Garment industry over the years has adopted various key performance measures from different industries and invented some of their own. In the third part of the article series, Mausmi Ambastha, a budding entrepreneur providing IT solutions for the apparel industry, Director and Founder of intelloCut, with years of experience as a consultant and a former faculty at NIFT, discusses a collection of performance metrics being used in the industry, for enhancing both the operational and financial performance of a business. Some of these measures may not be part of scientific analysis or give a holistic picture but they do serve the purpose for which they have been designed and are being successfully used.

Performance Measurement Tools – 3
Cutting and Production Planning

In the third part of the article series on Simple Performance Measurement Tools, the author discusses performance measures from cutting, planning and human resource related areas. Cutting is considered to be the most important operation in apparel manufacturing because firstly, it handles the costliest material resource – the fabric. Secondly, the spreading and cutting process is irreversible; the concept of repair or alteration does not work here. Further, and most importantly, due to over-emphasis on measuring sewing department performance, there is a sheer neglect of measuring the spreading, cutting and planning performance. This results in building up inefficiencies, leading to erosion of cost advantages.

Cutting

The performance metrics in this department are mostly focussed on fabric, the most expensive resource.

Material Productivity: This is an indicator of the output or value generated per unit of material used.

\[
\text{Material Productivity} = \frac{\text{Output (value or unit or value added)}}{\text{Value of raw material used}}
\]

This is a fundamental re-examination of how, when and why materials are used. This measure shows how effectively material is used through the system. Any material left in the fabric store is also a waste as it will be disposed of at a much cheaper rate. This is not a very common metric in garment industry but has been extensively used in textile industry. As per the PhD thesis, “A Study of Productivity and Financial Efficiency of Textile Industry of India”, submitted by Zala, Virambhai S to the Saurashtra University in 2010, the average material productivity of Textile Industry is 4.07. This study was done on financial data of seven prominent textile companies of India.

Example: Factory XYZ bought 4200 metres of fabric at the cost of Rs. 46 per metre for order A1. They produced 2000 garments and sold them at the cost of Rs. 300 each.

Therefore, Material Productivity is \(\frac{2000 \times 300}{4200 \times 46} = 3.10\).

Therefore, order A1 generated Rs.3.1 per Rs.1 of material used.

Marker Efficiency: This is the ratio of fabric actually used on the marker to total available fabric.

\[
\text{Marker Efficiency} = \frac{\text{Area of marker used for garments}}{\text{Total area of marker}}
\]

Area of marker used for garment: The CAD system calculates the area of all the patterns placed on the marker.

Total area of marker: This is simple multiplication of length x width.

Marker efficiency above 80% to 85% is considered good. However, this value can vary depending on the pattern shapes (say bias skirts) and restrictions on pattern placements.
“Both the aspects of cutting and spreading handle the most costly raw material – the fabric, and their operations are also irreversible in nature. Still due to overemphasis on the sewing floor, there is sheer neglect in measuring various critical aspects of both the spreading and cutting departments. The measures discussed would surely serve as a stepping stone for an apparel manufacturer.” – Mausmi Ambastha

(say for stripes and plaids). This is an important indicator to decide on the quality of marker or whether by changing the position of the patterns the CAD operator is improving on the marker or not.

It is often observed that 80% of the garments are cut by 20% of the markers. Therefore, effort should be expended to improve marker efficiency of these 20% markers which can result in significant amount of savings.

One should note that the marker efficiency only states the quality of marker, there is still room for material wastage in a lay in terms of end loss, width loss and mismanaged end-bits.

**Marked Consumption:** Consumption of a garment calculated as per the markers made by the CAD department. In order to calculate this metric the following steps have to be followed:

- Make a cut order plan stating markers and no. of plies for each lay.
- Make all the markers.
- Calculate total length of fabric being used on the lays.
- Divide this value by total garments to be produced.

*Example:*

<table>
<thead>
<tr>
<th>Cut Order Plan</th>
<th>Markers</th>
<th>S</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lay 1= 100 plies</td>
<td>S-1, M-1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Lay 2= 50 plies</td>
<td>M-2</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

100 pcs. of S & 200 pcs. of M

Marker lengths: S-1, M-1 = 3.8 metres, M-2 = 4.1 metres

Total fabric needed = 3.8X100 + 4.1X50 = 585 metres

**Marked fabric consumption =** 585/300 = 1.95 metres. This value does not include wastages such as end loss or end bits.

