

Project Description

Problem Statement

AMS is a large production plant for nutritional products (mainly milk powders). AMS is doubling production in the next two years. The warehouse efficiency has to be improved to hold extra production capacity.

Project Objective

The management wants to evaluate current warehouse operations and improve warehouse efficiencies to cope with future expansion.

- Use IE tools to track bottlenecks in the warehouse
- Perform scenarios analysis under varying demands
- Propose recommendations to improve warehouse efficiency

Methodology

Define

Project objectives
Project scope

Measure

Performance metric
Data collection
Data processing

Analyze

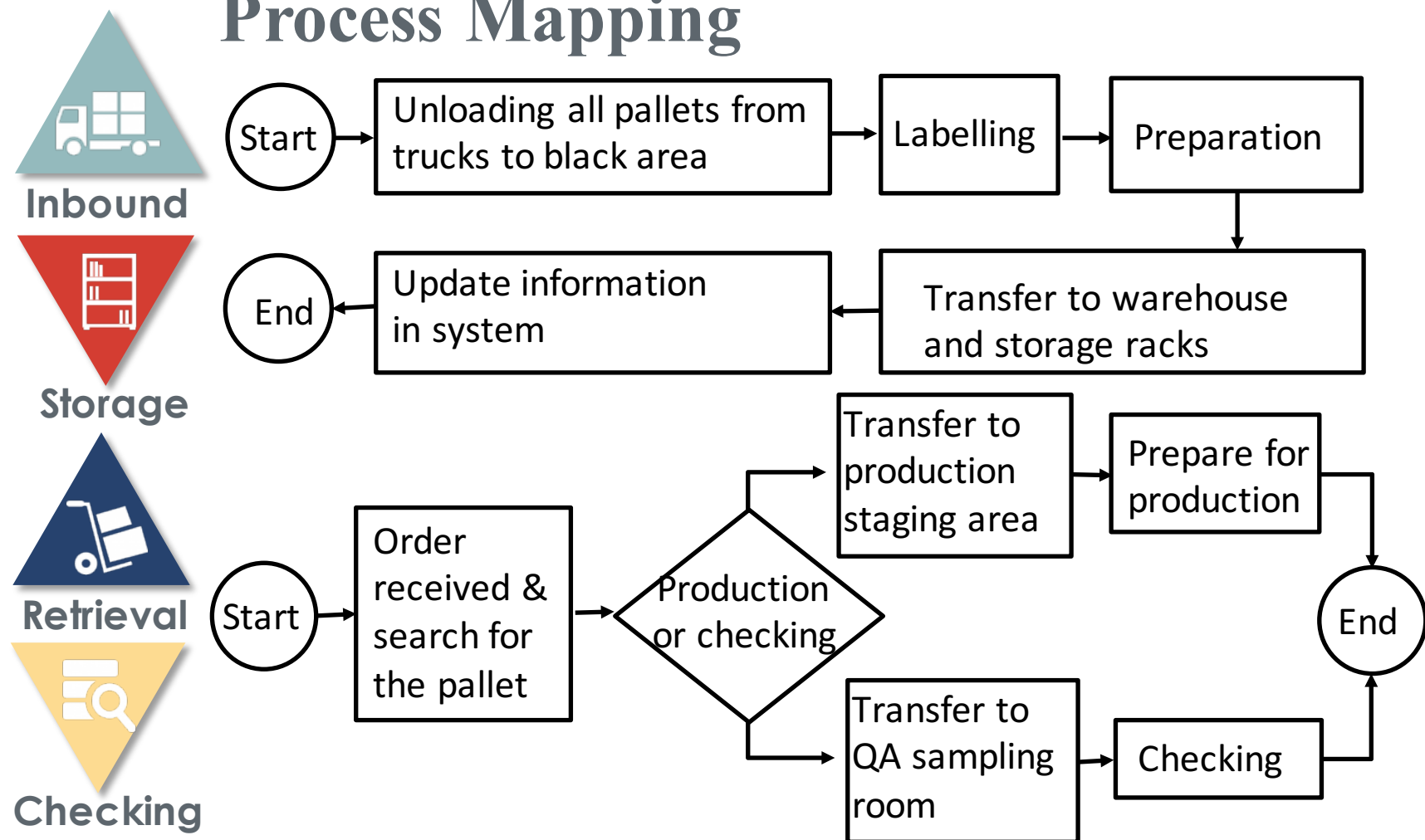
Process mapping
Problem identification
Simulation modelling
Result analysis

