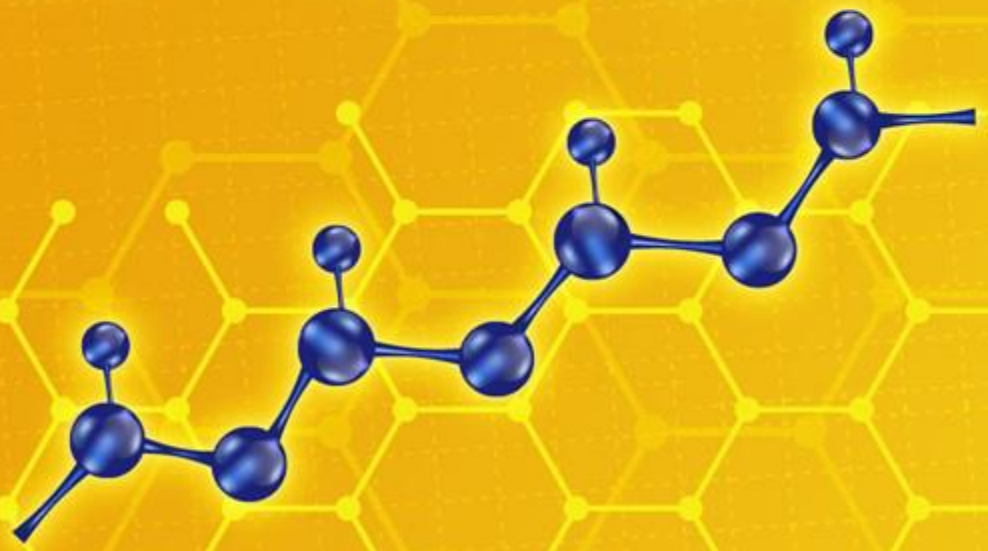
انجمن ملی صنایع پلیمر ایران

IRAN NATIONAL POLYMER INDUSTRIES ASSOCIATION

چهارمین همایش ملی

اقتصاد صنایع پلاستیک در ایران ۱۴۰۲



۳۱ خرداد الی ۱ تیر ۱۴۰۲

انجمن ملی صنایع پلیمر ایران

موضوع:

Digitalization and Innovative Technologies in Polymer Industry

Milad Mehranpour

۳۱ خرداد الی ۱ تیر ۱۴۰۲


Industry 1
>Revolution>
Industry 4.0

Key Challenges in the Polymer Manufacturing Industry

- Quality control and process optimization
- Supply chain management
- Energy efficiency and sustainability
- Maintenance and asset management
- Customization and flexibility

Industry 4.0 and its Relevance to Polymer Manufacturing

Industry 4.0 is based on four core principles:

- Interconnectivity
- Data Transparency
- Decentralized Decision-Making
- Automation

What is Digitalization?

- Digitalization refers to the process of adopting digital technologies and integrating them into various aspects of an organization's operations, processes, and services.

Benefits of Digitalization and Industry 4.0 in Polymer Manufacturing

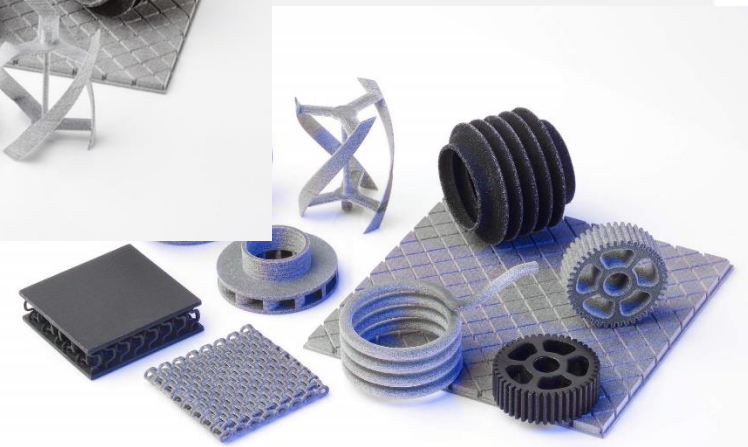
- Increased efficiency
- Improved quality
- Reduced costs
- Increased innovation
- Better customer service