**Achieved Consumption:** This is the actual consumption achieved per garment after the whole production process is completed. This requires extensive calculation but the result gives a realistic image of loss of material in the system.

**Achieved consumption =** Total fabric bought for the style / Total garments shipped

The above formula will show final achieved consumption. The losses on material incurred by the whole factory in terms of dead stock, end bits and cutting room losses, part change and rejection in sewing, rejection in finishing as well as unshipped garments are included in this calculation.

If user wants to measure only cutting room achieved consumption then the formula should be slightly altered. Total fabric issued to cutting divided by total cut garments issued to sewing department will show the achieved consumption of cutting room.

*Example: For the previous example 640 metres of fabric was finally bought(9.4% more than that required) out of which 630 metres was issued to cutting department. The cutting room records show cutting of 315 garments. The factory finally shipped 290 garments. 25 garments were rejected in the process.*

Achieved consumption (factory level) = 640/290 = 2.21 metres (11.8% wasted)

Achieved consumption (cutting room) = 630/315 = 2 metres (2.5% wasted)

**Fabric Utilization:** This is the ratio of fabric used on garments to fabric available to be used. This metric tells us the fabric utilization status of the entire order. Fabric generally costs 60% to 70% of the cost of the garment. Strict controls should ensure that every inch of the fabric is used properly and is accounted for.

Fabric utilization = Fabric used on garments / Total fabric available

Total fabric available = Fabric allocated or bought for the order.

Fabric used on garment = This can be calculated in following ways.

- **By weight**
  - i. Weigh one garment of each size (garment should be weighed before sewing)
  - ii. Multiply weight with number of garments cut in each size.
  - iii. Divide total weight by GSM and fabric width to get total metres used in garments.

- **By Length**
  - i. Multiply Marker length with its Marker efficiency and number of plies laid in the marker.
  - ii. The above calculation is done for each marker in the order and then sum of all gives the total metres used in garments.

The above will give fabric utilization for the order. The formula can be extended to calculate overall fabric utilization for the factory in a month.

*Example: As per the previous example Total Fabric available = 640 metres

The fabric weight is 110 GSM and the fabric width is 1.07 metres. The markers as mentioned in previous examples are shown below:
Efficiency of a cut order plan is defined by the number of plies and lays it suggests. An inefficient cut order plan results in 4-6 cm end loss per ply, lower marker efficiency, more labour time in cutting, besides substantial amount of fabric wastage.

<table>
<thead>
<tr>
<th>Markers</th>
<th>Marker length</th>
<th>Marker efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lay 1=  100 plies</td>
<td>S-1, M-1 = 3.8 metres</td>
<td>85%</td>
</tr>
<tr>
<td>Lay 2= 50 plies</td>
<td>W-2 = 4.1 metres</td>
<td>80%</td>
</tr>
</tbody>
</table>

Fabric used in the garment:

a. By weight
   - Weight of size "S" garment = 187.1 gms, size "M" garment = 193 gms
   - Total weight of order = (100 X 187.1) + (200 X 193) = 57310 gms
   - Total metres used on garments = 57310 / (110 X 1.07) = 487 metres

b. By Length
   - Marker 1 = 3.8 X 0.85 X 100 = 323 metres,
   - Marker 2 = 4.1 X 0.80 X 50 = 164 metres
   - 323 + 164 = 487 metres

Both the formulas achieved the same result. The factory can use either of the methods for calculation. Fabric utilization = 487 / 640 = 76.10%.

Cut order plan: A cut order plan is effective if it uses least number of plies and least number of lays while cutting an order. An ineffective cut order plan can result in following losses:

a. Additional 4 cm to 6 cm end loss on every increased ply
b. Smaller markers may have lower marker efficiencies.
c. Higher number of plies and lays result in more labour time in laying and cutting
d. Higher number of plies and lays may result in higher end bits and fabric wastages.

It is possible to calculate least number of possible plies and least number of possible lays for an order.

Least possible plies = \( \frac{Total \ order \ quantity}{Maximum \ pieces \ allowed \ in \ a \ marker} \)

Least possible lays = \( \frac{Total \ order \ quantity}{(Maximum \ pieces \ in \ a \ marker \ X \ Maximum \ plies \ in \ a \ lay)} \)

It should be noted that it is always possible to achieve the above least possible numbers if the orders are properly planned. There may be slight variation of 1% in case of multiple colour orders. For some specialized cases like placement prints, this formula may not give the achievable solution.

