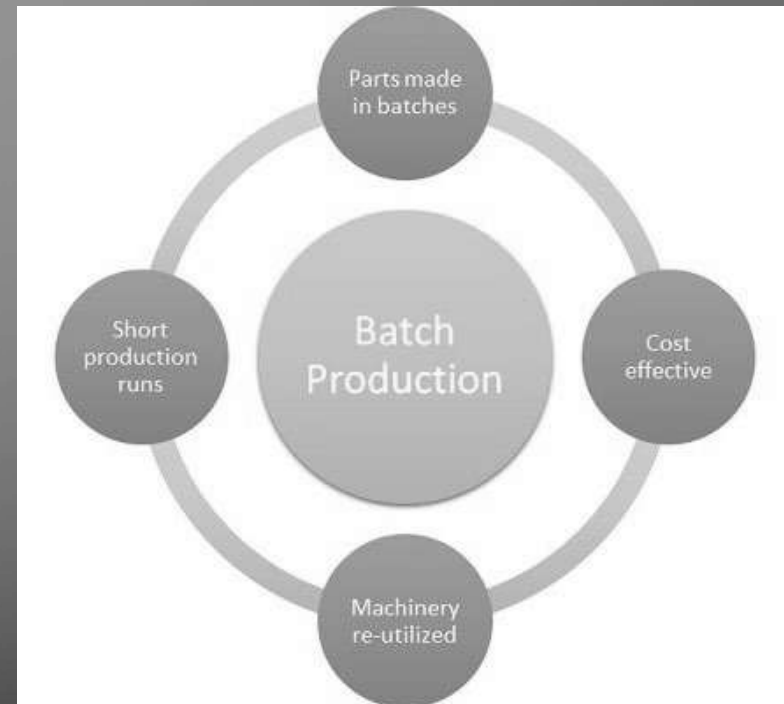
1. Higher rate of production with reduced cycle time.
2. Higher capacity utilization due to line balancing.
3. Less skilled operators are required.
4. Low process inventory.
5. Manufacturing cost per unit is low.

Limitations

1. Breakdown of one machine will stop an entire production line.
2. Line layout needs major change with the changes in the product design.
3. High investment in production facilities.
4. The cycle time is determined by the slowest operation.

BATCH PRODUCTION

- American Production and Inventory Control Society (APICS) defines Batch Production as a form of manufacturing in which the job pass through the functional departments in lots or batches and each lot may have a different routing. It is characterized by the manufacture of limited number of products produced at regular intervals and stocked awaiting sales



BATCH PRODUCTION

- Batch Production is characterized by
 1. Shorter production runs.
 2. Plant and machinery are flexible.
 3. Plant and machinery set up is used for the production of item in a batch and change of set up is required for processing the next batch.
 4. Manufacturing lead-time and cost are lower as compared to job order production.

Limitations

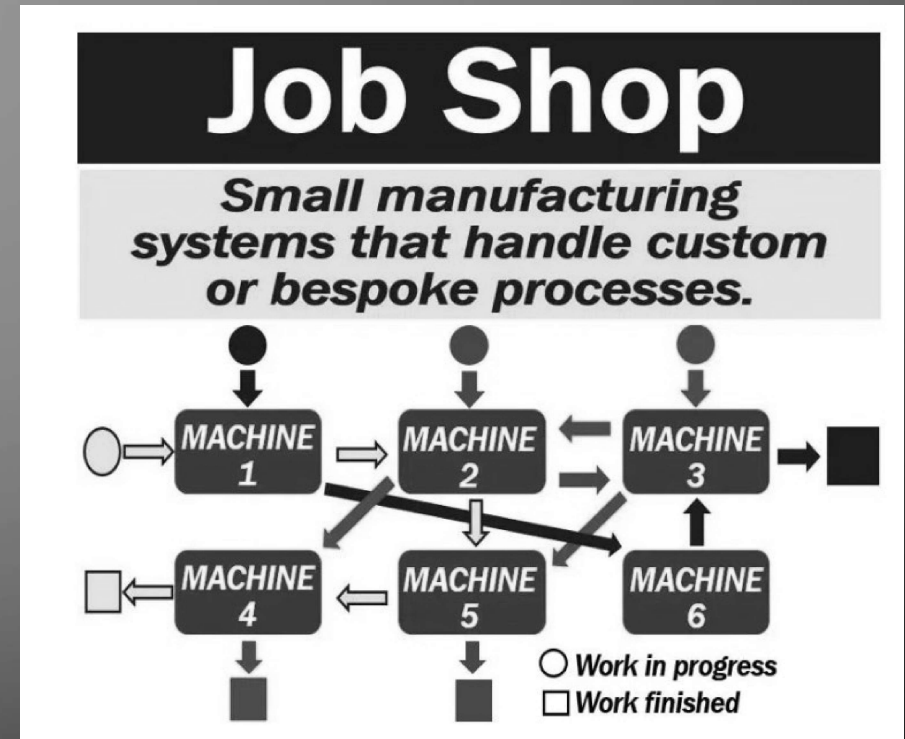
1. Material handling is complex because of irregular and longer flows.
2. Production planning and control is complex.
3. Work in process inventory is higher compared to continuous production.
4. Higher set up costs due to frequent changes in set up

Advantages

1. Better utilization of plant and machinery.
2. Promotes functional specialization.
3. Cost per unit is lower as compared to job order production.
4. Lower investment in plant and machinery.
5. Flexibility to accommodate and process number of products.
6. Job satisfaction exists for operators.

JOB-SHOP PRODUCTION

- Job-shop production are characterized by manufacturing one or few quantity of products designed and produced as per the specification of customers within prefixed time and cost. The distinguishing feature of this is low volume and high variety of products. A job-shop comprises of general-purpose machines arranged into different departments. Each job demands unique technological requirements, demands processing on machines in a certain sequence.



JOB-SHOP PRODUCTION

- Job-shop Production is characterized by:

1. High variety of products and low volume.
2. Use of general purpose machines and facilities.
3. Highly skilled operators who can take up each job as a challenge because of uniqueness.
4. Large inventory of materials, tools, parts.
5. Detailed planning is essential for sequencing the requirements of each product, capacities for each work center and order priorities.

