Garment Production Management

Week 2 Production systems in garment manufacturing

Lecturer: Dr. Shalemu Sharew (Associate Prof.)

Bahir Dar University
Bahir Dar, Ethiopia

Recap-previous week

- General course introduction
- Concepts of operation and production management
- Historical enablers of operations management
- Benefits of operations management
- Production management systems

Lecture Learning Outcomes

1. Identify the different garment manufacturing steps
2. Understand garment manufacturing systems
3. Analyze unique features of each garment manufacturing system
4. Describe the benefits of each garment manufacturing system

Introduction

Session outline

- Definition of garment manufacturing systems
- Types of garment manufacturing systems
- Unique features of each garment manufacturing system

Production systems in garment industry

Garment manufacturing system

- Garment manufacturing is characterized by:
  - Labor-intensive manual operations
  - Frequent style changes
  - Seasonal demand
  - Shortening production lead times [1]
- Garment manufacturing system manage work flow and deliver finished goods through an integration of materials handling; production processes, personnel, and equipment

Garment manufacturing systems

Types of garment manufacturing systems [2]

1. **Make through:**
   - **Complete/ whole garment system:** one person makes the whole garment (cutting, sewing and pressing)
   - **Departmental production system:** one person does all operations with the equipment allocated to a department
   - **Section or process system (Group system):** improvement of make through system
     - Operators specialize in one major component (E.g. Front component: assemble front panels, set pocket)

Whole garment production system

- Maily used in businesses engaged in custom-wholesale in high end fashion houses
- Master tailors who are experienced in that product finish the whole garment
- Normally high priced and exclusively made for a particular customer
- Manufacture limited quantity (only 10-20 garments) are made
- Typical examples are:
  - Custom made suit manufacturing houses
  - Designer collections

Departmental production system

- Used by custom wholesale manufacturers as well as high price or better garment manufacturers
- More than one equipment can be used to complete job
- One operator does all the work with the equipment allocated to a department
    - E.g. Cutting work in cutting department; sewing work in sewing department, and pressing and packing work in finishing and packing

Departmental production system

Advantages

- For very large variety of garments produced in extremely small quantities
- Good for individual piece rate system
- Operator will be specialized in his own working area
- Pay rate depends on task difficulty
- Work in Progress (WIP) is reduced