Improve

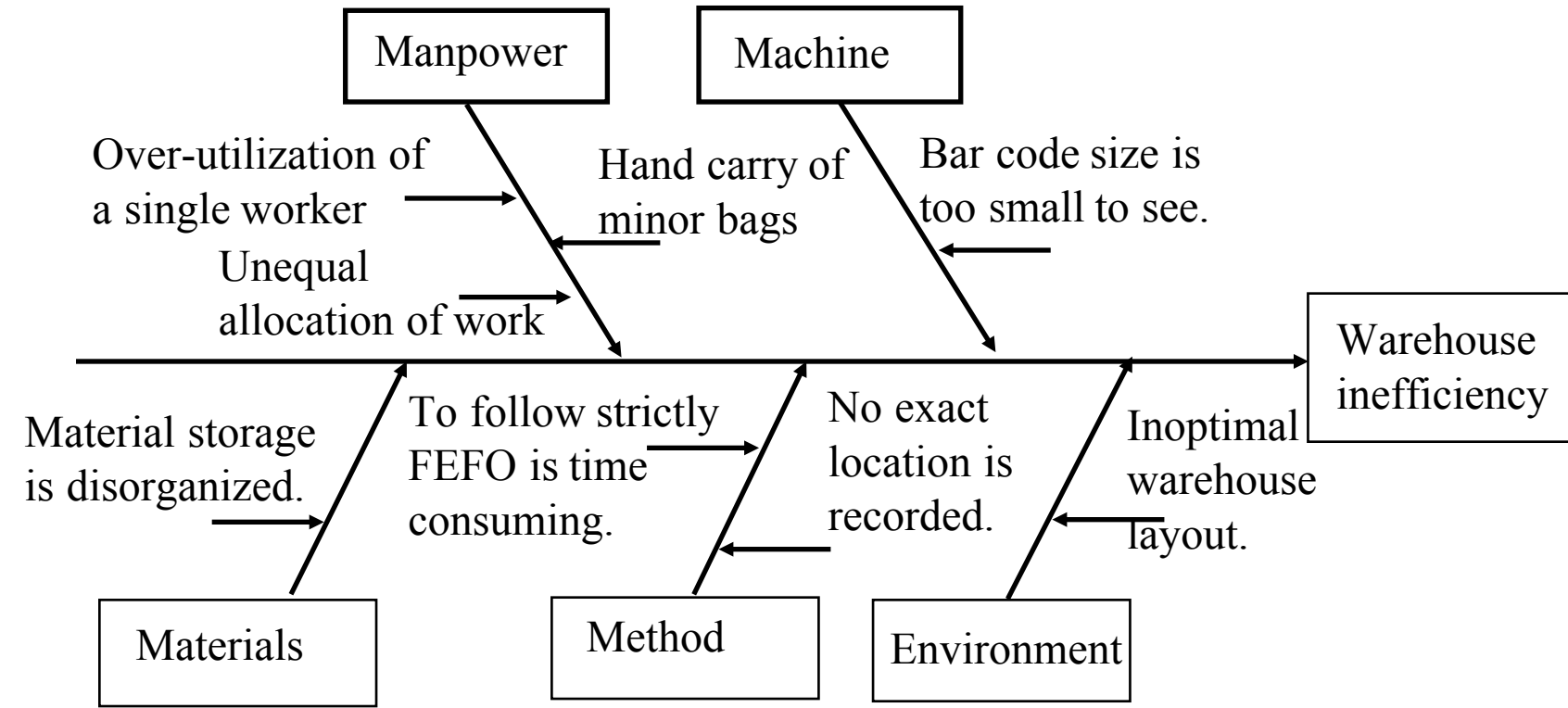
Propose solutions
Evaluation

Current System Analysis

Process Mapping



Problem Identification



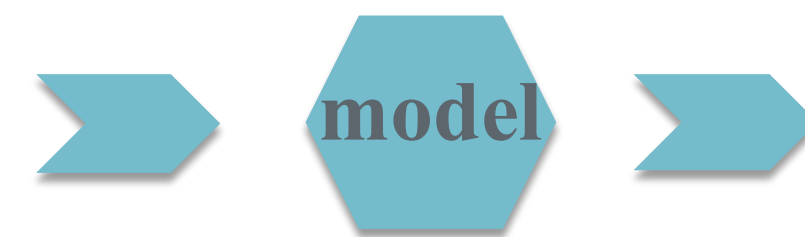
Scenario Analysis

Simulation modelling

