1. Introduction

Background: Statistical Process Control (SPC) has a long success story in manufacturing operations. However, SPC is rarely used at warehouse level.

Objective: Exploit the warehouse data to identify possible issues in warehouse operations and develop management tools for process supervision and improvement.

Choice of Site: Distribution Centre Asia

- Second largest warehouse in Infineon’s global supply chain network
- Efficiency in warehouse management has large potential in further revenue contribution

Choice of Station: Packing Station

- High potential for process standardisation
- Steady feed of data through the system
- Intensive human factor -> High potential in applying management tools

2. Approach

Start

SPC control charting

Test chart out of control

Continue revising SPC charting, as it is needed

Stop

- The Ishikawa diagram below is used to identify the possible causes if an out-of-control is observed.

3. Data Analysis

3.1 Control Chart

1. SPC on packing time
- All packers combined/Each individual packer
- S charts out-of-control

2. SPC on fulfilment rate
- Monthly/Weekly/Daily
- R charts out-of-control

Conclusion: Current process at packing station is out-of-control

3.2 Identification of causes

Conclusion: The fall in fulfilment rate coincides with the surge in total DN and decreasing in median packing time per box.

3.3 Regression Modelling

Conclusion: Human factors contribute more to the performance at Packing Stations and currently there is no method to track each operator’s packing speed

4. Recommendation

4.1 Identified Assignable Causes

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge in DN -&gt; Drop in Fulfilment Rate</td>
<td>CLM contact customers for possible delay in delivery</td>
</tr>
<tr>
<td>Contract operators are not tracked consistently</td>
<td>Assign a consistent ID to every operator for better data quality</td>
</tr>
<tr>
<td>Lack of training for specific contract packer</td>
<td>Targeted training for contract packer</td>
</tr>
<tr>
<td>Long packing time not due to anomalies</td>
<td>Capture “pausing” of packing</td>
</tr>
<tr>
<td>Wrong products sent from High Racks</td>
<td>Check sheet for error frequency</td>
</tr>
</tbody>
</table>

4.2 Box Plot Management Tool

- Visualize operator’s performance and use Median and Variance to analyse operator performance
- Compare performance level among operators
- Compare performance level of a specific operator over time

4.3 Deliverables Package

- R program
  - Generate box plot for operators
  - Generate control charts for packing time and fulfilment rate
- Instruction Manual
  - How to use the program
  - How to make changes to the program

5. Conclusion & Possible Continuation

5.1 Conclusion

- SPC may not be suitable for warehousing due to intensive human operations involved at current stage.
- However management tool can be used to supervise and improve human operator’s performance.

5.2 Analysis on other station processes

- Implement real time data collection
- Analyse utilisation and identify bottleneck station

NUS Supervisors: Associate Professor Ng Szu Hui, Assistant Professor Michel Alexandre Cardin
Infineon Supervisor: Roxane Desmicht, Wong Kwang Yong, Low Sze Ping
Team members: Che Jia Yong Joshua, Li Jia Qi, Liang Jingyi, Lim Yong Kian, Nicolas, Ng Chon Beng, Pang Yuwei