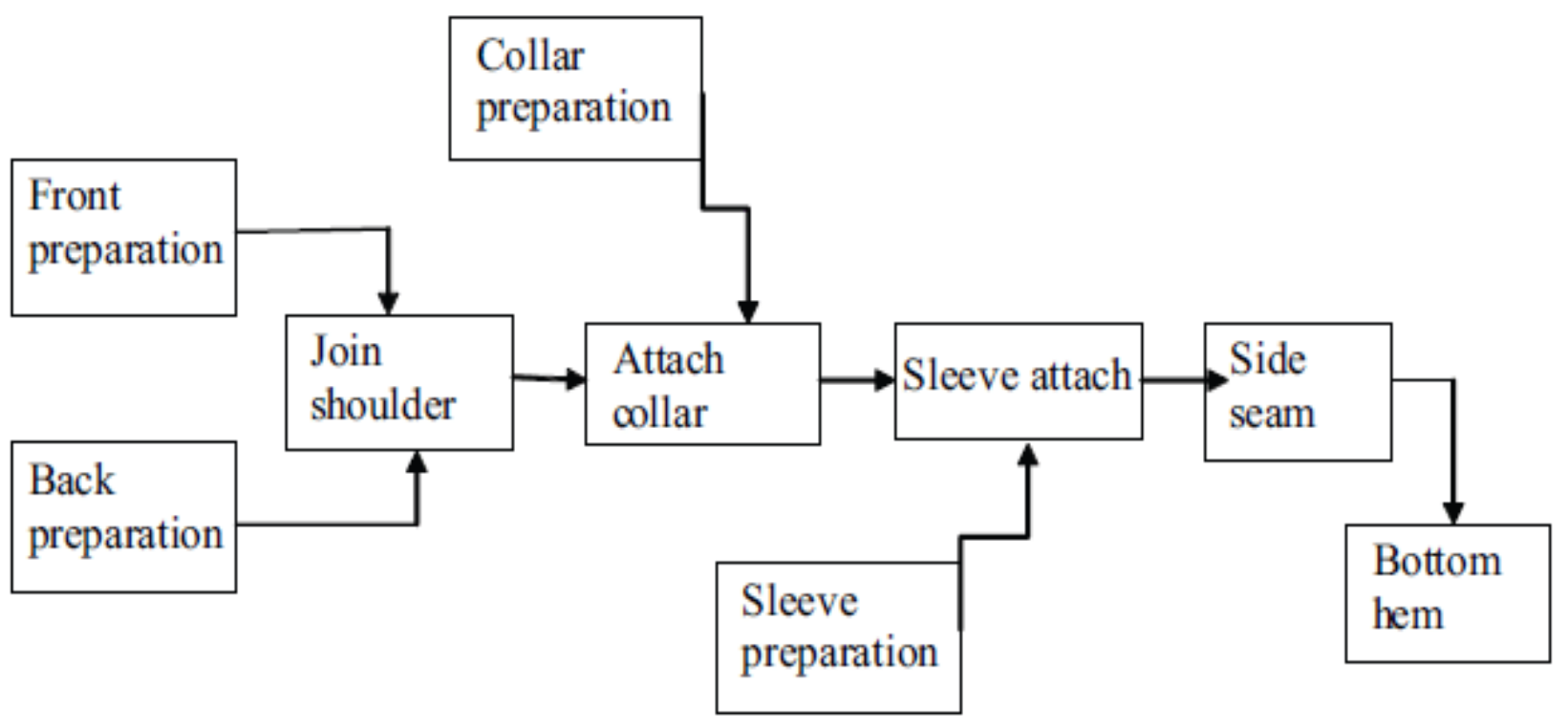
Disadvantages

- Highly skilled laborers are used, so the cost of labor is high
- Quality of the product may be compromised
- Productivity is less due to lack of specialization
- Not effective for large quantity

Section (group) production system

- Operators specialized in one major component and assemble it from beginning to end
- Many sections with versatile operators capable of performing a specific component
- The main sections include:
  - Pre-assembling (preparation of small parts; collar, sleeve, cuff,etc.)
  - Front preparation
  - Back Preparation (assemble yoke, back and labels, etc.)
  - Main assembly operations (closing, setting collars and sleeves, etc.)
  - Lining preparation
  - Sewing linings
  - Finishing operations (buttonholes, Button attach and blind-stitching, etc.)

Section (group) production system



- Preparation sections
- Assembly sections

Figure 1: Section production system

Garment Production System: Types, Advantages and Disadvantages. url: https://i0.wp.com/textilelearner.net/wp-content/uploads/2021/12/Group-system-garment production.png?resize=624%2C271&ssl=1https://i0.wp.com/textilelearner.net/wp-content/uploads/2021/12/Group-system-garment-production.png?resize=624%2C271&ssl=1

Section production system

Advantages

- Labor cost is less than whole garment system (semi-skilled, skilled, trainee operators)
- Productivity is higher than i whole garment system (special machine & all types of labor)
- Automation and specialization can be done
- Absenteeism and machine breakdown has no serious problems

Disadvantages

- All levels of operators are involved (quality may be compromised)
- Though productivity is high highly skilled operators perform simple operation in the section
- More operators per section require more WIP and inventory cost increase
- Shade & size mixing will affect quality and production

Conventional bundle system

- Sewing machines are arranged in lines
- Work flows from the central (store) area --> first machine --> back to the store -->next machine
- A distributor at the store is responsible for receiving and dispatching the work
- The work in progress is in the form of bundles
- Widely used in garment factories in Hong Kong during the 1950s (require less managerial skill)
- Used in areas frequent style changes and low level of managerial skill

