ANALYZING THE EFFECT OF LINE-CELL CONVERSION ON MANUFACTURING SYSTEMS

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Abstract

The objective of our poster is to convert the traditional assembly line system to a cell system by cross training the workers. For this we are minimizing the total cost required to train workers while simultaneously trying to reduce the total throughput time as well as the processing times.

Graphical Abstract

Objectives

The main objectives of line-cell conversion are summarized in Table 1.

Table 1: The main objectives of line-cell conversion

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augment skilling required workforce</td>
<td>Aims at reducing workers</td>
</tr>
<tr>
<td>Cell formation</td>
<td>Main Objectives cell formation</td>
</tr>
<tr>
<td>Cell productivity manifold</td>
<td>Augments Single skilled</td>
</tr>
<tr>
<td>Shorter throughput</td>
<td>System allows manufacturing</td>
</tr>
</tbody>
</table>

Problem definition

The problem formulation is as follows:

Objective Function:

Minimize $z = \sum_{i=1}^{n} c_i x_i + \sum_{i=1}^{n} a_i y_i$

Subject to constraints:

$\sum_{i=1}^{n} a_i y_i = 1$, $\forall j$

$\sum_{i=1}^{n} c_i x_i = 1$, $\forall j$

$\sum_{i=1}^{n} a_i y_i = 1$, $\forall i$

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$\sum_{i=1}^{n} a_i y_i = 1$, $\forall j$

Methodology

The methodology is as follows:

1. Each cell is only capable of processing a single product type.
2. The workers are multi-skilled. It is highly preferable for a worker to perform all tasks on a product.
3. Since the number of workers in the cell system is more than or equal to the number of product types, in most cases only a single worker present in a particular cell.
4. The number of workers, before and after the reconfiguration of the production system, is fixed.

Mathematical Formulation

The mathematical formulation is as follows:

Objective Functions:

$\text{Minimize } z = \sum_{i=1}^{n} c_i x_i + \sum_{i=1}^{n} a_i y_i$

Subject to constraints:

$\sum_{i=1}^{n} a_i y_i = 1$, $\forall j$

$\sum_{i=1}^{n} c_i x_i = 1$, $\forall j$

$\sum_{i=1}^{n} a_i y_i = 1$, $\forall i$

$\sum_{i=1}^{n} c_i x_i = 1$, $\forall i$

$\sum_{i=1}^{n} a_i y_i = 1$, $\forall j$

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$\sum_{i=1}^{n} c_i x_i = 1$, $\forall j$

Conclusion

Some production systems are a new kind of manufacturing systems that entered in Japan because of the changing market conditions which include high variety and low demand. Although many developed the model successfully, there are many problems that need to be considered.

References