Advantages

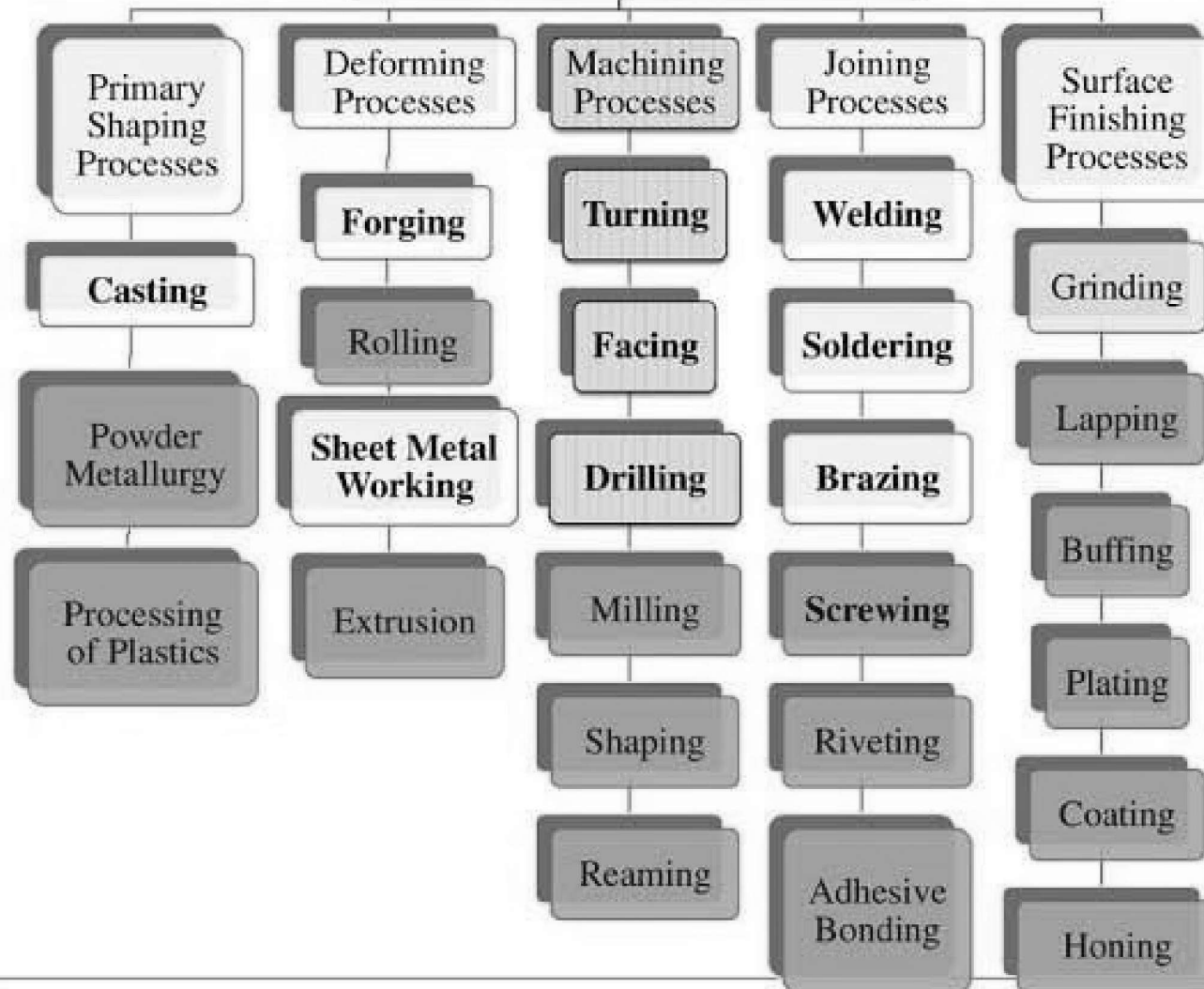
1. Because of general purpose machines and facilities variety of products can be produced.
2. Operators will become more skilled and competent, as each job gives them learning opportunities.
3. Full potential of operators can be utilized.
4. Opportunity exists for Creative methods and innovative ideas

Limitations

1. Higher cost due to frequent set up changes.
2. Higher level of inventory at all levels and hence higher inventory cost.
3. Production planning is complicated.
4. Larger space requirements.

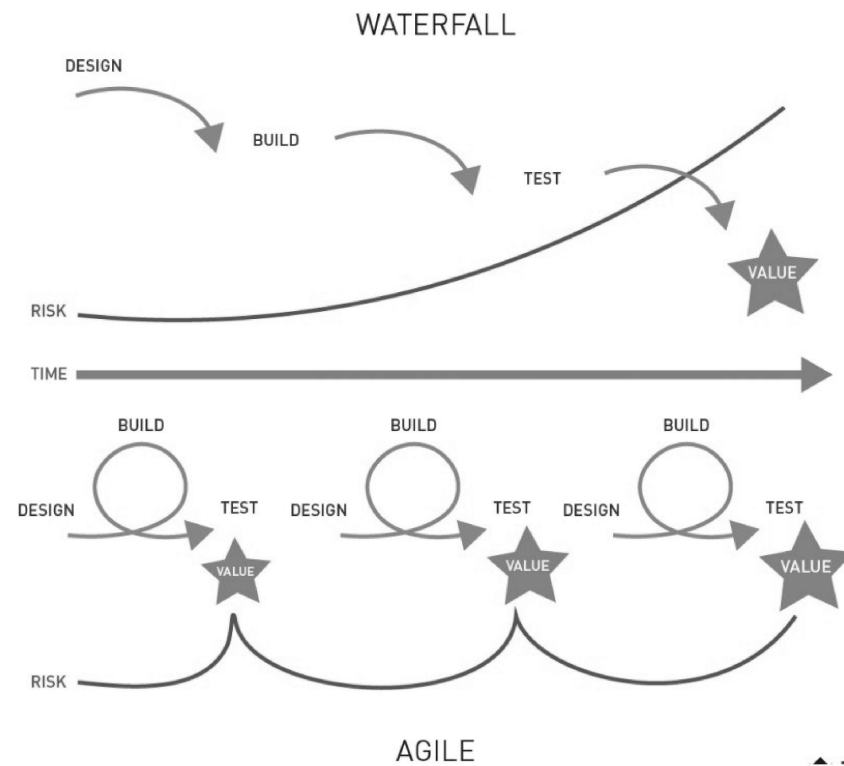


Manufacturing Processes.



Agile Manufacturing

Agile and Waterfall

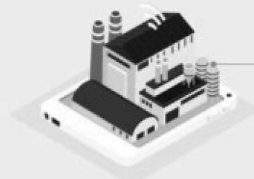


History



The 4 major shifts in manufacturing

4 FUNDAMENTAL SHIFTS IN MANUFACTURING



RAPIDLY EVOLVING ENVIRONMENT

Customer demands and regulations are becoming more challenging.



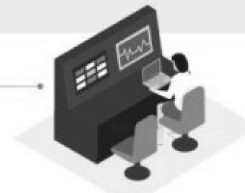
CONSTANT TECHNOLOGICAL DEVELOPMENT

New technologies appear every day.



WORKFORCE TRANSFORMATION

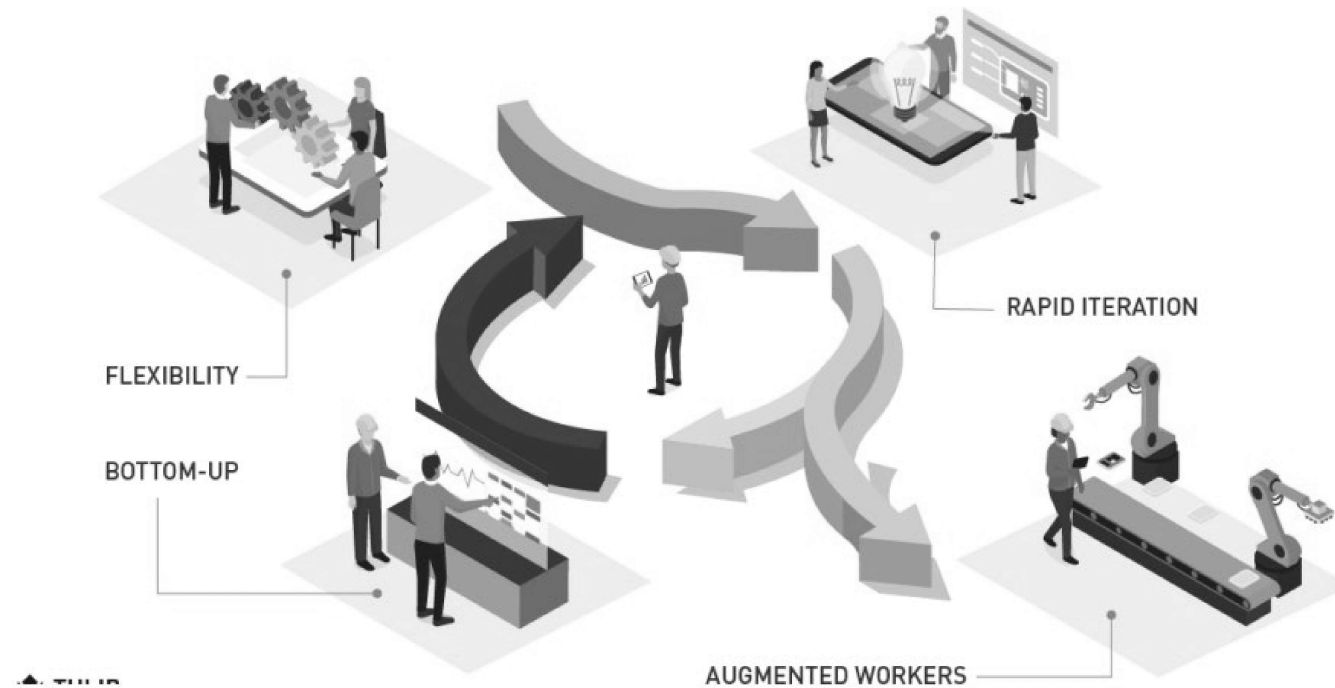
Skilled labor shortages as well as the constant need to reskill workers affect manufacturers.



