Improving Plant Efficiency and Quality Using Automation

Anil Kelkar,
Chief - Group Manufacturing - Polyester,
Reliance Industries

Sept 30, 2006
Reliance Group - An Overview
India: A Textile Hub

Textile Industry Contributes

- 5% of GDP
- 14% of industrial production
- 21% of work force
- 20% of export earnings

Employs around 35 million people
Indian Textile Industry

Exports to grow at a CAGR of 29%

Source: Ministry of Textiles
# Reliance Industries

India’s largest private sector enterprise

<table>
<thead>
<tr>
<th></th>
<th>USD Billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>16.7</td>
</tr>
<tr>
<td>Net Profit</td>
<td>1.7</td>
</tr>
<tr>
<td>Cash Profit</td>
<td>2.6</td>
</tr>
<tr>
<td>Exports</td>
<td>5.8</td>
</tr>
<tr>
<td>Market Cap</td>
<td>18</td>
</tr>
</tbody>
</table>
## Historical Growth

A track record of sustained high growth rates

<table>
<thead>
<tr>
<th>CARG</th>
<th>Since 1977 (%)</th>
<th>Last 5 years (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td>Net Profit</td>
<td>34</td>
<td>26</td>
</tr>
<tr>
<td>Assets</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>Market Cap</td>
<td>42</td>
<td>25</td>
</tr>
</tbody>
</table>

1977 is the year of IPO
Backward vertical integration has been the cornerstone
Global Ranking: 2005

<table>
<thead>
<tr>
<th>Product</th>
<th>Rank</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>POY/ PSF</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>PTA</td>
<td>6</td>
<td>1.3</td>
</tr>
<tr>
<td>MEG</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>PX</td>
<td>3</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Global leadership in all major product lines
“To continuously grow on a sustainable basis and be the largest, the most innovative, the most profitable and the most admired polyester producer in the world”
Reliance Polyester Capacity

Reliance touched 1 million ton mark in 2002

2 million tonnes (2006)

10 KTA (1982)
Major Polyester Manufacturers

Yesterday
• DuPont
• Hoechst
• ICI
• Rhone Poulenc

Today
• Reliance
• Nan Ya
• Far Eastern
• Yizheng
Quality Assurance

Reliance Industries Limited

Quality Policy

We at RIL are committed to total customer satisfaction in terms of quality and services for the entire range of our products. Our continued commitment to excellence and innovative efforts help us stay ahead as market leaders.

Mukesh D. Ambani

- Six Sigma quality management
- ISO 9002 Certified
- Labs for quality control and process control
- Processing facilities for applications & customer support
- Product development support

Total Customer Satisfaction
Process Management

- To support such a growth scale and to do it effectively by increasing operating efficiencies and product quality AUTOMATION is a must.

- Business processes involves key processes, support processes and sub-processes. Typical business processes include
  - Procurement
  - Product development
  - Production
  - Order delivery
  - Distribution
  - Customer support
Automation helps to

• Receive customer order through SAP.

• Plan raw materials through SAP.

• Measure usage of raw materials.

• Sense, monitor, compare and correct the process parameters of the chemical and physical processes involved.

• Sense online quality measurement and integrate with offline measurement and use for product grading and release.

• Store and despatch product.
Automation also helps to

- Monitor machine reliability/run hours/uptimes/vibration levels.

- Based on PM schedules through SAP indicate which machines are to be stopped/ spare parts changed/overhauled.

- Define manpower requirement based on machine reliability.

- Processes can be monitored from any remote location through use of interfaces and data transmission, helps in reducing manpower.

- Manpower productivity can be measured and, every unit of product can be identified by the crew which produced it. This can also be used to define training needs of operating persons.
Automation - raw materials

• Monitors receipts based on flow meters, tank level indicators, weighbridges, updates using SAP system

• Monitors daily/hourly usages using plant instrumentation. Gives feedback to SAP.

• Controls usage based on product requirement

• Gives warning if usage ratios are deviating.

• Raises purchase requisitions if stock is depleting based on desired stock levels.
Automation in process control

- Processes can be chemical or physical in nature.
- Chemical processes will involve reaction rates / absorption / evolution of heat / phase separations.
- Physical processes will involve flows, mass transport / heat transfers. separation with settling, centrifuging, leaching, distillation etc.
- All these can be efficiently measured and controlled using automation and auxiliary tools like model simulations, image comparisons.
Automation in quality measurement

• Automation can measure quality on line and do product gradation.

• It can take offline quality releases and integrate it with process automation and grade the product produced today where
  - raw material was put into process at earlier time periods.
  - there was some deviation from a desired value in any point in process during the production period.

• Based on results and statistical analysis it can tell whether overall process or parts of it are stable or not.

