Selection of Technological Structures

Course: Production Management and Logistic Systems [10592713]

Economia e management (Latina Campus)

AA 2024-2025 | Prof. Alessandro Pietrogiacomi

SAPIENZA
UNIVERSITÀ DI ROMA

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Lesson Plan for Tuesday, March 18

Overview of the lesson, and educational objectives,

Topic: Selection of Technological Structures
Time: 10:00–13:00
Duration: 3 hours

Learning Objectives

By the end of this lesson, students will be able to:

- Understand the criteria for selecting production technologies.
- Evaluate the role of automation in modern production systems.
- Explain the key concepts and benefits of Industry 4.0.
- Apply knowledge to real-world scenarios involving technology selection.

Lesson Outline

1. Introduction (15 minutes)
2. Criteria for Selecting Production Technologies (45 minutes)
3. Automation in Production (45 minutes)
4. Industry 4.0 (45 minutes)
5. Recap, Q&A and Homework Assignment (15 minutes)

Introduction

- Welcome back, let’s recap the previous session
- Welcome students and recap the previous session (Production Planning).

Criteria for Selecting Production Technologies

- **Cost:**
  - Initial investment vs. long-term savings.
  - Maintenance and operational costs.
- **Flexibility:**
  - Ability to adapt to changes in product design or demand.
  - Multi-purpose vs. single-purpose technologies.
- **Scalability:**
  - Capacity to handle increased production volumes.
  - Modular systems that can be expanded as needed.
- **Quality:**
  - Precision and consistency of the technology.
  - Impact on product quality and defect rates.
- **Sustainability:**
  - Energy efficiency and environmental impact.
  - Use of eco-friendly materials and processes.
- **Integration:**
  - Compatibility with existing systems and processes.
  - Ease of integration into the production line.

Activity

Case Study Analysis: Robotic Welding Systems vs. Manual Welding

Task: Identify the benefits and challenges of automation in the case study.

Automation in Production

- **Definition**: The use of technology to perform tasks with minimal human intervention.
- **Benefits**:
  - Increased efficiency and productivity.
  - Improved consistency and quality.
  - Reduced labor costs and human error.
- **Types of Automation**
  - **Fixed Automation**:
    - Designed for high-volume production of a single product.
    - Example: Assembly lines in the automotive industry.
  - **Programmable Automation**:
    - Suitable for batch production of different products.
    - Example: CNC machines.
  - **Flexible Automation**:
    - Allows for quick changes in production tasks.
    - Example: Robotic arms in electronics manufacturing.
- **Challenges of Automation**
  - High initial investment.
  - Need for skilled personnel to operate and maintain automated systems.
  - Potential job displacement.

Activity

Case Study Analysis: Amazon’s use of robots in warehouses

Task: Identify the benefits and challenges of automation in the case study.

Key Concepts of Industry 4.0

Definition: The fourth industrial revolution, characterized by the integration of digital technologies into production.

Key Technologies:

- Internet of Things (IoT): Connecting machines and devices for real-time data exchange.
- Artificial Intelligence (AI): Using machine learning for predictive maintenance and quality control.
- Big Data Analytics: Analyzing large datasets to optimize production processes.
- Cyber-Physical Systems: Integrating physical machines with digital systems.

Benefits of Industry 4.0

- **Enhanced Efficiency**: Real-time monitoring and optimization of production processes.
- **Improved Flexibility**: Rapid adaptation to changes in demand or product design.
- **Predictive Maintenance**: Reducing downtime by predicting equipment failures.
- **Customization**: Enabling mass customization of products.

Challenges of Industry 4.0

- **High implementation costs.**
- **Cybersecurity risks.**
- **Need for skilled workforce.**

Activity:

Discuss a scenario: Adopting Industry 4.0 Technologies at SmartFab Manufacturing

Recap and Homework Assignment

A. Recap of Key Points

- Criteria for selecting production technologies.
- Benefits and challenges of automation.
- Key concepts and benefits of Industry 4.0.

B. Homework Assignment

- **Task**: Research a company that has successfully implemented Industry 4.0 technologies.
- **Deliverable**: Write a 1-page report describing the technologies used, their impact on production, and the challenges faced during implementation.