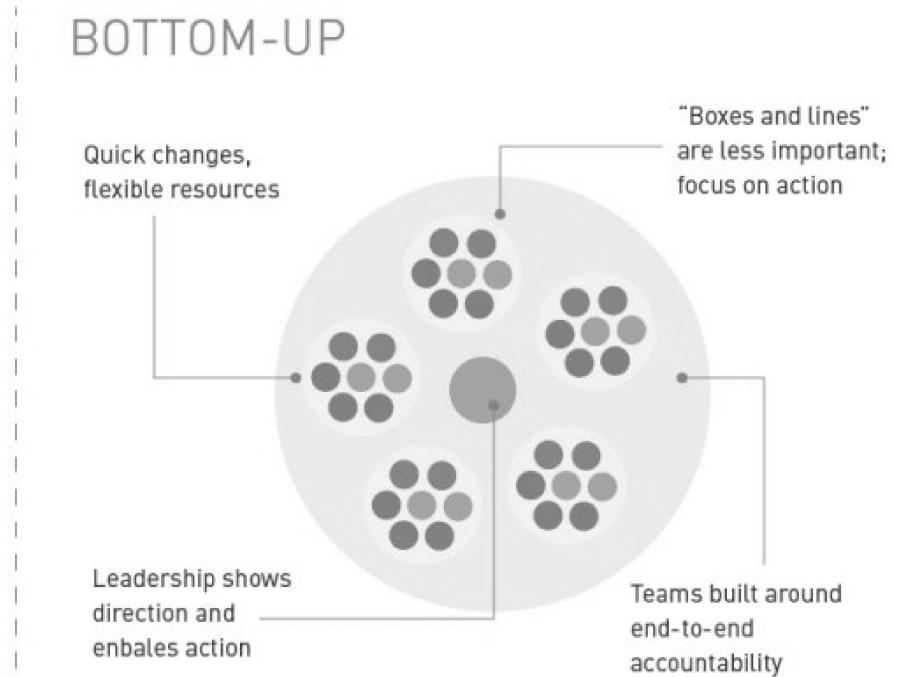
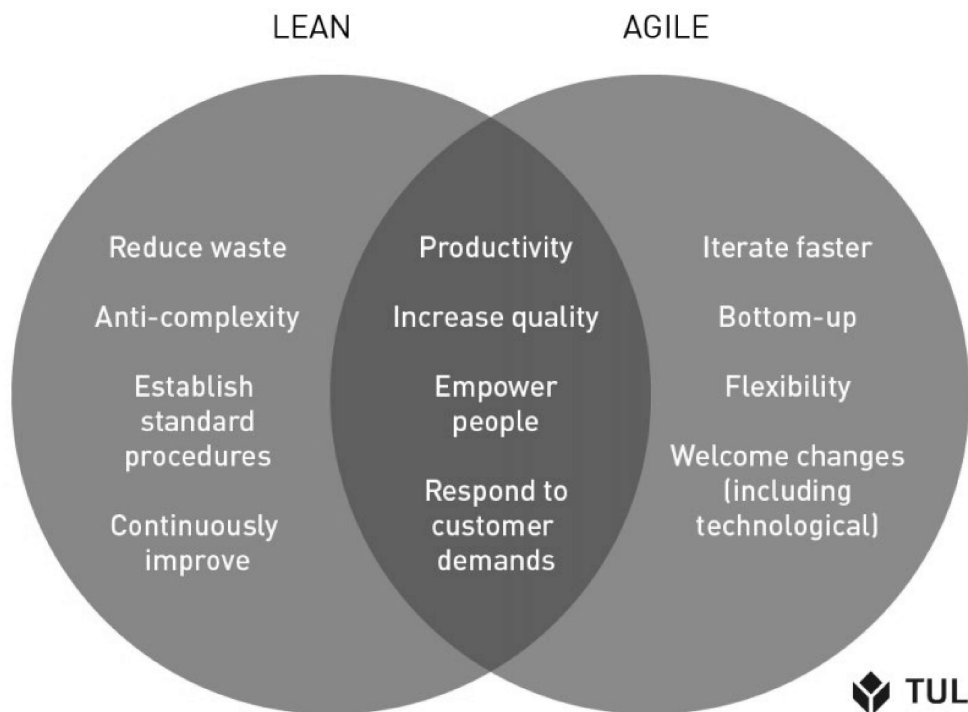
MORE ACCESS TO INFORMATION

Democratization of information requires more transparency.