The clump system

- It is a type of conventional bundle system with same characteristics
- Operator collects a clump of materials from the worktable --> carries out the first operation --> return to the table and so on
- The process is 'collection-work-return' continues until the whole garment has been assembled

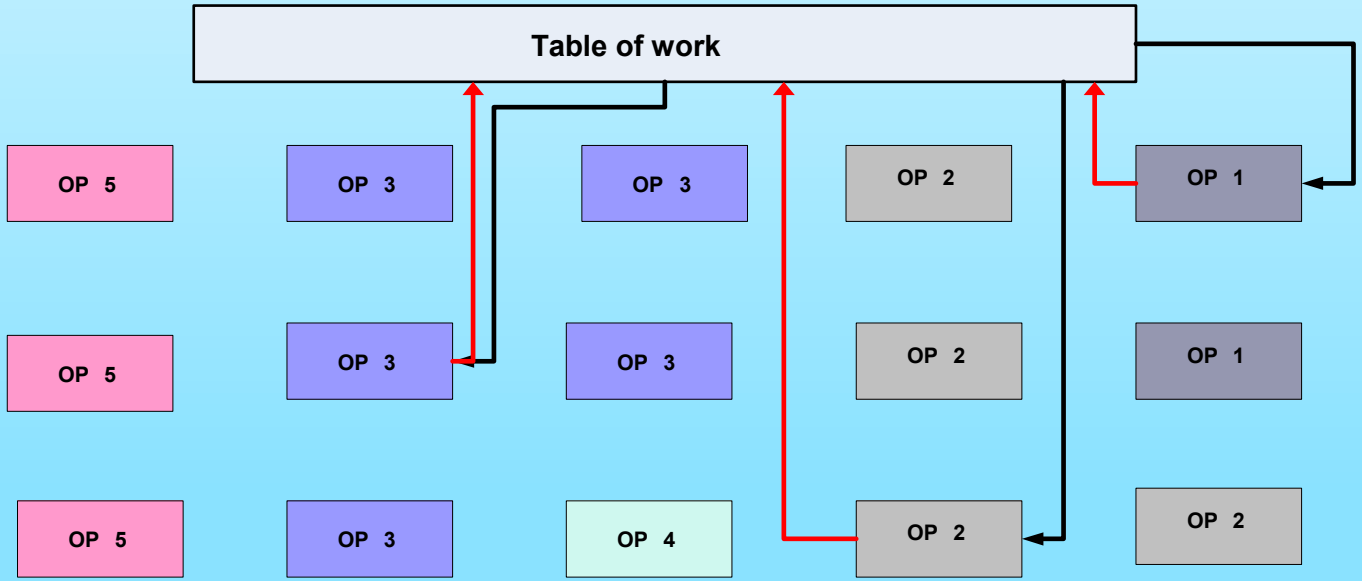


Figure:2 The clump system of garment manufacturing

Source: Author creation

Conventional bundle system (CBS)

Advantages

- Flexible for frequent style changes
- Worker absenteeism does not cause any major problems, as the controller can control the amount of work received and dispatched
- Easy to operate and supervise
- Encourage individual workers to work faster
- Uniform quality, as the controller check the quality

Disadvantages

- Excessive handling of the materials by the operators,
- It is difficult to control the inventory
- It is difficult to see the WIP at the various stages
- High level of WIP
- Engineering of work places is difficult as machines are arranged in the limited capacity
- Large storage space is required to manage high WIP

Progressive bundle system(PBS)

- Bundles of garment parts move from operation to operation in sequence
- Each operator receives a bundle, does the work, reties the bundle and passes it to the next operator
- Widely used system by garments manufacturers
- Bundles contain parts needed to complete a specific operation or garment component
  - E.g. An operation bundle for pocket attaching (shirt fronts and pockets)
- Standard or variable bundle size (based on cutting orders, fabric shading, size of the pieces) are used