A simulation model was constructed to evaluate the performance of current warehouse operations, and also examine the impacts of potential changes in the future.

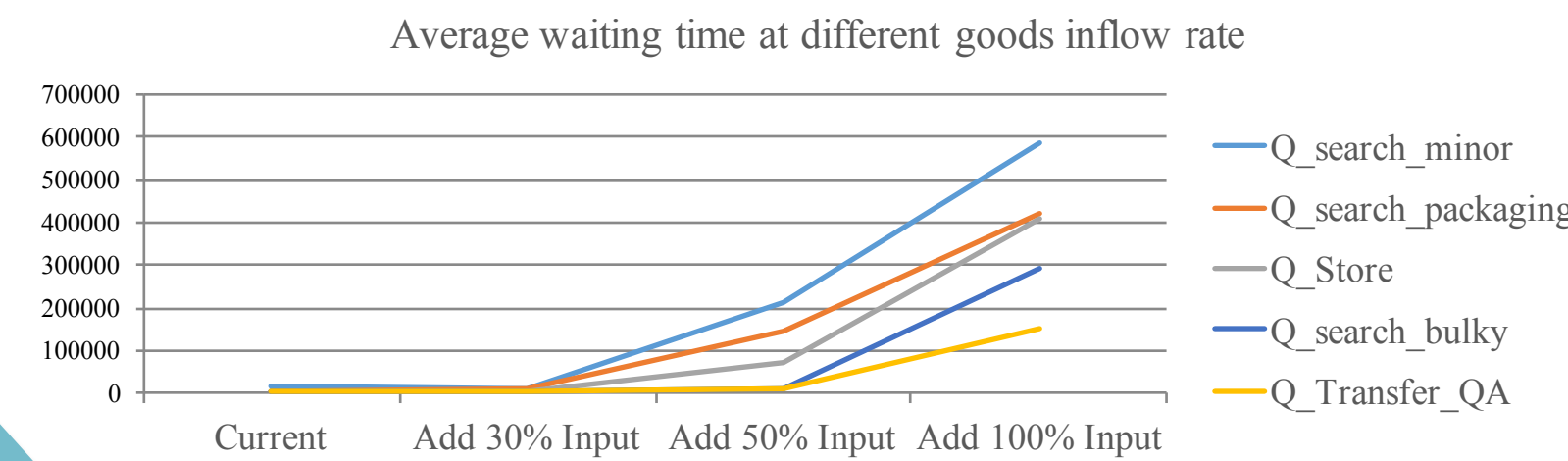
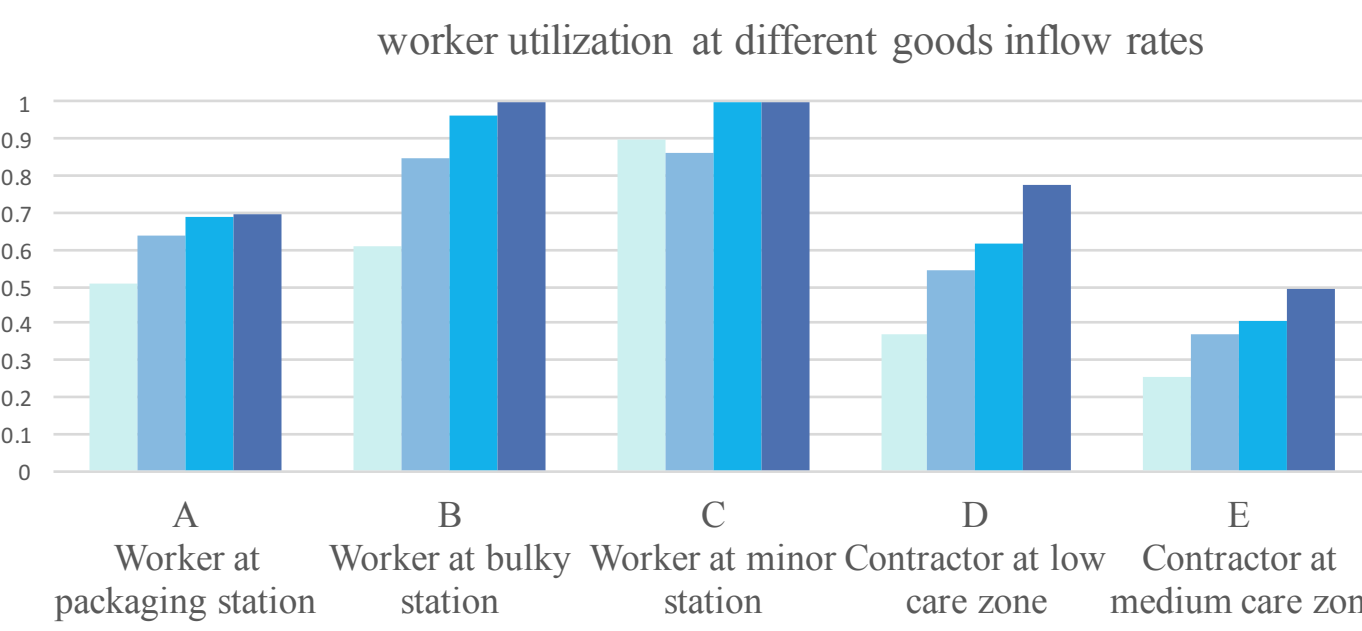
Input variables