The 4 core values of Agile Manufacturing



Agile Manufacturing Principles



Agile

Frequent
Value
Delivery

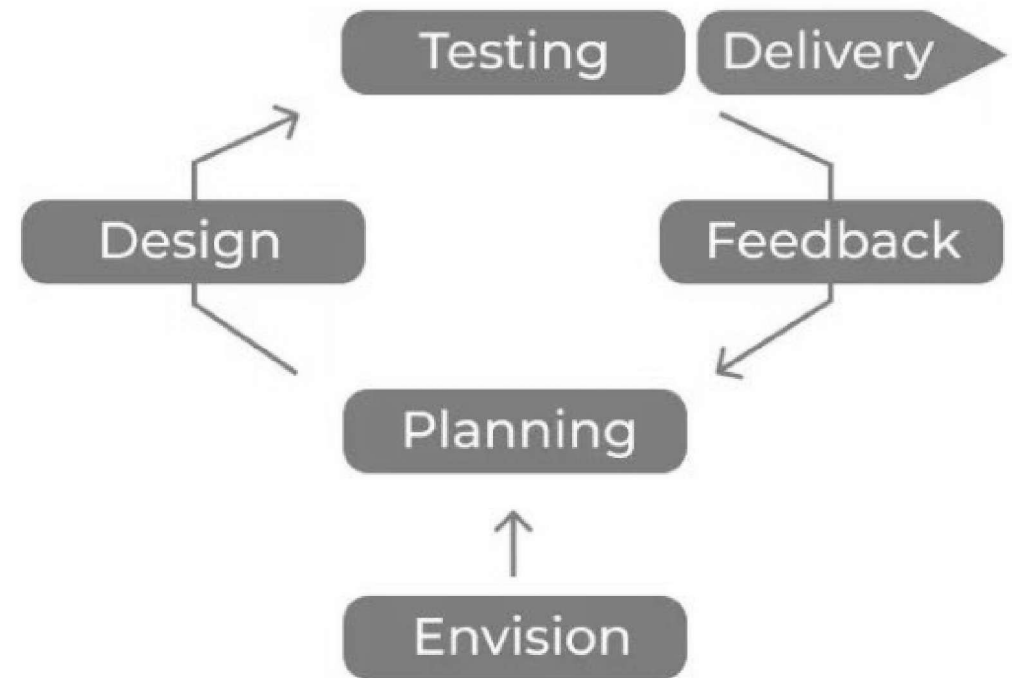
Adaptive to
Changes

Team
Collaboration

Customer
Collaboration



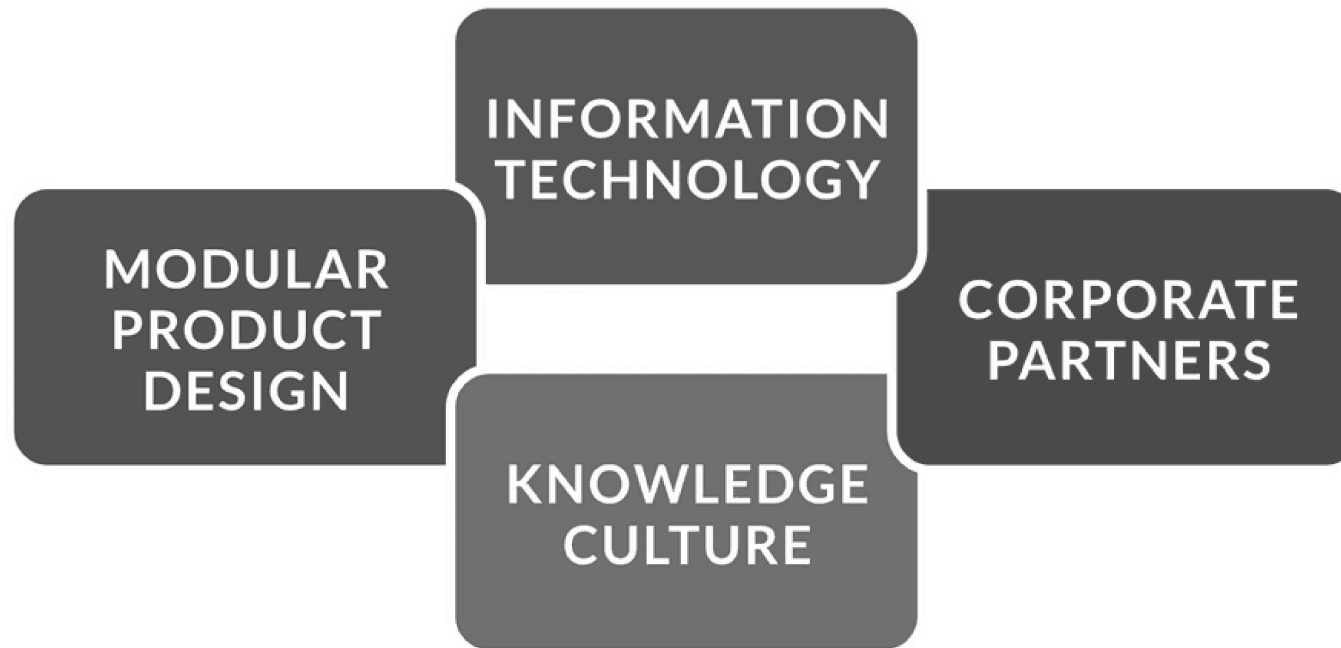
Traditional vs Agile Workflow

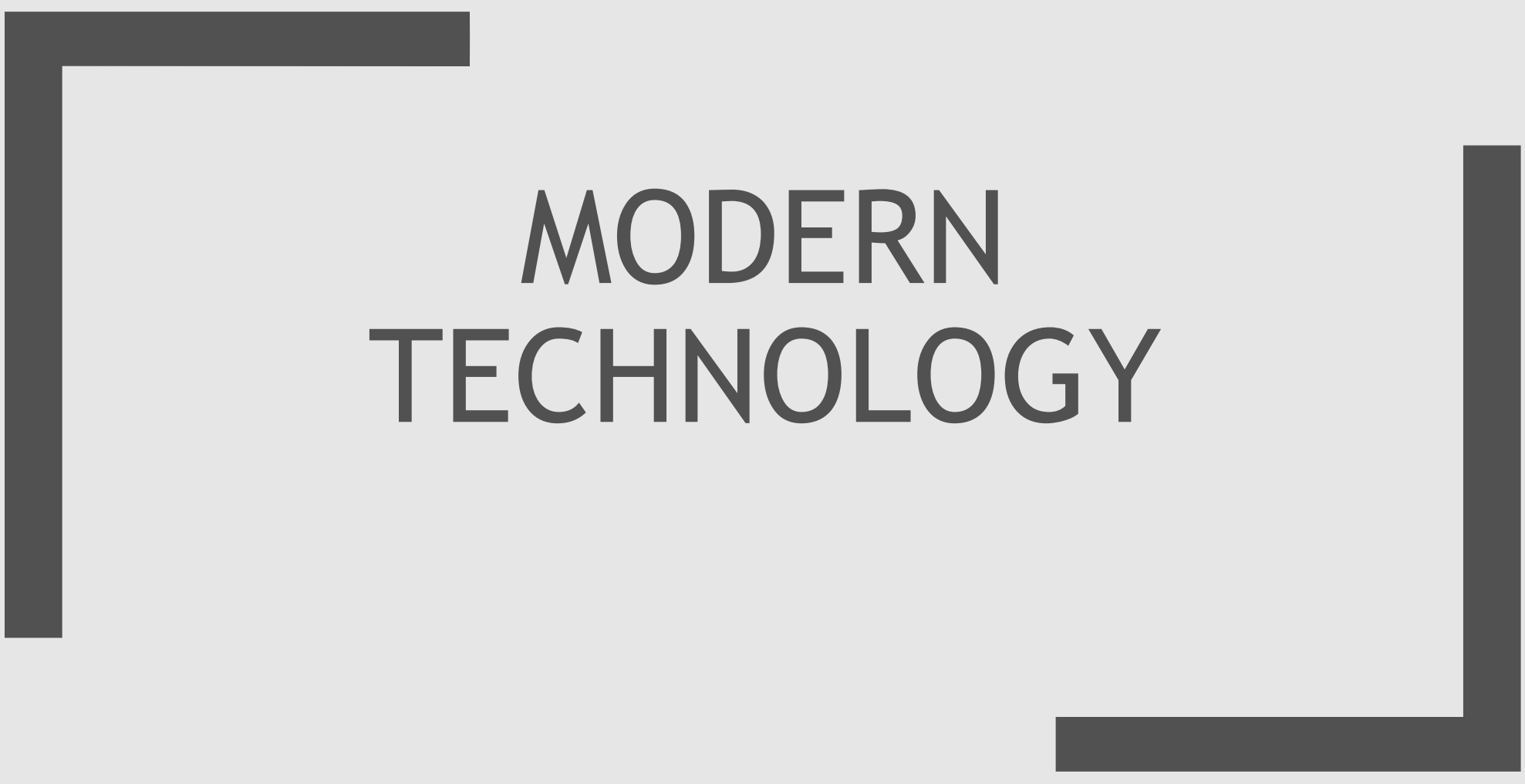


Difference between Agile and Waterfall



4 KEY AGILE MANUFACTURING ELEMENTS



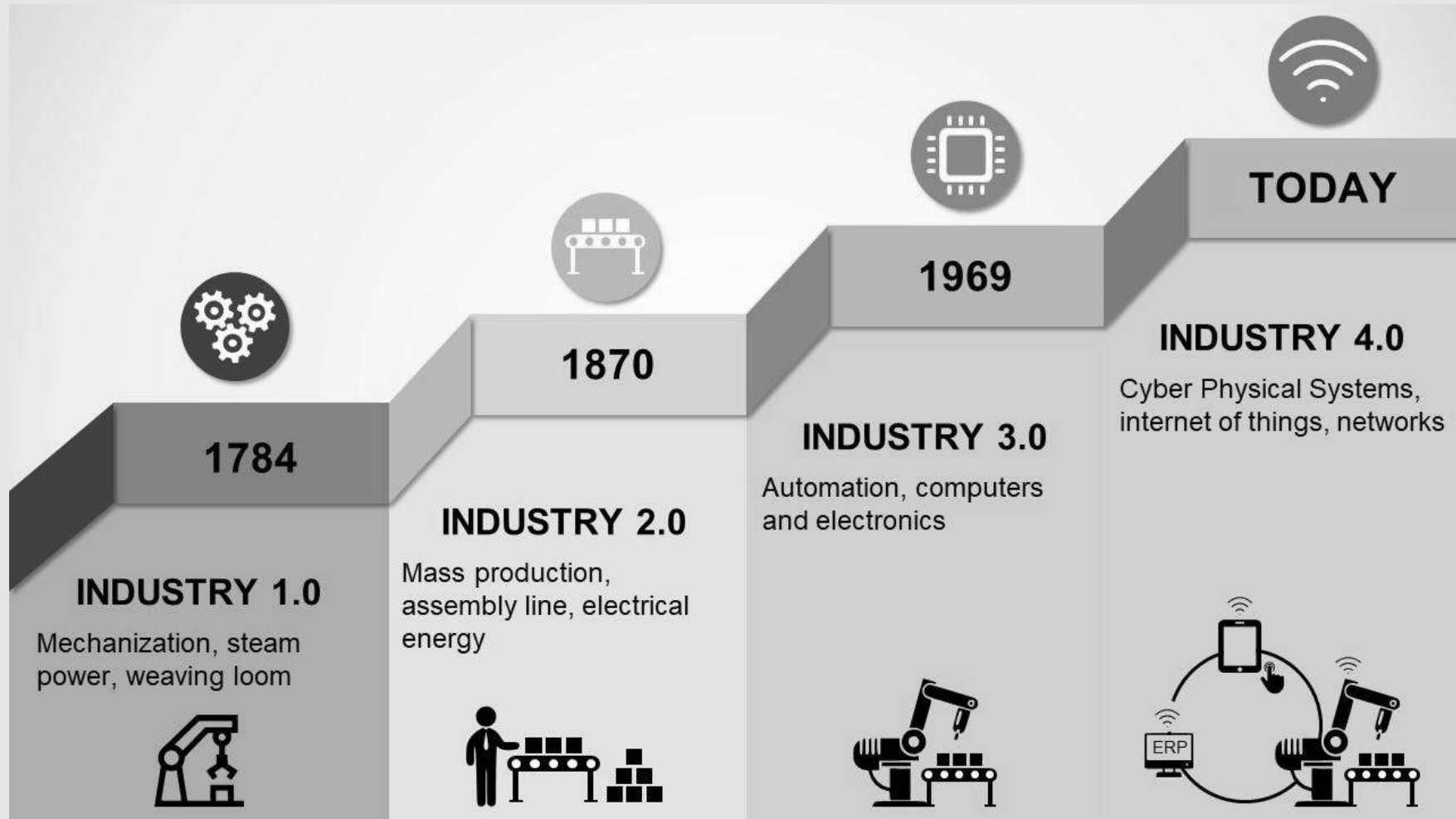
The graphic features the text 'MODERN TECHNOLOGY' in a bold, sans-serif font, centered on a light gray background. The text is flanked by two large, dark gray L-shaped brackets. The left bracket is positioned on the left side, with its vertical bar extending downwards and its horizontal bar extending to the right. The right bracket is positioned on the right side, with its vertical bar extending upwards and its horizontal bar extending to the left. The overall composition is minimalist and modern.