Progressive bundle system (PBS)

Advantages

- High productivity
- A high level of labor utilization
- Uniformly high standard of work
- Training time and costs can be reduced
- Semi-skilled labor can be used
- Individual performance can be monitored & incentivized

Disadvantages

- Requires a high management skill to arrange workflow
- Requires decision on number of operators for each operation
- Requires a high WIP hence high capital
- High bundle management and transportation cost
- Not very flexible or adaptable for short-run production & frequent style changes

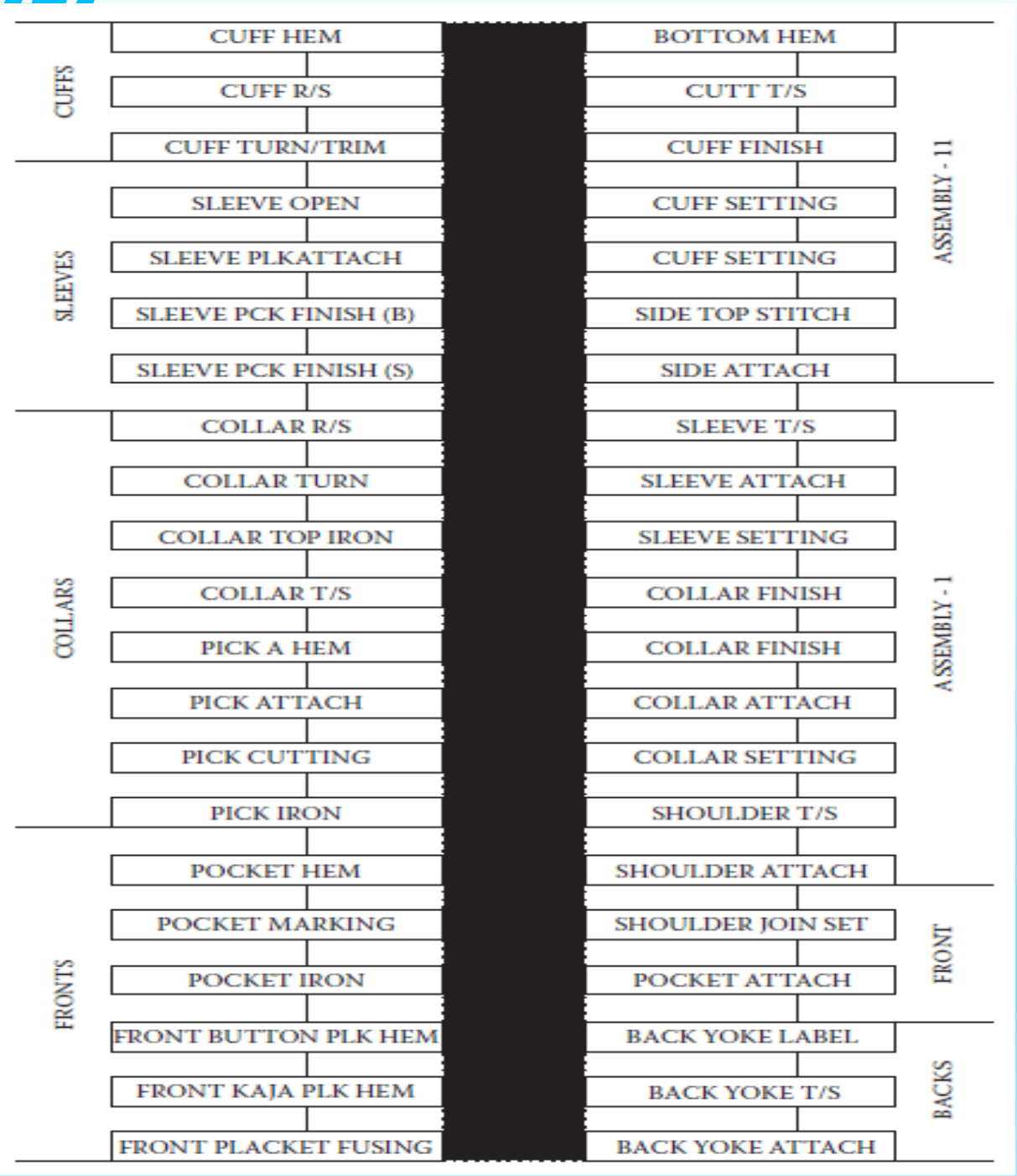
Progressive bundle systems-Batch system

- Works based on a synchronized flow of work through each stage
- Time-synchronization is the most important factor of this system
- The flow of work cannot be synchronized if there are considerable variations in:
  - Standard Allowed Minute (SAM) or Standard Minute Values (SMVs) for all the operations
- This system is rigid and particularly vulnerable to absenteeism and machine breakdowns

Progressive bundle systems-Batch system

This system effectively works in the following cases:

- Volume of production volume
- Accurate line balancing
- Reserve operators or helpers
- Reserve machinery and equipment



Progressive bundle systems

The material handling rack is in-between the line

Front preparation
Back preparation
Collar & Cuff preparation
Sleeve preparation
Assembly of front and back(Sholder attach)
Collar attach
Sleeve setting or attach
Side seam attach

Figure 3: Progressive bundle system for shirt

Garment Production System: Types, Advantages and Disadvantages.URL https://i0.wp.com/textilelearner.net/wp-content/uploads/2021/12/Layout-for-full-sleeve-shirt-%E2%80%93-batch-system-1.png?resize=431%2C709&ssl=1

Unique features of PBS

- A traditional and widely used production system today
- Sewing operations are laid out in sequence
- Bundles of cut components passes from one workstation to another
- Storage facilities (E.g. rack, bin or table) store WIP between each operation
- The bundles are routed using tickets/barcodes
- Within each sections works is balanced according to time required for each sub functions
- Commonly found in shirt factories, jeans factories, jacket factories, etc.

Straight line system

- The manufacturing process is broken down into several operations (with the same time)