- Number of resource
- Working hour
- Process time
- Inflow volume
- Outflow volume



Output KPIs

- Worker utilization rate
- Waiting time to complete a process
- Total time to complete all processes.



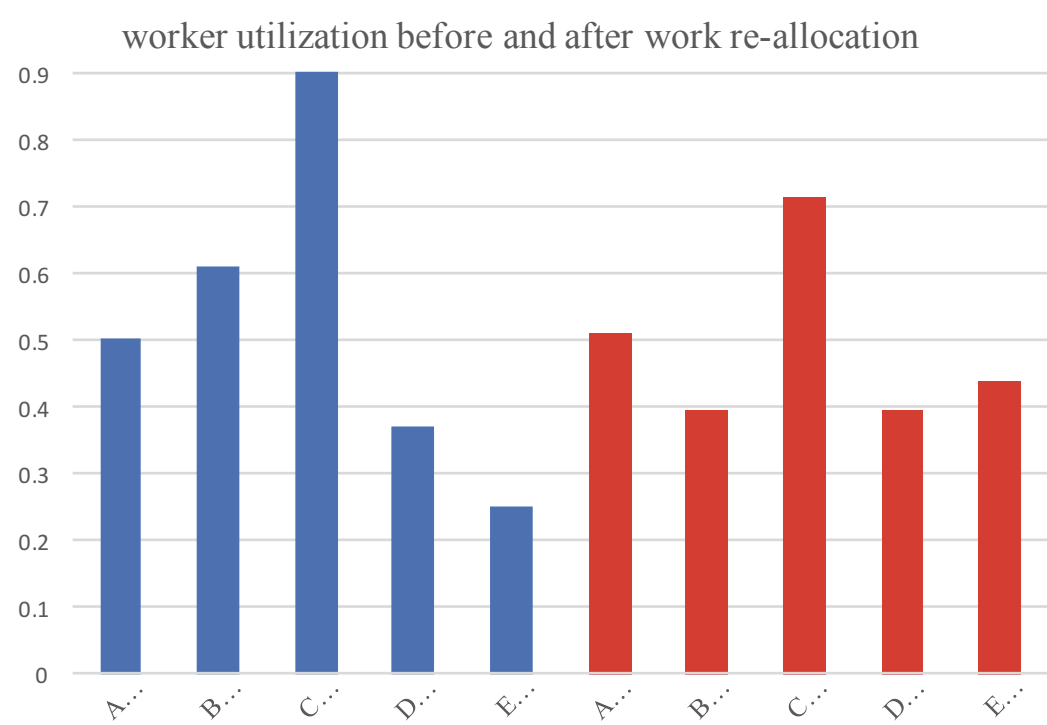
- Currently, there is uneven distribution of workload.
- With increase in goods inflow rate, there is significant increase in the worker utilization rate.
- The utilization of both worker B and C reaches 1 when increase in goods inflow rate reaches 50%.
- With increase in goods inflow rate, there is significant increase in the average waiting time for major tasks.
- When goods inflow rate doubles, the average waiting time increases more than 30 times. Some tasks even increase more than 50 times.