MODERN TECHNOLOGY

Introduction



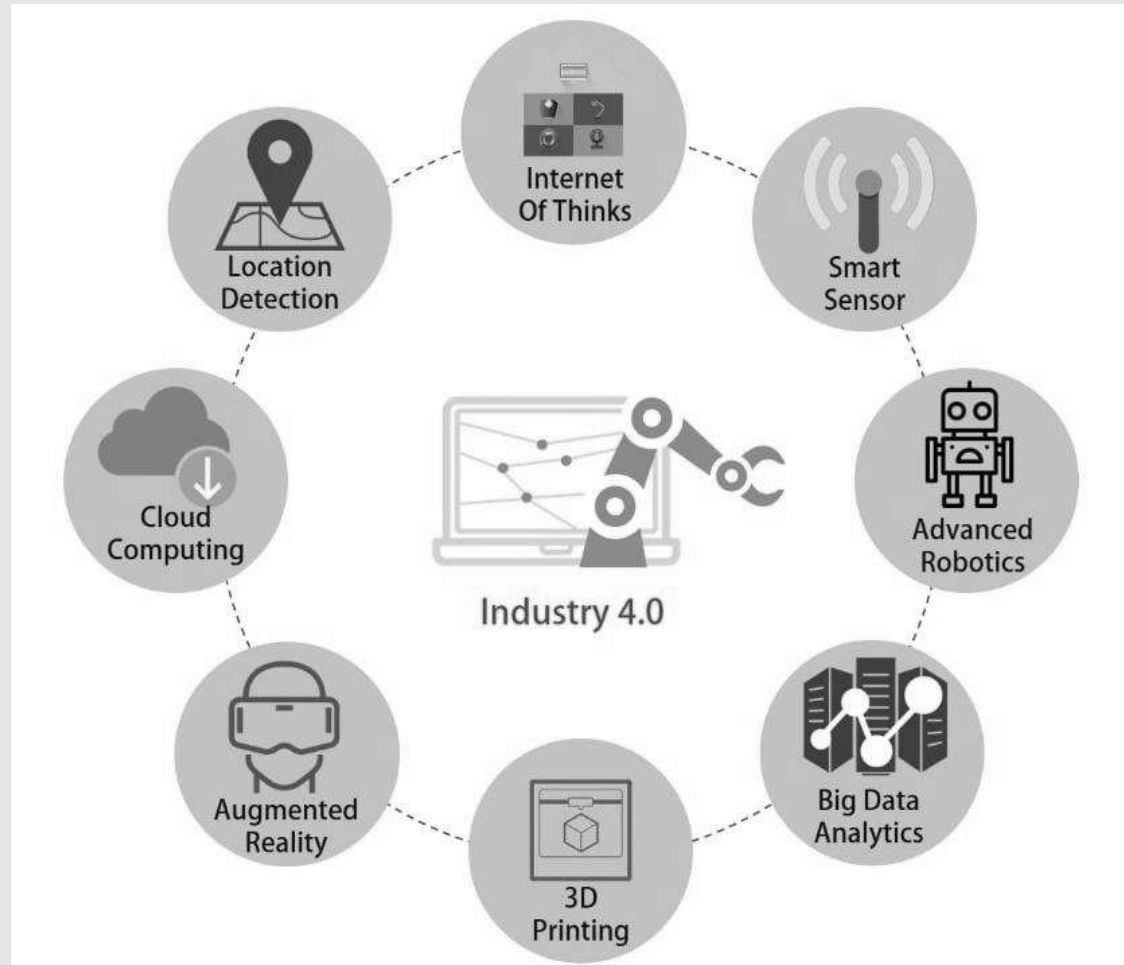
History



Contrast of Traditional vs Advanced Manufacturing

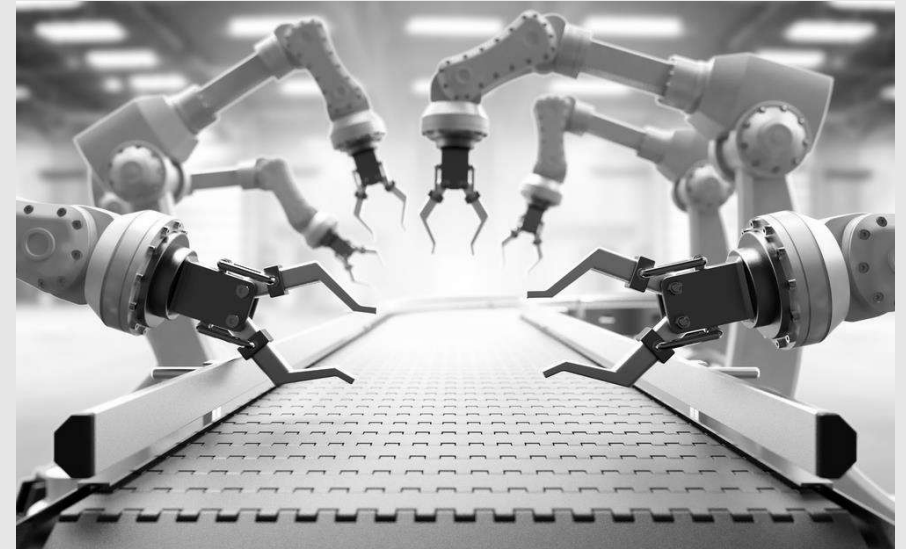
Traditional Manufacturing	Characteristics	Advanced Manufacturing
Mass Production	Production Strategy	Customization and customer-focused
Hierarchical	Organizational Structure	A flat, open flow of information
Abundant labor supply	Labor Supply Criteria	Skilled/technical labor available
Unskilled and semi-skilled	Skills Required	Semi-skilled and technical skills
On-the-job-training. High school/vocational school	Education	Technical degree from college/university
3 semi-skilled workers for every skilled worker	Labor Force	4 skilled workers for every semi-skilled worker
Casting, welding, molding, brazing, machining, etc.	Production Technology	Additive and rapid manufacturing: 3-D printing, powder bed, material deposition, etc.
Investment into production	R&D/Innovation	Re-invest revenues into R&D
Low-cost	Energy	Low-cost, highly dependable
Space	Infrastructure Requirements	IT/digital infrastructure
Highway and/or rail accessibility	Logistics	Global supply-chain management
Low crime	Quality of Life Criteria	Cultural amenities

Characteristics



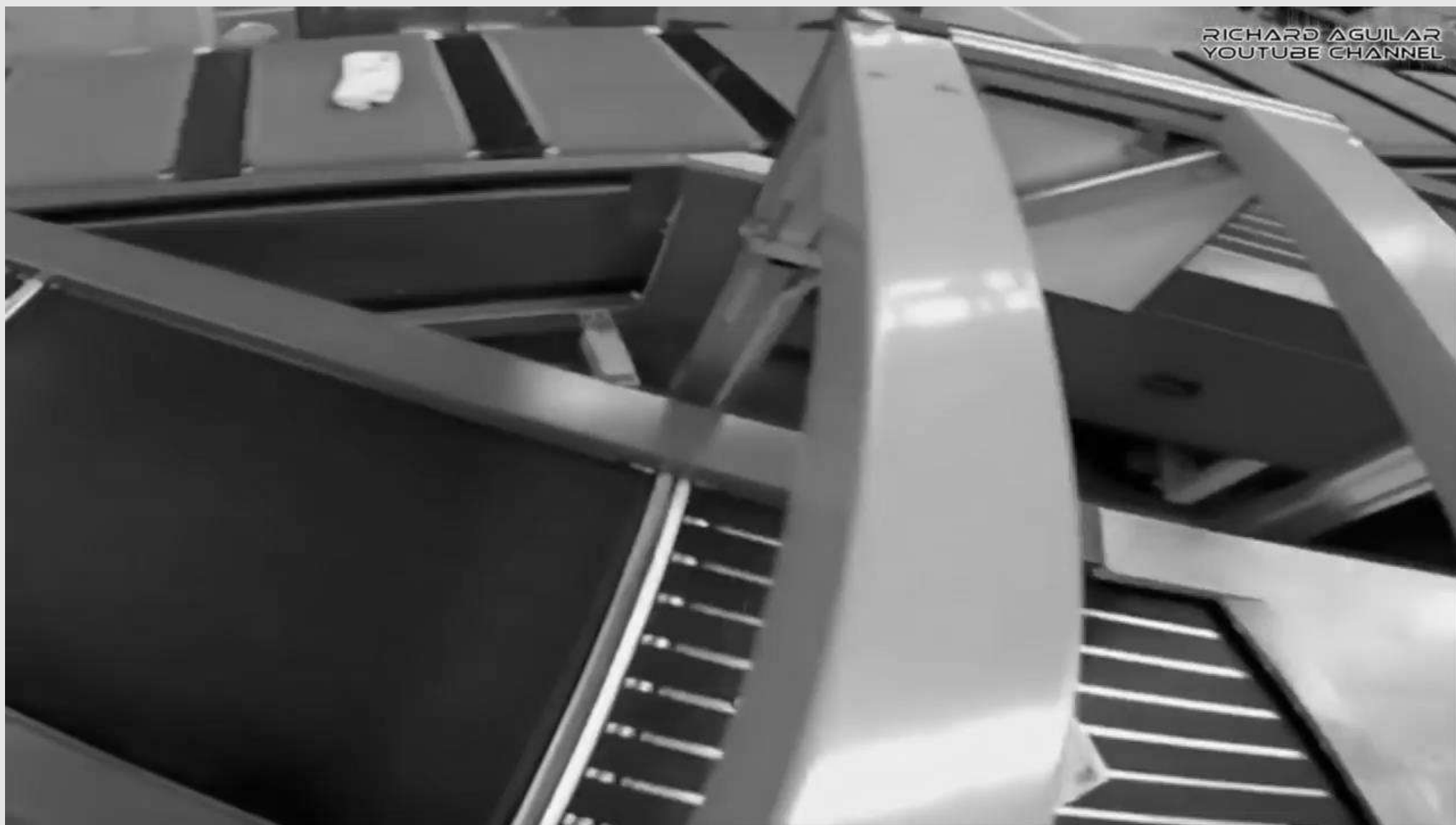
Robotics

With advances in robotics technology, robots are more likely to become cheaper, smarter, and more efficient. Robots can be used for numerous manufacturing roles and can help automate repetitive tasks, enhance accuracy, reduce errors, and help manufacturers focus on more productive areas.



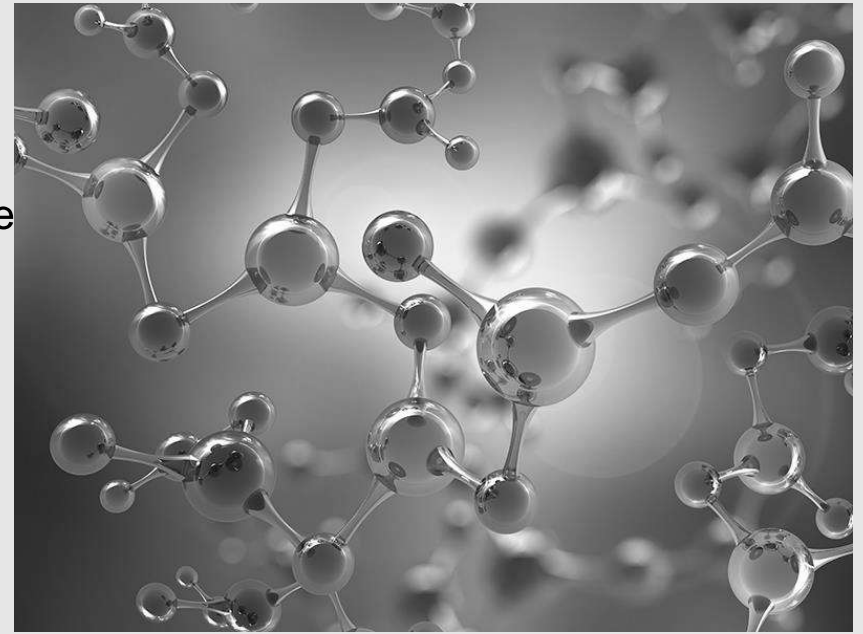
Benefits of Using Robotics in Manufacturing:

- ✓ They improve efficiency right from handling raw material to finished product packing
- ✓ You can program robots to work 24/7, which is excellent for continuous production
- ✓ Robots and their equipment are highly flexible and can be customized to perform complex jobs
- ✓ They are highly cost-effective even for small manufacturing units



Nanotechnology

Nanotechnology has grown to a great extent in the last few years. It involves the manipulation of nanoscopic materials and technology. Though its widespread use is relatively new, it will be indispensable to every manufacturing industry soon. Further research and experimental designs suggest that nanotechnology can be highly effective in the manufacturing industry