- Equal work sharing principle
- Groups of operators are required to handle only individual garments
- The garment parts pass from one operator to the next for each group of operators
- The central distribution unit (a fixed table or a conveyor belt)
- The speed will be set to suit the cycle time

Flexible flow system (FFS)

- Similar to the modular manufacturing system
- Used for small production quantities and used for functional layout
- A section of sewing operators work at an engineered work place
- Each operators receive work in a WIP management rack at the side
- Machines are planned in advance using the correct number of operators in sequence
- The number of operators for an operation should be proportionate to the time needed for that operation

Unit production system (UPS)

- **Operational principles**

  All the components for one garment are loaded to a carrier at a work station especially designed for this purpose
- Each section of the carriers have a quick-release clamp which prevents component falling during movement
- When a batch of garments has been loaded into carriers it is fed past a mechanical or electronic device which records the number of the carrier and addresses it to its first destination

Unit production system (UPS)

Key features

- Production unit is a single garment and not in bundles
- Automatic transportation of components from work station to work station based on pre-determined sequence
- The work stations are close to the operator's left hand to reduce movement to grasp and position the component to be sewn

Figure 4: Unit production system

Garment Production System:Types, Advantages and Disadvantages. url: https://i0.wp.com/textilelearner.net/wp-content/uploads/2021/12/UPS-production-system.jpg?resize=600%2C400&ssl=1

Unit production system

Advantages

- Bundle handling is completely eliminated
- The time to pickup and disposal of cut components is minimum
- Output is automatically recorded, hence eliminates the operator to register the work
- The computerized systems balance the work between workstations automatically
- Up to 40 styles can be produced simultaneously on one system

Disadvantages

- Unit production system requires high investments
- The payback period of the investment takes long time
- Proper planning requires being effective.