Recommendation

Manpower

Flexible manpower allocation

To allocate some of the tasks from worker B and C to worker E, so as to achieve a more equitable worker utilization. This could prevent worker B and C from becoming the bottleneck when workload increases in the future.



Utilization of both worker B and C drop, and utilization of worker E is now in the safety range. Worker utilization is more evenly distributed now.

Ergonomic aspect improvement

- Handling tips for minor material preparation
- Place materials at waist height to reduce bending
 - Maintain enough free space around pallets (to avoid awkward posture)
 - Grip materials firmly and bring it close to body
 - Use legs to push up the materials, not upper body or back
 - Avoid repetitive motions and frequent handling
 - Wear gloves or other hand and forearm protection for objects with sharp edges or splintered surfaces.
 - Introduce material handling equipment: such as hand trucks, dollies and pallet jacks

Machine & Method

Record down the exact location of the pallet

Label at each position: rack X layer Y depth Z
Knowing the exact location would reduce unnecessary movement and thus save searching time.

Increase label and barcode size

Our interview result with workers shows that,

1. Barcode scanning process is not user-friendly.
2. During the retrieval process, it is difficult to see clearly the label, and thus making it troublesome to recognize the correct pallets.

Thus increase label and barcode size would help to speed up their working process.

Impacts on average waiting time with 40% reduction in searching time (s)

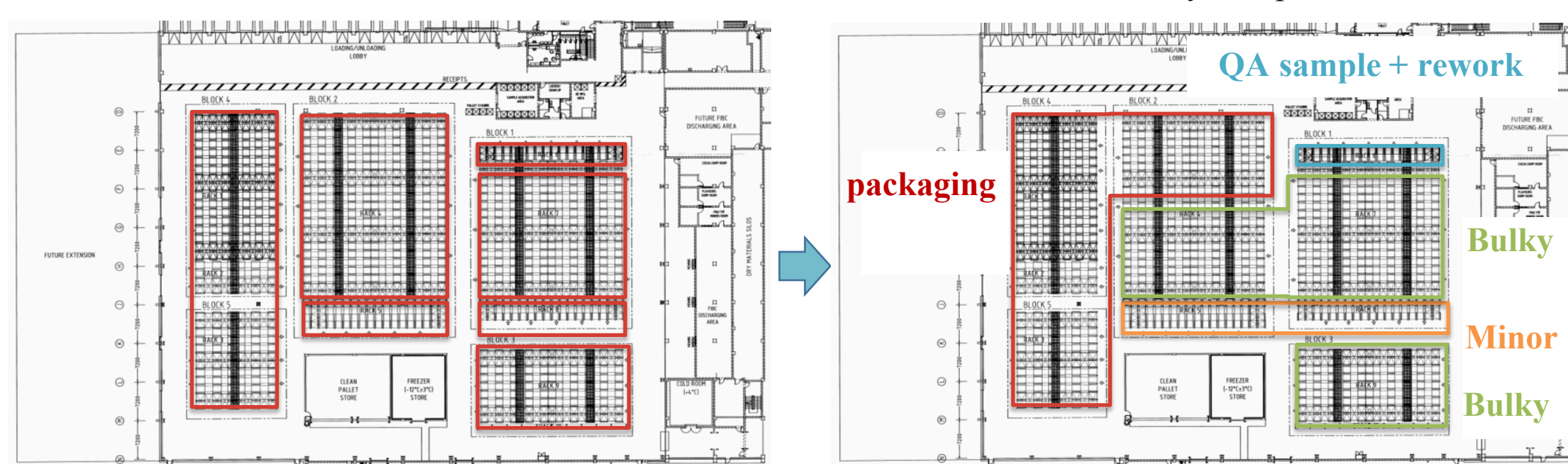
	Current	After	% change
Search_bulky	3442	2790	19%↓
Search_packaging	5780	4068	30%↓
Transfer_QA	2509	1970	21%↓
Search_minor	15710	12154	23%↓