Applications of Nanotechnology in Manufacturing:

- ✓ Create stable and effective lubricants that are useful in many industrial applications
- ✓ Car manufacturing
- ✓ Tire manufacturers are using polymer nanocomposites in high-end tires to improve their durability and make them wear resistance
- ✓ Nanomachines, though not used widely in manufacturing now, are, for the most part, future-tech

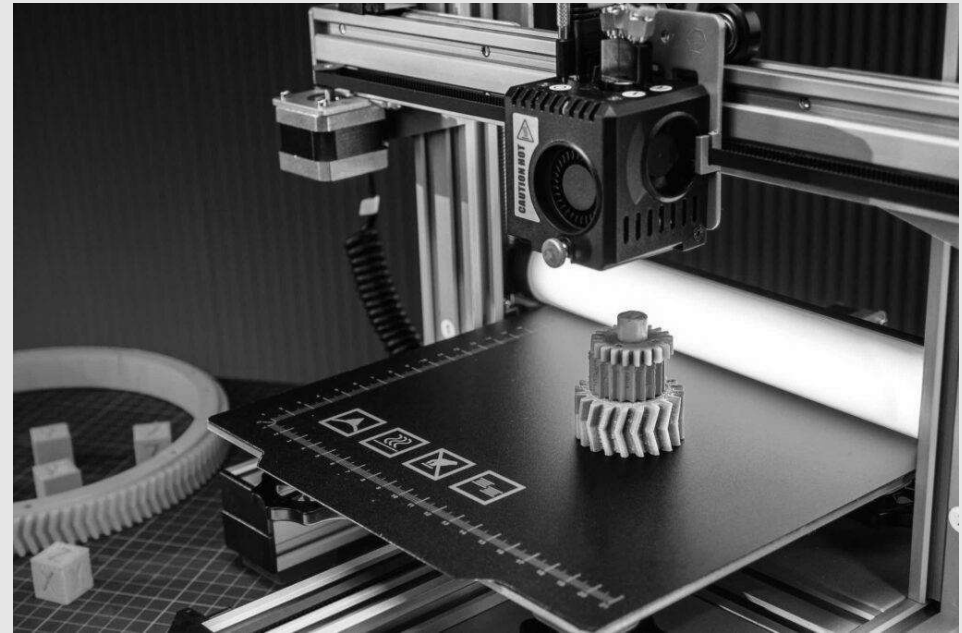


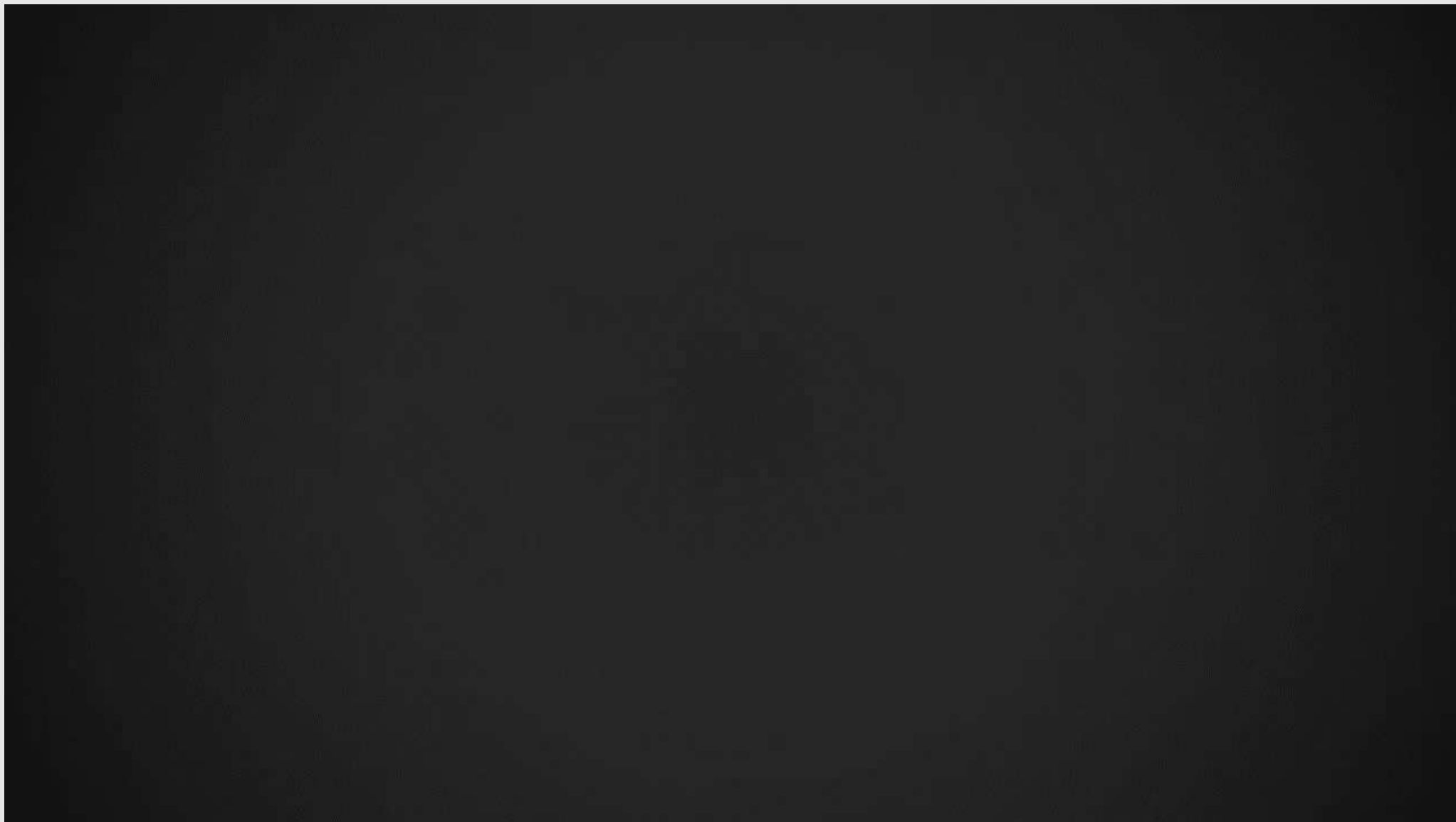
3D Printing

Post its tremendous success in the product design field, 3D printing is set to take the manufacturing world by storm. The 3D printing industry was worth USD 13.7 billion in 2019 and is projected to reach USD 63.46 billion by 2025. Also known as additive manufacturing, 3D Printing is a production technology that is innovative, faster, and agile

Benefits of Using 3D Printing in Manufacturing:

- ✓ Reduces design to production times significantly
- ✓ Offers greater flexibility in production
- ✓ Reduces manufacturing lead times drastically
- ✓ Simplifies production of individual and small-lot products from machine parts to prototypes
- ✓ Minimizes waste
- ✓ Highly cost-effective



