

Garment Production Management

Week 7

Work measurement and standard time development

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Recap-previous week

- Work study concepts
- Method study or motion study concepts
- Procedures in method or motion study
- Benefits of method or motion study
- Motion economy
- Principles of motion economy

Lecture Learning Outcomes

1. Understand work measurement concepts
2. Analyze time study techniques
3. Understand the work measurement principles
4. Compare different time study techniques

Session outline

- Work measurement concepts
- Work measurement techniques
- Standard Minute Value(SMV) or Standard Allowed Minutes (SAM) analysis

Introduction to work measurement

- Application of techniques to determine the time to complete a specific task
- **A standard time** required to complete the job
- The time is measured using:
 - Qualified worker
 - Working at a standard pace
 - Following a standard method
- In work study, method study ensures best way to do a job and
- Work measurement establishes **how long the task should take using the best method**

Introduction to work measurement

- Time standards reflect the **amount of time needed to complete a given job** performed under typical conditions
- **Job times are vital inputs for:**
 - Capacity planning
 - Workforce planning
 - Estimating labour costs
 - Scheduling and budgeting
 - Designing incentive systems

Work measurement techniques

Time study using stop watch:

- The most direct and traditional technique
- Basic time = Observed time × Worker rating
 - Samples of observed time measurements (5 to 10) are taken while a qualified worker is operating in each cycle (Pick up-align-sew-dispose)
- Standard time=Basic time + Allowances (fatigue, personal, delay)
- Standard time is a **standard allowed minute (SAM)** for each operation
- The standard time the base for setting worker's target and measure efficiency or productivity

Time study for a side seam of T-shirt

| Task elements/cycle | Observed time (sec) | Rating (%) | Normal time/Basic time((sec) |
|---|---------------------|------------|------------------------------|
| Pick up front and back panels | 3.5 | 100 | 3.5 |
| Align edges under presser foot | 4.5 | 90 | 4.05 |
| Sew 40 cm seam | 8.0 | 110 | 8.8 |
| Trim thread ends | 2.5 | 100 | 2.5 |
| Stack finished piece | 2.0 | 95 | 1.9 |
| Total | 20.5 | | 20.75 |
| Add 15% allowances → Standard time = $20.75 \times 1.15 = 23.9$ seconds per piece | | | |

Table 1: Practical example for time study

Source: Author's creation

Work measurement techniques

Predetermined motion time systems (PMTS):

- Most common in garment sewing operation
- Analyze a task into its basic human motions (reach, grasp, move, position, release) to set time standards
- Use pre-assigned time values for each motion elements
- Methods-time measurement (MTM) and general sewing data(GSD)
- GSD is an industrial standard for garment industry
- GSD operations are divided into specific categories
- All GSD codes are measured in time measurement unit (TMU)
- $1\text{TMU}=0.0006$ minutes or 0.036 seconds

Shirt pocket attach

| Activity | Category | GSD code | TMU |
|---|--------------------------|----------|--------------------------|
| Pick up the pocket and shirt body simultaneously | Obtain & match | MG2T | 76 |
| Position the bundle under the presser foot to sew | Move to needle | FOOT | 38 |
| Align the pocket edges with the shirt markings | Alignment | AM2P | 61 |
| Sew the pocket (15cm, straight, visible) | Sew | S15MC | 165 |
| Trim the loose thread ends | Trim threads (first cut) | TCUT | 50 |
| Place the finished piece in the stack | Aside one hand | AS1H | 23 |
| Total | | | 413=0.248 Minutes |

SAM=0.248+bundle allowance(10%)+machine and personal allowance (15%)=0.31 minutes

Table 2: GSD method

Source: Author's creation

Work measurement techniques

Work sampling/activity sampling:

- A statistical technique that observe group of sewing operators in some interval
- Estimate the proportion of time **a worker or machine spends** on:
 - Working
 - Idle time
 - Delay activities
- Large number of instantaneous, random observations are considered
- Do not require timing an activity
- Does not provide precise elemental times but identifies productivity losses

Work measurement techniques

| Activity Category | Observations | Share in % |
|------------------------------|--------------|------------|
| Sewing (productive) | 68 | 68 |
| Machine adjustment | 8 | 8 |
| Waiting for bundles | 10 | 10 |
| Personal / idle | 6 | 6 |
| Thread break / needle change | 5 | 5 |
| Quality inspection | 3 | 3 |
| Total | 100 | 100 |

Table 3: Work sampling method

Source: Author's creation

Work measurement techniques

Standard data:

- It is also called synthetic data or tabular standard data
- uses pre-established, scientifically derived **time values** for basic work elements (e.g. Sewing shoulder)
- Time values are stored in a database or table
- Synthesized to set time standards for new jobs
- No direct observation
 - New operations are calculated by summing known element times
 - **E.g. Standard data library for lockstitch machine (5000 RPM)**

Work measurement techniques

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Work measurement techniques

Types of standard data:

- Micro level: Individual basic motions (PMTS); E.g. Reach 15 inches = 0.002 min
- Elemental level: Small work elements (start sewing machine)
- Complete operations (machine a surface)
- Operational level: Complete operations
- Product level: Entire product families

Principles of standard data:

- Eliminates the need to re-time the same motion or operation every time it appears
- Once you know **time taken to attach shoulder**, you can reuse that value forever
- Standard data gives you the operation time based on variables (distance, weight, material, etc.)

Work measurement techniques

Standard data:

- Database of pre-established time values for common sewing work elements (e.g., sewing 1 cm of seam on a specific machine type)
- Uses time study or PMTS data
- New operations are calculated by summing known element times
- E.g. Standard data library for lockstitch machine (5000 RPM):

| Operation element | Time per unit (seconds) |
|------------------------|-------------------------|
| Sew 1 cm straight seam | 0.12 |
| Sew 1 cm curve seam | 0.18 |
| Backtack (start/end) | 1.5 |
| Pick up / align part | 2.0 |
| Trim thread (manual) | 1.5 |

Table 4: Standard data method

Source: Author's creation

Standard data application domain

| Applied for | Not applied for |
|--|---|
| Repetitive manufacturing operations (sewing or assembly of garments) | highly creative or artistic work |
| Tasks with predictable and measurable variables | Non-standard or unique activities or projects |
| Work elements that recur frequently across products | Tasks heavily dependent on human judgment |
| Machine-controlled cycles | Variable manual tasks without patterns |
| High-volume production environments | Early-stage R&D work |

Table 5: Standard data application domain

Source: Author's creation

Advantage and disadvantage

| Advantage | Disadvantage |
|--------------------------|----------------------------------|
| Speed | High initial development cost |
| Consistency | Requires statistical expertise |
| No observation bias | Outdated data |
| Pre-planning | May miss unique interactions |
| Method improvement | Not for completely new processes |
| Low cost for high volume | |

Table 6: advantage and disadvantage of standard data

Source: Author's creation

Work measurement techniques

Computerized / Video-Based Motion Analysis

- Uses high-speed video recording and specialized software
- Analyze sewing motions frame-by-frame for **micro-motion improvement**

| Motion observed (video) | Time (sec) | Improved method | New time (sec) |
|-----------------------------------|------------|--|--------------------|
| Operator reaches 40 cm for bundle | 2.5 | Reposition bundle tray to 20 cm | 1.2 |
| Two hand movements (sequential) | 1.8 | Redesign workflow for simultaneous hand use | 0.9 |
| Searching for start point | 1.2 | Add visual guide (tape mark) | 0.3 |
| Total saving per piece | | | 3.1 seconds |

Table 7: Video based motion analysis method

Source: Author's creation

Work measurement techniques

Physiological work measurement:

- Measures a **worker's physiological response** to physical strain and workload
- E.g. **heart rate, oxygen consumption**
- Relevant for **heavy physical tasks** where fatigue is a major factor

Major steps followed:

- **Measure baseline:** Record resting heart rate (HR), oxygen consumption (VO_2), or EMG for 5–10 minutes before work begins
- **Attach equipment:** Fit the worker with sensors (HR monitor chest strap, portable metabolic system, or EMG electrodes)
- **Perform task:** Worker performs the job while physiological data is recorded continuously

Work measurement techniques

Physiological work measurement:

- **Reach steady-state:** Wait 3–5 minutes for physiological responses to stabilize at constant work intensity
- **Record working values:** Average the HR, VO_2 , or EMG readings during the steady-state period.
- **Measure recovery:** Monitor how quickly **HR or VO_2 returns to baseline** after task ends (indicator of fatigue)
- **Calculate workload:** Apply formulas to classify task intensity (% Max heart rate; volume of oxygen)
- **Compare to limits:** Check against safe limits (e.g., working HR < 120 bpm for 8-hour shift; VO_2 < 40% of max)

Work measurement techniques

Steps in rating of perceived exertion (RPE):