Innovative Technologies in Polymer Manufacturing

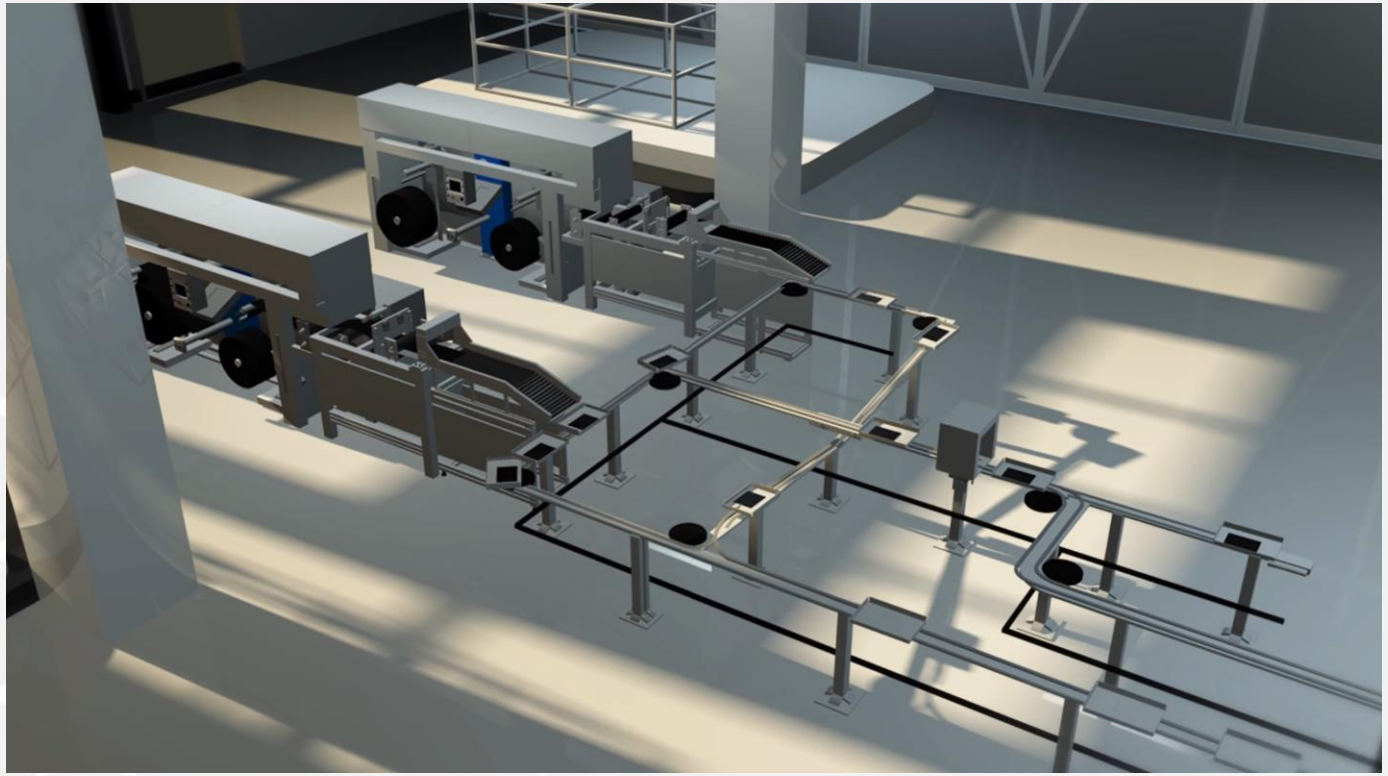
- Additive manufacturing
- Advanced robotics
- The Internet of Things (IoT)
- Artificial Intelligence (AI) and machine learning

Applications of Additive Manufacturing in Polymer Industry

- Rapid prototyping
- Tooling
- Customized products
- Complex geometries



Digital Composites Manufacturing system



Advanced Robotics and Automation in Polymer Manufacturing

- Autonomous Robots vs. Automation

What is Industrial IoT?