• By integration of Laser systems even Visual checks can be done on products.
Automation storage and Product Despatch

Based on lab releases and product volumes and data on storage

Automation can

• Move the product to areas and keep track of the product.

• Automatic stacking and retrieval systems-ASRS- As order comes in it can from the order, decide what product to be picked up and knowing the location, pick it up and take it to despatch, pack, box, wrap, palletise, and take it to despatch gantries for sending out by truck/rail or containers as the case may be.

• Keep an inventory and give alarms on low / hi stocks / non moving products etc.
Automation in cost control

- Measure usages- raw materials, energy, water, products and byproducts produced, wastes generated.
- Calculate efficiencies based on usages of raw materials, energy, spare parts, machine run hours.
- Point out steps in process which are main weak points in terms of usages etc.
- Benchmark between various sites finding the most suitable operation.
- Inventory control in terms of raw materials, products, additives, packaging materials, stores and spares.
Automation and Quality Improvement

• Gradation without subjectivity.

• Gradation not subject to “Chal jayega” syndrome

• Untouched by human hands, no oil stains / fingerprints; No mix-ups of different grades of products.

• Process parameters monitoring can be used for product gradation even in absence of online monitoring-use of soft sensors. Product by Process can be really implemented.

• Product traceability; All history of processes and Lab releases available, product can be traced to its origin even when it is consumed at customer.
Continuous Polymerization & Spinning DCS → Quality rules server

On-Line System → Quality Data

Testing Lab → Quality Data • Identity

Quality rules server → Time-stamp Start / end

Quality Data → Limits Input

Limits Input → Quality rules server

Limits Input → Quality Data

Limits Input → Quality Data

• Compare
• Compile
• Final Quality / Identity

Quality Release to Auto Packing System
Event Processing - Logic

- IP21 protocol to send process data from process - DCS on continuous basis.
- Quality rule book to be defined by operator.
- Quality routine to be run in server to determine the quality segregation.
- Quality server to indicate the time stamp for quality segregation and grading.
- Use the time stamp and unique doff numbers on m/c for product segregation.
Benefits of Product by Process

• Monitoring of processes for eliminating reasons of Quality defects.
• The product released by such integrated system can
  – accept Increase in texturing machine speeds
  – has reduced texturing breaks
  – has reduced OLT rejects
  – reduced customer complaints.
• Product by process is capable of eliminating routine lab testing.
• Improvement in product quality / consistency.
• Reduction in testing waste.
• Improved packing system utilization.
• Effective predictive maintenance for process pumps, ceramic guides, finish applicator tip changes etc.
• Improved product image and premium on products.
The system consists of the following main areas:

- Doffing system
- Bobbin processing, inspection and Laboratory areas
- Interim Storage area
- Packing area

- POY Bobbins are received from Winder through Auto Doffers.
- Transported to Automated Testing Machines through Shuttles.
- Bobbins are stored on intermediate storage carousals.
- Auto Release System - bobbins are unloaded automatically and placed on respective conveyors to Carton or RU packing.
Salmoiraghi Automatic Doffers in operation
Bobbin-transport Shuttles in the existing Hazira Plant Textile Laboratory
APHS
Automatic Product handling System

Typical Bobbin Transfer Station
Three-tiered Carousel Tower installed in the existing Hazira Plant
Film-bagging machine
TRANSPORT UNIT
Auto Ware House – Flow Diagram

- **POY LAG AREA**
- **RECEIPT**
- **STORING**
- **RETRIEVAL**
- **POY/FDY & PSF AUTOMATED WAREHOUSE**
- **PSF RELEASE (LAB)**
- **BALES SEGREGATION AREA (Rejected)**
- **PSF BALER AREA**
- **REJECTED UNITS**
- **ON LINE GRADATION**
- **LOADING BAYS**
- **LOADING**
- **BACK STORING**
- **BACK STORING**
Material Flow Diagram – Auto warehousing (Peak)

**SRM transport assignments**
- *In feed:* 146.5 PLT/Hr
- *Out feed:* 259.5 PLT/Hr
- *Total:* 406.0 PLT/Hr

**Production plant – PSF**
- 20 hours
- 4 Lines, 8 Balers, 680 Ton/day
- Peak Factor: 20%

**Production plant**
- 20 hours
- 21POY + 2 FDY M/C, 660 Ton/day
- Peak Factor: 20%

**Auto Warehouse**
- PSF Capacity: 12,000 Cells
- POY/FDY Capacity: 18,400 Cells (consider peak and 85% storage utilization)
- Total Storage Capacity: 30,400 Cells

**Shipping**
- 12 hours: 10 dock
Concluding

Automation in Industry helps to improve efficiencies and quality

• By sensing
• By monitoring and comparing
• By predicting and controlling
Thanks