Comparison of UPS Vs. PBS

UPS

- Technology advancement help overhead transport system
- Reduces manual transport and handling
- Easy pick up and disposal at each work station result in quick response time
- Throughput time is less
- Less handling time reduce direct labor content
- Planning is easy and requires less overtime

PBS

- PBS is the mostly used or installed sewing system
- High WIP demands more cutting capacity
- Bundles of cut pieces feeding is done manually by the helpers
- The operators take bundles-->finish their operation--> move forward to the next operator

Modular Production System (MPS)

- It is also called a team or cellular system
- Originated from the Japanese auto manufacturing
- Recent Production systems in the apparel industry
- Helps to meet the flexibility in demands required in the garment industry
- Operator/worker involvement and team work

Modular Production System (MPS)

- This system is suitable for:
  - Short production cycles
  - Greater operating flexibility
- Less requirement of labor compared to PBS
- Modules use a cross-training technique
- Require multi-skilled workers
- Small set of machines to produce a finished garment
- Workers are responsible for quality

Modular Production System (MPS)

Key features

- Groups of workers with multiple skills in one module
- Group piece rate or hourly rate compensation
- U-shaped module, and single piece hand offs
- This system is called Group Technology or Cellular Manufacturing
- Less material handling reduces inventory levels and throughput time
- Saves the cost of inventory and material handling

Modular production system

Advantages

- Bundle handling is completely eliminated.
- The time involved in the pickup and disposal is reduced to minimum
- Output is automatically recorded, hence eliminates the operator to register the work
- The computerized systems automatically balance the work between stations
- Up to 40 styles can be produced simultaneously on one system

Disadvantages

- Unit production system requires high investments
- The payback period of the investment takes long time
- Proper planning requires being effective.

General classification of garment production systems

Garment manufacturing systems are generally classified as:

1. Traditional bundle system or progressive bundle system
    - Most widely documented system for mass production
    - Garment parts are grouped into bundles moving through specialized workstations
2. Modular manufacturing system
    - Use of multi-functional teams or modules rather than individual repetitive tasks [4]
3. Unit production system
    - An evolution of PBS and uses overhead transport system
4. Make-Through system
    - Single operator finish the whole garment and common in high end fashion houses

General classification of garment production systems

Production system	Volume	Flexibility	Skill level	WIP inventory	Throughput time/ lead time
Make-Through	Vey low	High	Very high	Negligible	Very short
Progressive bundle	Very high	low	low	Very high	Very slow (days/weeks)
Unit production	High	Medium	Medium	Low	Fast
Modular	Medium	Very high	High	Very low	Very fast

Table 1: Comparison of production systems

Summary

- Each garment manufacturing system has different application context
- Group manufacturing system and modular manufacturing systems have flexibility
  - Operators and workstations are flexible
- Progressive bundle system has standardization of tasks and operator specialization
  - Adjusting work station and operator assignment is rigid
- The following factors determine selection of appropriate manufacturing systems
  - Production volume
  - Operators' skill set
  - Cost of production
  - Inventory and WIP management cost
  - Space and production layout flexibility
  - Style changes in the business, etc.

References

[1] Mok, P.Y., Cheung, T.Y., Wong, W.K. *et al.* Intelligent production planning for complex garment manufacturing. *J Intell Manuf* **24**, 133–145 (2013). https://doi.org/10.1007/s10845-011-0548-y

[2] Jana, Prabir, and Manoj Tiwari. *Industrial engineering in apparel manufacturing*. Apparel Resources Pvt. Ltd., 2020.

[3] Lin, Shu-Hwa, Doris H. Kincade, and Carol Warfield. "Productivity and production in the apparel industry." International Journal of Clothing Science and Technology 6, no. 1 (1994): 20-27.

[4] Svetlík, Jozef. "Modularity of production systems." In *Machine Tools-Design, Research, Application*, pp. 1-22. London, UK: IntechOpen, 2020.

Thank You !

Contact email: shalemu14@gmail.com