- Industrial IoT (IIoT) is the use of internet-connected devices, sensors, and software to collect and analyze data in industrial settings. This data can be used to improve efficiency, productivity, and safety in manufacturing and other industrial processes.
- IIoT has grown rapidly in recent years. The global IIoT market is expected to reach $152.8 billion by 2025.
- The polymer industry is one of the most promising areas for IIoT adoption.

Top industrial IoT use cases

Predictive maintenance

Location tracking

Workplace analytics

Remote quality monitoring

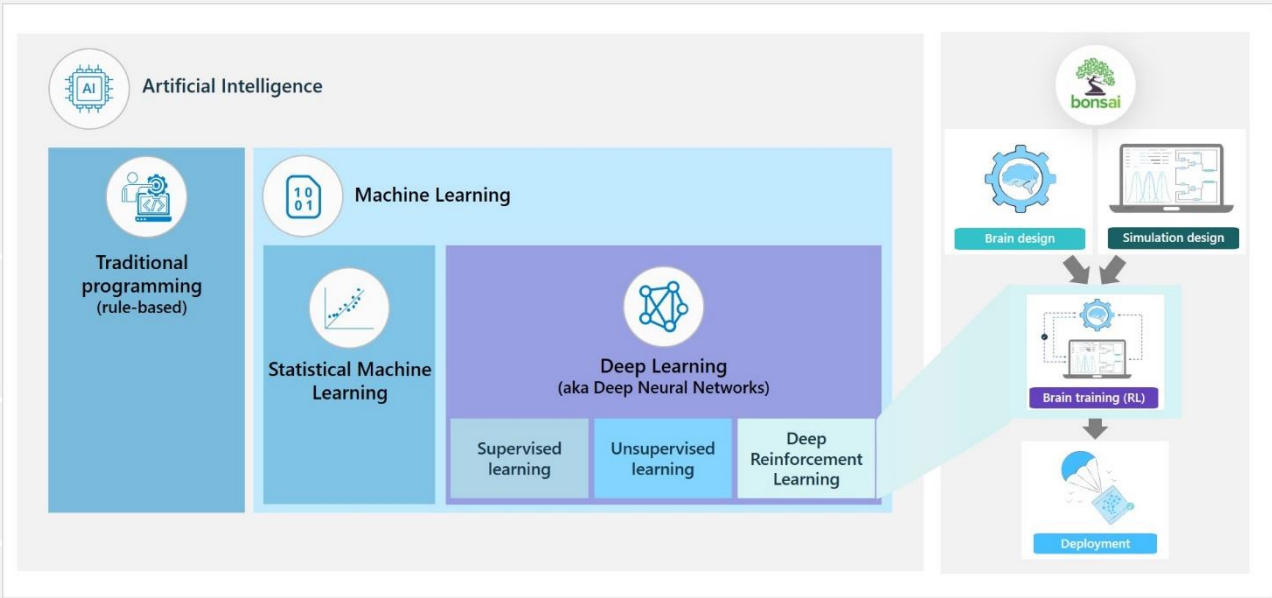
Energy optimization

AI and Machine Learning in Polymer Manufacturing

- Artificial intelligence (AI) and machine learning (ML) are rapidly transforming the polymer manufacturing industry. These technologies are being used to improve efficiency, productivity, and product quality in a variety of ways.
  - Process optimization
  - Product design
  - Quality control