When searching time is reduced 40%, there is significant decrease in average waiting time for major tasks.

Material

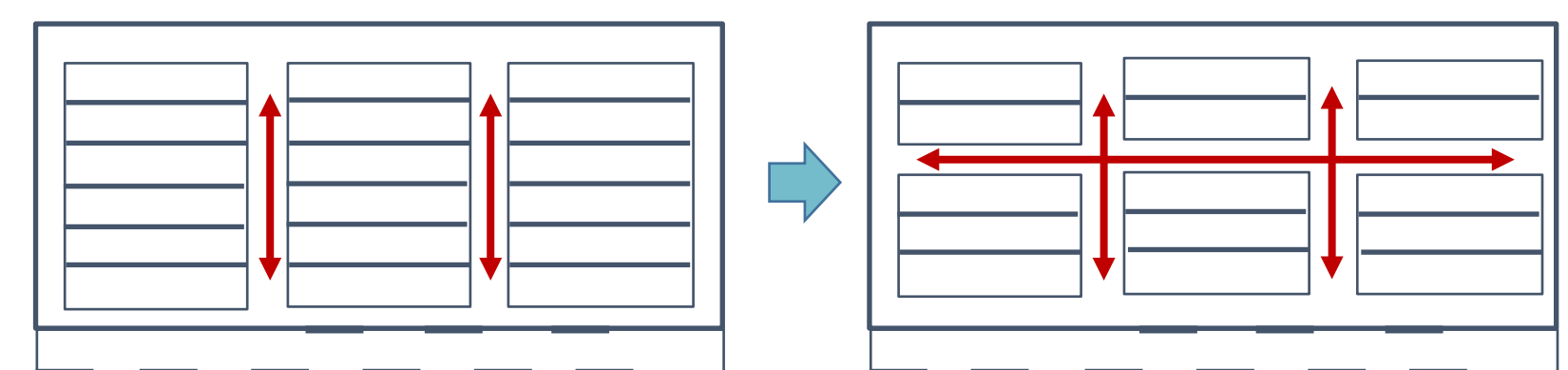
Material re-allocation

Currently, some of the different types of materials are stored in the same rack. Especially for minor materials, they are spread over 5 racks.



- After material re-allocation, warehouse is divided into 5 major areas, with each area storing only 1 type of material.
- Same type of material is stored in the same rack or adjacent racks. This would facilitate the workers during searching and retrieval process.

Environment



Grid network of aisles

Add cross aisles to main aisles.
Easier access to main aisles, faster and more efficient movement.

Drive-through racks vs Selective racks

	Drive-through	Selective
Rack depth	High	Low
Storage density	High	Low
Product variety	Low	High
Flexibility in retrieval	FILO	FIFO / FEFO
Accessibility	Low	High