Part II
Methods Engineering & Layout Planning

Chapters:
8. Introduction to Methods Engineering and Operations Analysis
9. Charting and Diagramming Techniques for Operations Analysis
10. Motion Study and Work Design

Introduction to Methods Engineering and Operations Analysis

Chapter 8

Sections:
1. Introduction
2. Evolution and Scope of Methods Engineering
3. How to Apply Methods Engineering
   - Systemic Approach in Methods Engineering
   - The Techniques of Methods Engineering
Work Study OR Methods Engineering

- Analysis and design of work methods and systems, including the
  - tooling,
  - equipment,
  - technologies,
  - workplace layout,
  - plant layout, and
  - work environment

Methods Engineering Definition

- Other names for methods engineering:
  - Work study
  - Work simplification
  - Methods study
Main Objectives in Methods Engineering and Work Study

- Increase productivity and efficiency
- Reduce cycle time
- Reduce product cost
- Reduce labor content
- Improve worker safety

Operations Analysis

- Operations Analysis is study of an operation or group of related operations for the purpose of analyzing their efficiency and effectiveness so that improvements can be developed

- Objectives of operations analysis are same as in methods engineering and work study

- Methods engineering places more emphasis on design. It is broader than operations analysis.
Methods Engineering OR Work Study

Can be divided into two areas:
1. Methods analysis
2. Methods design

Methods Analysis

- Concerned with the study of an existing method or process
  - Break the method (process) down into work elements or basic operations
  - Examine the details of the elements: a systematic (methodical) search to improve the process
  - This involved checklists of questions and suggestions for improvements
Methods Analysis (Cont.)

- **Objectives:**
  - **Eliminate** unnecessary and *non-value-adding* work elements
  - **Combine** elements and operations
  - **Rearrange** elements into more logical sequence
  - **Simplify** remaining elements and operations

Methods Design

Concerned with either of the following situations:

1. **Design of a new method or process**
   - Required for new product or service and there is no existing precedent
   - Method must be designed from scratch, using best existing practice for similar operations

2. **Redesign of an existing method or process based on a preceding methods analysis**
   - **Break the method (process) down into work elements or basic operations**
   - **Examine the details of the elements:** a systematic (methodical) search to improve the process
   - This involved **checklists** of questions and suggestions for improvements
How to Apply Methods Engineering

- **Systematic Approach**
  1. Define the problem and objectives
  2. Analyze the problem
  3. Formulate alternatives
  4. Evaluate alternatives and select the best solution
  5. Implement the best method
  6. Audit the study

  - A systematic approach is more likely to yield operational improvements than an undisciplined approach

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**Step 1: Define the problem and objectives**

- **Problem:**
  - low productivity, high cost, inefficient methods, the need for a new method/operation

- **Objective:**
  - Increase productivity, reduce labor content, improve safety, develop a new method

- The problem definition and the objectives must be specific to the problem under investigation.
Step 2: Analyze the problem

- Data collection and analysis.
- Kind of activities involved
  - Identify the basic function of the operation
  - Gather background information
  - Observe existing/similar processes
  - Collect data
  - Construct experiments on the process
  - Develop/utilize a mathematical model of the process
  - Perform a computer simulation of the process
  - Use charting techniques

Step 3: Formulate Alternatives

- There are multiple ways to perform a task or accomplish a process.
- Some of them are more efficient and effective than others
- Formulate all feasible alternatives
Step 4: Evaluate alternatives and select the best

- Methodical assessment of the alternatives with respect to the original problem definition and the objectives.

- Selecting the best one with respect to the objective (but this is not a simple task)

Step 5: Implement the best method

- Install the selected solution
  - Introduce changes proposed in the existing method
  - Pilot studies and trials of the new (revised) method
  - Documentation of the revised method
Step 6: Audit the study

- Continuous improvement (follow-ups)
  - How successful was the project in terms of the original problem definition and the objectives?
  - What were the implementation issues?
  - What should be done differently in the next study?

Techniques of Methods Engineering

- The following techniques are mostly associated with the analysis step in the methods engineering:
  - Charting and diagramming techniques
  - Motion study and work design
  - Facility layout planning
  - Work measurement techniques
  - New approaches
Charting & Diagramming Techniques

- Network diagrams
- **Traditional industrial engineering charting techniques**
  - Operation charts
  - Process charts
  - Activity charts
  - Flow diagrams
- Block diagrams and process maps

Motion Study and Work Design

- Concerned with **basic motions of a human worker** while performing a given task
- **Examples of basic motion elements:**
  - Reach
  - Grasp
  - Move
  - Release
- Guidelines for work design include “**principles of motion economy**”
Facility Layout Planning

- Facility layout refers to:
  - Size and shape of a facility
  - Arrangement of the different departments and equipment within the facility
- Problem area includes:
  - Design of a new facility
  - Installing new equipment, retiring old equipment
  - Expanding (or contracting) an existing facility

Work Measurement Techniques

- **Four basic work measurement techniques:**
  1. Direct time study
  2. Predetermined motion time systems (PMTS)
  3. Standard data systems
  4. Work sampling

- **They** can be used in methods engineering to make improvements in the work methods
New Approaches (use for improving production & services operations)

- **Lean production** *(Just-in-time production)*
  - Based on the Toyota production system
  - Embraced by U.S. companies due to its success at Toyota
  - **Lean production** is an assembly line technique that was created by Toyota and vehicles factories.
  - **This technique aims to:**
    - Eliminating waste of material
    - Empowering workers
    - Reduced inventory and
    - Improved productivity

- **Six Sigma and other quality-focused programs**
  - Widely adopted in industry for improving quality of work processes
  - **Six Sigma** is a name of quality-focused program that utilizes worker teams to accomplish projects aimed at improving an organization’s operational performance
  - Started at Motorola Corp in 1980s
  - Quality based on Normal Distribution
New Approaches

- **5S: The 5-step work organization:**
  - Seiri (Sort), Seiton (Set in order), Seiso (Shine), Seiketsu (Standardize), Shitsuke (Sustain)

**5S Methodology**
- Sort - Eliminate disorder flow
- Seiri - Change in order
- Set in order - Sustain work
- Shut down of work
- Standardize - Maintenance and make the "5S" habit in order to organize the workplace effectively.

**SORT**
- Divide items in the workplace into 3 categories: retain, return and rid.

**SUSTAIN**
- Organize and maintain the knowledge, skills, and abilities gained from the "5S" process in order to organize and maintain the workplace effectively.

**SET IN ORDER**
- Find a place for the part by deciding which part belongs there - Organizing, arranging and making equipment accessible and information.

**SHINE**
- Clean the workplace and maintain cleanliness - By cleaning up, it becomes easier to maintain the workplace.

**STANDARDIZE**
- Maintain and make the "5S" habit in order to organize the workplace effectively.

**5S Examples:**

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