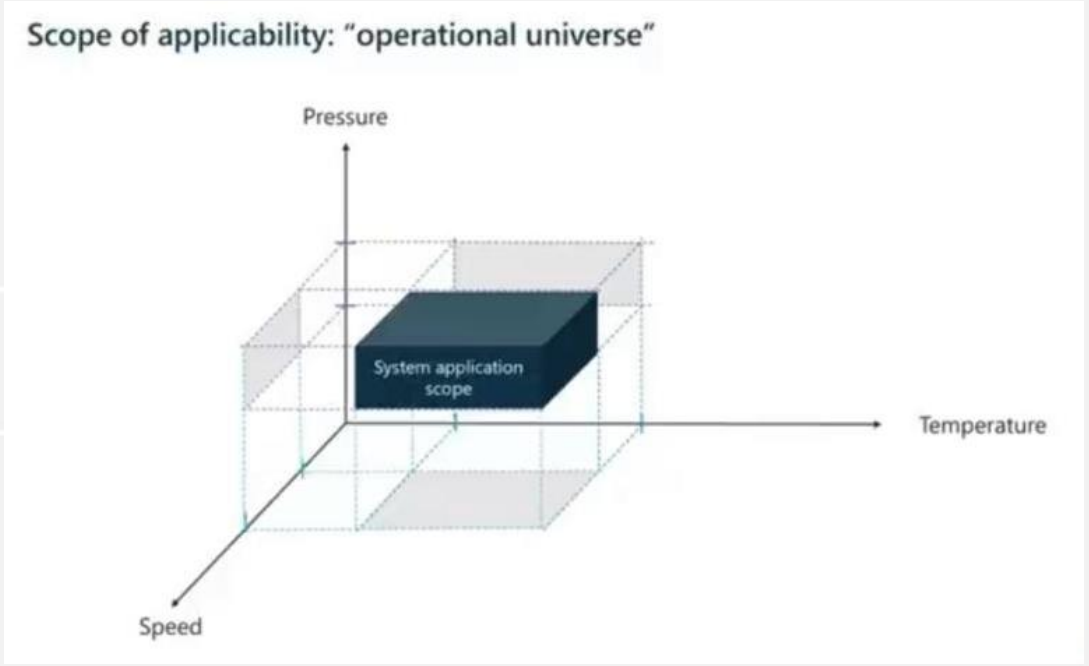
Microsoft Bonsai

bonsai



How is IIoT being used in the polymer industry?

- IIoT is being used to monitor the temperature and pressure of polymer reactors and extruders, to track the movement of materials through production lines, and to identify defects in finished products.
- This data can be used to optimize production processes, prevent equipment failures, and improve product quality.