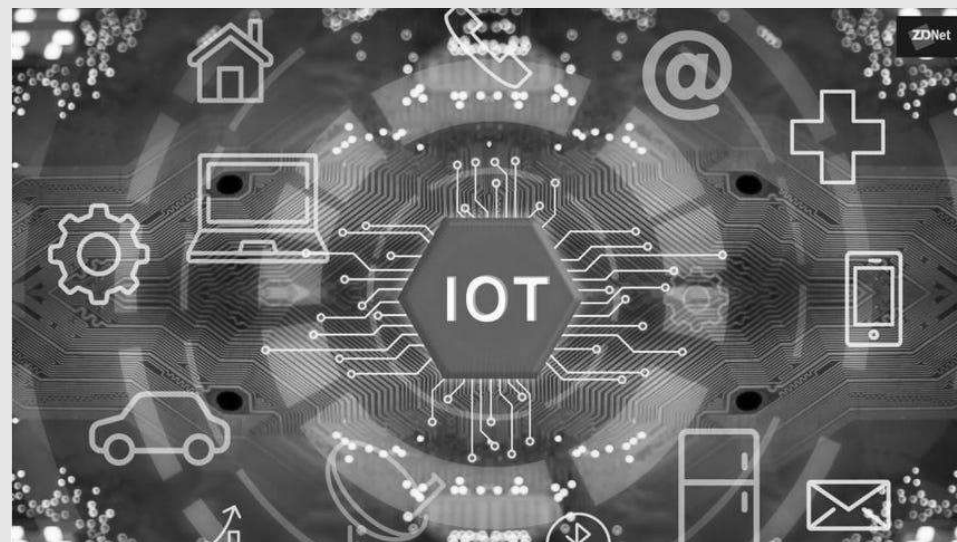


The Internet of Things (IoT)

IoT in manufacturing employs a network of sensors to collect essential production data and turn it into valuable insights that throw light into manufacturing operational efficiency using cloud software. This connectivity had brought machines and humans closer together than ever before and led to better communication, faster response times, and greater efficiency.

Benefits of Using IoT in Manufacturing:

- ✓ Internet of Things (IoT) reduces operational costs and creates new sources of revenue
- ✓ Faster and more efficient manufacturing and supply chain operations ensure a shorter time-to-market. For instance, Harley- Davidson leveraged IoT in its manufacturing facility and managed to reduce the time taken to produce a motorbike from 21 hours to six hours.
- ✓ IoT facilitates mass customization by providing real-time data essential for forecasting, shop floor scheduling, and routing.
- ✓ When paired with wearable devices, IoT allows monitoring workers' health and risky activities and making workplaces safer





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Cloud Computing

What is cloud computing? This is access to data on demand, and industries can store software and important information using the internet. With everything being online now, this is the most secure option for keeping track of all business-related operations.



The process for industries is more reliable than the average computer. Cloud computing saves money as there's no need to pay for servers, is easy to scale, offers competitor advantages, doesn't need to be updated as often, and is easy for the entire company to manage.

Overall, this helps to increase productivity and deliver products quickly. If you work in the networking space and are looking for better places to store data, here are some tools you should use as a Google cloud expert.



Big Data

The manufacturing industry is complicated in terms of the variety and depth of the product. As far as opening new factories in new locations and transferring production to other countries is concerned, companies can leverage big data to tackle it.

As the process of capturing and storing data is changing, new standards in sharing, updating, transferring, searching, querying, visualizing, and information privacy are arising. Think of manufacturing software like MES, ERP, CMMS, manufacturing analytics, etc. When integrated with big data, these can help find patterns and solve any problems.



Benefits of Using Big Data:

- ✓ Improve manufacturing
- ✓ Ensure better quality assurance
- ✓ Customize product design
- ✓ Manage supply chain
- ✓ Identify any potential risk



Augmented Reality

AR allows you to see the real world and the virtual one simultaneously, but how does this help the manufacturing industry in terms of productivity?

With augmented reality, factory workers can be trained easily using workplace equipment, and employees can mentor others remotely in real-time.

This is great for people who work from home.

What other types of remote assistance can come into play?

For example, markers or text annotations, technology can be maintained using a screen, and products can be developed by using 3D models.

Imagine how much the industrial manufacturing industry can benefit from this technology. If you'd like to experience this firsthand in the comfort of your home, try out some iPhone apps to redesign your home using augmented reality.





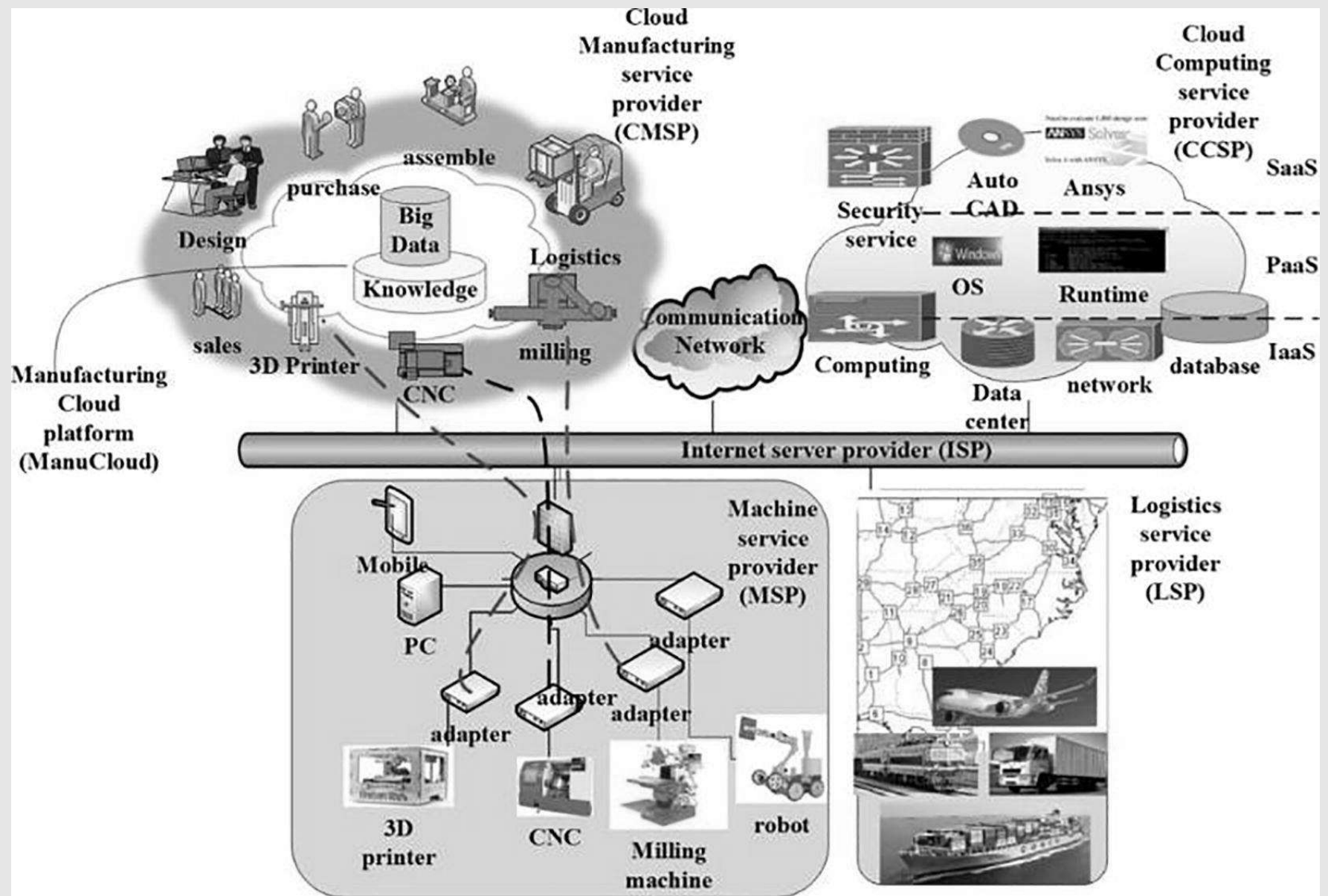
5G

5G is not only used for connecting our phones to a powerful internet source, but the manufacturing spaces use this too. Since it can monitor in real-time, 5G improves connectivity in the workplace as well as the collection of useful data.

5G assists with automation of tasks with sensors, remote monitoring of production, maintenance of machines, augmented reality troubleshooting, fast 3D printing, automated portable robots or those who pack and unpack, camera-based analytics, location of inventory, and so much more. 5G is very much a step forward in revolutionary for the manufacturing industry, as it keeps a large portion of things running smoothly.









Thank you for your attention!