- **Select the scale:** Choose the **0-10 Borg RPE Scale** (0 = no effort, 10 = maximal effort). Explain the endpoints to the worker.
- **Calibrate (Highly recommended):** Worker perform a Grip-to-Scale exercise using a dynamometer to match verbal anchors (e.g., light, hard) to actual force
- **Perform & rate:** Worker performs the task and will be asked to rate (0-10 scale) during or immediately about “how hard did your whole-body work?”
- **Record context:** Note the RPE score alongside task details (duration, environment, tools).
- **Interpret score:** RPE of 7 or above indicates high strain requiring further investigation or redesign

Work time structure

Components of total work time

- Work content : time actually required to perform the task
- Ineffective time: time spent on unproductive activities

Work time categories

- Basic/normal time
- Allowances (personal, fatigue, delay)
- Standard time
- Idle time
- Machine time vs. manual time

Work measurement steps

1. Sample size determination

- Statistical basis for number of observations required
- Related to desired accuracy and confidence level

2. Work selection

- Choosing appropriate jobs for measurement
- Considering job stability and frequency

3. Worker selection

- Selecting representative, **qualified operators**
- Ensuring cooperation and understanding of measurement purpose

Work measurement steps

4. Observation and recording

- Using appropriate recording tools (timing devices, study boards, and forms)
- Recording elemental times and performance rating

5. Data analysis

- Calculating basic times for each element
- Applying rating to convert observed times
- Determining standard time with allowances

Recommended work measurement techniques

| Nature of work | Recommended technique |
|--|---|
| Repetitive, short-cycle (seconds to minutes) | Stopwatch time study or PMTS |
| Non-repetitive, variable, long-cycle (hours) | Work sampling or analytical estimating |
| New, not yet in production | PMTS or analytical estimating |
| Heavily physical (manual material handling) | Physiological measurement (heart rate, VO2) |
| Team-based or machine-intensive | Work sampling |
| Requiring high precision and method detail | PMTS or video analysis |
| Organization with many similar tasks | Standard data development |

Table 8: Recommended work measurement techniques based on nature of work

Source: Author's creation

Standard time

- The amount of time a qualified worker takes to complete a specified task:
 - Working at a sustainable rate
 - Using given methods
 - Tools and equipment
 - Raw material inputs
 - Workplace arrangement or layout
- A complete description of the parameters of the job is required, as the actual time is sensitive to all of these factors
- Changes in any one of the factors can materially affect time requirements
- Changes in product design or changes in job performance brought about by a methods study should trigger a new time study to update the standard time

Standard time

- Organizations develop time standards in a number of different ways
- The most commonly used methods of work measurements are:
 - Stopwatch time study
 - Historical Times
 - Predetermined data
 - Work sampling
 - a technique for estimating the proportion of time that a worker or machine spends on various activities and the idle time
 - does not require timing an activity, observation of the activity in some intervals

Tools for work measurement techniques

- **Stopwatch Time Study:** Stopwatch (digital or decimal-minute), observation board, time study sheet, video camera (optional for review)
- **Predetermined Motion Time Systems (PMTS):** PMTS data cards/manuals (e.g., MTM, MOST), video recording equipment, motion coding sheets
- **GSD (General Sewing Data):** GSD coding manual, GSD analysis software, video camera, sewing operation coding sheets

Tools for work measurement techniques

- **Work Sampling / Activity Sampling:** Random alarm generator (e.g., smartphone app), observation tally sheet, clipboard or mobile data collection device
- **Standard Data:** Database of pre-established time values (spreadsheet or software), data retrieval system
- **Synthesis Method:** Library of elemental time values (from standard data or past studies), element breakdown sheet, calculator or spreadsheet software

Application of work measurement

Work measurement are used to:

- Cost accounting
- Production Planning and Control
- Schedule production
- Personnel Management: Staffing and labor cost estimation
- Design incentive systems (fair wages standards)
- Compare alternative manufacturing methods
- Productivity Improvement

Summary

- Work measurement is a critical step to measure how long a job takes
- Work measurement techniques are selected based on the nature of the work
- Work measurement helps in key decision-making activities
 - Production scheduling and balancing
 - Cost control
 - Manpower assignment and target setting
 - Design incentive schemes
 - Productivity improvement

Summary

- Various work measurement techniques are:
 - Stop watch based time study
 - Predetermined motion time systems(PMTS): **pre-established time values for basic human motions** (e.g., MTM)
 - GSD or MTM technique
 - Work sampling/activity sampling techniques: Indirect measurement using random observations to determine time distribution
 - Standard data: Using historically compiled time data for similar operations
 - Synthesis method: Building standard times **from previously established element times**

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Thank You !

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