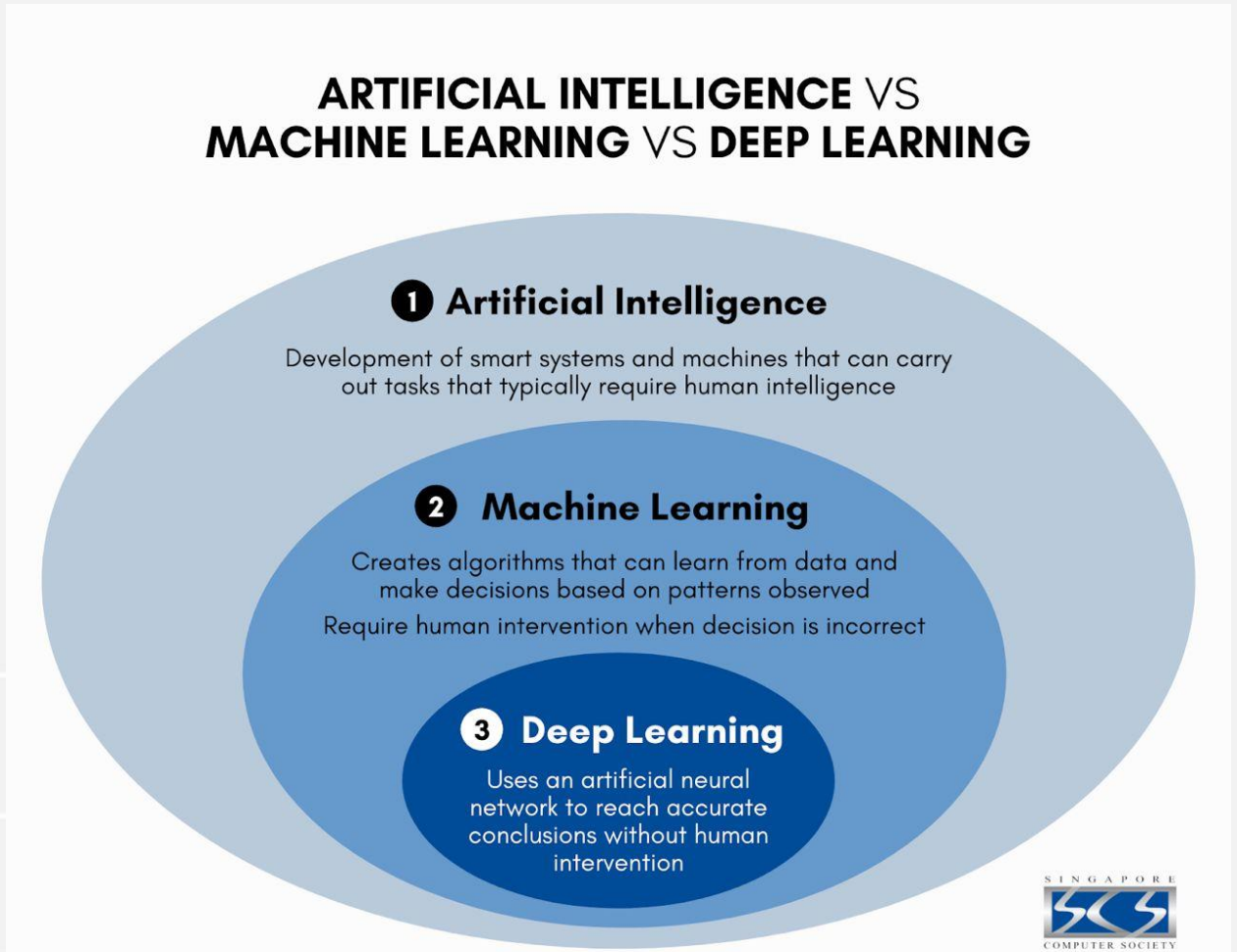


Deep reinforcement learning: Simulations

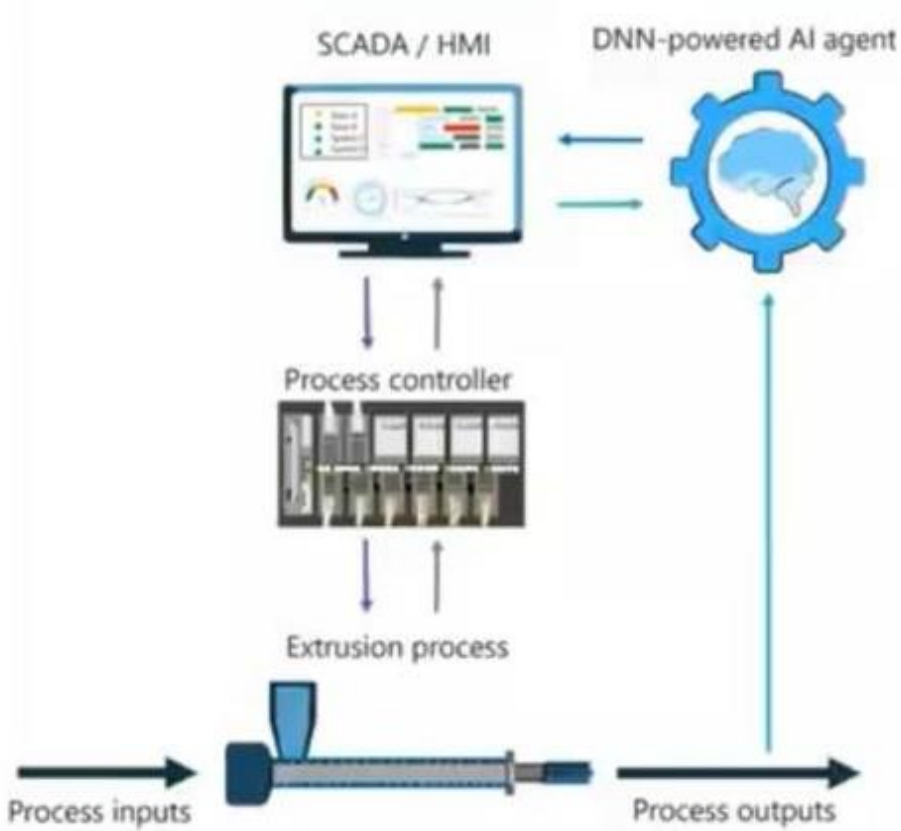
Physics based

Software package

AI based


ARTIFICIAL INTELLIGENCE VS
MACHINE LEARNING VS DEEP LEARNING
1 Artificial Intelligence
Development of smart systems and machines that can carry out tasks that typically require human intelligence
2 Machine Learning
Creates algorithms that can learn from data and make decisions based on patterns observed
Require human intervention when decision is incorrect
3 Deep Learning
Uses an artificial neural network to reach accurate conclusions without human intervention
SINGAPORE COMPUTER SOCIETY