The factory can compare actual with least possible solutions and check if their cutting room managers are following the above systems and using the available fabric in best possible way.

Production Planning

It is defined as “The technique of foreseeing or picturing ahead every step along series of separate operations; each step to be taken in the right place, of the right degree and at the right time, and each operation to be done at maximum efficiency.” – in “Production Management and Productivity” by Dayal. R. et al.

Cut to Ship Ratio: This shows the percentage of garments shipped out of total number of garments cut for the order. It shows a bird’s eyeball of the entire system. A number close to 98% will be considered very well. This means only 2% of garments are rejected or lost in the system.

Cut to ship ratio = \( \frac{Total \ pieces \ shipped}{Total \ pieces \ cut} \)

Total pieces cut: This should be taken from cutting room daily records. This should be from final packing list.

Labour Cost per minute: This is a very important metric while calculating the price of a garment. It helps to quickly calculate the labour cost that will be incurred in production of the given garment.

\[
\text{Labour Cost per minute} = \frac{Total \ cost \ incurred \ on \ labour}{Total \ available \ working \ minutes \ X \ No. \ of \ labour}
\]

This can be calculated over a month or a year to give an accurate value to cost per minute.

To calculate labour cost of a new order, its standard minute is calculated and then multiplied to cost per minute and efficiency to get the actual labour cost that will be incurred during its production.

Example: Factory XYZ has 400 direct sewing operators and helpers. The cost to company for these 400 operators is Rs. 32,00,000 per month. The company works for 8 hours per day for 24 days in a month. Therefore, total working minutes per operator = 11,520 minutes per month.

\[
\text{Cost per minute} = \frac{32,00,000}{11,520 X 400} = Rs. 0.69 \ per \ minute
\]
Plan Performance Index: This shows the percentage of variation between the planned work and the actual work done.

\[
\text{Plan Performance Index} = \frac{\text{Achieved production}}{\text{Planned production}} \times 100
\]

This helps in evaluating how efficient is your factory plan in order to meet your delivery dates. The ideal value is 100% but a 97% hit rate should be considered good.

This is just a representative figure and further investigation is required to investigate the results. Overtime, work outsourcing, vendor delay, quality can affect this index value and the result may need further investigation. For example a 100% PPI may have been achieved by doing a lot of overtime which is not the expected result.

On-time Delivery: This represents the percentage of deliveries that a factory is able to make on-time without any delays or extensions.

\[
\text{On-time Delivery} = \frac{\text{On-time delivery}}{\text{Total deliveries}} \times 100
\]

An on-time delivery means that the products are delivered exactly on the date the exporter has promised to the customer. A before time delivery is equally bad as a late delivery as it needs the buyer to spend on warehouse space and money. This simple indicator is a very important factor in most buyers' books to evaluate their factory performances.

Capacity Utilization: Extent or level to which the productive capacity of a factory is being used in generation of goods. Therefore, it refers to the relationship between actual output that 'is' produced with the installed equipment and manpower, and the potential output which 'could' be produced with it, if capacity was fully used.

\[
\text{Capacity utilization} = \frac{\text{Produced garments or minutes}}{\text{Capacity in terms of garments or minutes}} \times 100
\]

If the factory makes standard product, capacity can be expressed in terms of number of pieces. However, if there is a huge variation in the products produced, then the unit of measure should ideally be number of minutes produced. This is summation of each garment produced multiplied by its standard minute value.

\[
\text{OTIF} = \frac{\text{Total number of deliveries}}{\text{Total working time}} \times 100
\]

OTIF: OTIF (On Time In Full), or DIFOT (Delivered In Full On Time), is one of the fundamental measurements for logistics performance. It measures, weather the Supply Chain was able to deliver on time or not -

- The expected product (reference and quality)
- In the quantity ordered (with the tolerance defined by the customer)
- At the place agreed
- At the time expected by the customer

To reach a good OTIF level, all the functions of the supply chain (among which orders taking, procurement, suppliers, warehouses, transport...) have to work at their best level. OTIF allows seeing at a glance; how the company delivers its customers.