Close loop manufacturing: Through SCADA/HMI



AI agent-driven close loop

- Operator monitors SCADA
- AI-agent directly controls the controller

Operator driven close loop

- AI-agent display advice on HMI
- Operator decides what to execute

Connectivity in Polymer Manufacturing

- Edge computing
- ERP and MES
- MIS & Data driven decision making
- Real-time monitoring, predictive maintenance, and supply chain optimization

ERP

MES

AUTOMATION PLC

Enterprise Layer

Master data — SAP PROD P01

Inventory data — Warh PROD P01

Production data — ERP PROD P01

Quality data — LIMS PROD P01

AVEVA Enterprise Integration

AVEVA MES

Inventory	Production	Quality	Traceability	Performance
Received, WIP, Produced/Shipped	Order Execution & Agility / Flexibility	BOM / Recipe Sampling / SPC Compliance	Materials, WIP Tracking & Tracing	OEE & Utilization

Automation Layer

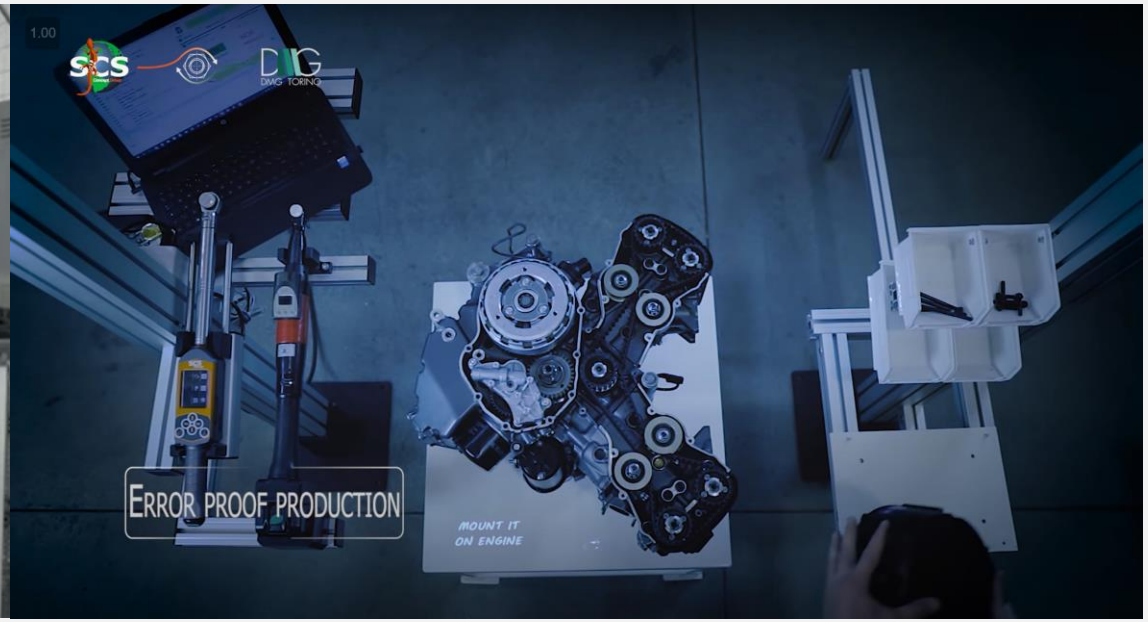
AVEVA System Platform

Receive → Make → Pack → Store / Ship

Logistic with digital twin

Extended Reality

Complex Assemblies



Industrial Meta versse

Case Studies

Dow Chemical

- The company has been using IIoT to improve its polymer manufacturing operations for several years.
- In one project, Dow Chemical used IIoT to monitor the performance of its polymer reactors.
- Installed sensors on the reactors to collect data on temperature, pressure, and other parameters.
- Using a cloud-based analytics platform, where it was analyzed to identify potential problems.
- Reduced the number of unplanned outages by 20%.
- Improved the quality of its products by 15%.
- Reduced its costs by 10%.

BASF

- The company has been using IIoT to improve its polymer manufacturing operations since 2015.
- BASF used IIoT to track the movement of materials through its production lines. l times.
- Improved efficiency of its production lines by 15%.
- Reduced the amount of waste generated by 10%.
- Increased customer satisfaction by 5%.

BASF
We create chemistry

SABIC

- The company has been using AI and machine learning to improve its polymer manufacturing operations since 2016.
- AI and machine learning have been used to improve production planning by optimizing the use of resources and ensuring that production is aligned with demand.
- Quality control & Supply chain management
- Improved the efficiency of its polymer manufacturing operations by 15%.

RTP Company

- RTP Company has been using AI and machine learning to improve its polymer manufacturing operations since 2018.
- Product design, Process optimization and Quality control
- improved the efficiency of its polymer manufacturing operations by 20%.

PolyOne Corporation

- PolyOne has been using AI and machine learning to improve its polymer manufacturing operations since 2019.
- Sales and marketing, Customer service and Supply chain management
- Improve the efficiency of its polymer manufacturing operations by 15%.

Polypipe

- Polypipe company has been using AI and machine learning to improve its polymer manufacturing operations since 2018.
- Product design, Process optimization and Quality control
- Improved the efficiency of its polymer manufacturing operations by 20%.

Continental

- Continental has integrated AI and machine learning technologies with its ERP software
- Developed predictive maintenance models and optimized its production schedules and identified opportunities to reduce waste.
- reduced unplanned downtime by 50%
- increase its production output by 10%

Continental
The Future in Motion

Bosch

- Integrated AI and machine learning technologies with its ERP software.
- The company has used AI to develop quality control systems that can automatically detect defects in its polymer products.
- Bosch has also used machine learning to improve its inventory management and to optimize its supply chain.
- Reduced the number of defects in its polymer products by 20%
- Reduce its inventory costs by 15%

Denso

- Denso has also integrated AI and machine learning technologies with its ERP software.
- The company has used AI to develop predictive maintenance models
- Denso has also used machine learning to optimize its production schedules and to identify opportunities to reduce waste.
- Reduced its energy consumption by 10%
- increased its productivity by 5%

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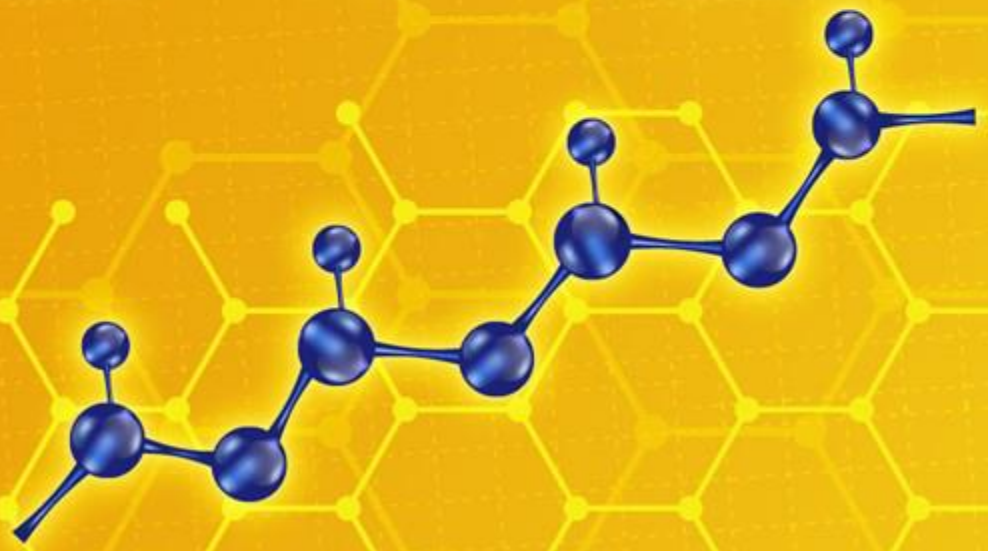

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