THE CONCEPTION OF INDUSTRY 4.0 IN THE ENVIRONMENT OF PULP AND PAPER COMPANIES IN INDIA

Presentation by:
Dr. S P Singh & B K Mishra

IPPTA Conference: Automation for process, asset, productivity, quality and marketing optimization
Content

✓ Introduction
✓ Technology Trends
✓ Pillars of Industry 4.0
✓ Organization Transformation
✓ Digitization in JKPM
   ▪ Technology upgradation
   ▪ Continuous improvement
✓ Rewards and recognitions
✓ Way Forward
Strategic location:
JKPM located close to raw material sources

Strong distribution Reach:
✓ 4 Regional offices
✓ 7 Warehouses
✓ 165 Distributors
✓ over 3,500 dealers

Product Mix:
Uncoated paper  291,000 TPA
Coated paper  55,000 TPA
Packing Board  90,000 TPA
Saleable Pulp  15,000 TPA
TOTAL:  455,000 TPA
Genesis of Plant

- **First** Indian paper company to get TPM certification from JIPM, Japan 3rd Paper company in the world.
- **First** Paper Mill to have ISO 9001, 14001 & OSHSAS 18000
- **First** to invest in World Class Pulp Mill (Fiber Line from Metso)
- **First** to successfully Brand Paper in Indian Market
- **First** to introduce Surface Size Wood Free Paper.
Overview of JKPM

- **Wood Handling**: 160 TPH
- **ClO₂ Plant**: 12 TPD
- **Pulp Mill**: 2,200,000 TPA
- **Paper Mill**: 3,000,000 TPA
- **Steam & Power Plant**: 55 MW
- **Recovery Island & Boiler**: 1,400 TPD
- **Converting line**: Paper
Progress in Automation with Industrial Revolution

**The 4th Industrial Revolution - "Industry 4.0"**

- **Drivers**
  - Quality of life
  - Engineering Sciences

- **Mobility**
- **μelectronics**

**1st**
- **Steam engine**
- **1782**
- **GB**

**Power generation**
- **Mechanical automation**

**2nd**
- **Conveyor belt**
- **1913**
- **US**

**Industrialization**

**3rd**
- **Computer, NC, PLC**
- **1954**

**Electronic Automation**

**4th**
- **ICT**
- **Cyber Physical Systems**
- **2015**

**Smart Automation**
Today is not the digitization of products, but the digitization (and resulting virtualization) of entire business models.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Widget Winners</th>
<th>Digit Winners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book retailing</td>
<td>Borders</td>
<td>Amazon</td>
</tr>
<tr>
<td>Movie rentals</td>
<td>Blockbuster</td>
<td>Netflix</td>
</tr>
<tr>
<td>Mobile phones</td>
<td>Nokia</td>
<td>Apple, Google</td>
</tr>
<tr>
<td>Online communication platform</td>
<td>AOL</td>
<td>Facebook</td>
</tr>
<tr>
<td>Photographs</td>
<td>Kodak</td>
<td>Flickr, Shutterfly</td>
</tr>
<tr>
<td>Maps</td>
<td>Rand McNally</td>
<td>TomTom, Garmin, Google</td>
</tr>
</tbody>
</table>

Got thrown by new technology wave
Key Industry 4.0 Technologies

✓ Cloud computing
✓ Internet of Things (IoT)
✓ Industrial Internet of Things (IIoT)
✓ Cyber Physical Systems
✓ Smart Factory
✓ Big Data
Cloud computing is a way of managing large numbers of highly **virtualized resources** such that from a management perspective, they resemble a single large resource. This can then be used to deliver services.
Commercial Clouds

Amazon Elastic Compute Cloud (Amazon EC2) - Beta

Appistry

Citrix®

3tera™

Q-layer

GOGRID beta

b-hive

Path®

Cycle Computing

Microsoft

VERIO

Sun

TAP INTO THE POWER OF NETWORK.COM

Engine Yard™

VM VMOps

Creating Lasting Impressions
"Thing" connected to the Internet

<table>
<thead>
<tr>
<th>World Population</th>
<th>Connected Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3 Billion</td>
<td>500 Million</td>
</tr>
<tr>
<td>6.8 Billion</td>
<td>12.5 Billion</td>
</tr>
<tr>
<td>7.2 Billion</td>
<td>25 Billion</td>
</tr>
<tr>
<td>7.6 Billion</td>
<td>50 Billion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connected Devices Per Person</th>
<th>2003</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.08</td>
<td>1.84</td>
<td>3.47</td>
<td>6.58</td>
</tr>
</tbody>
</table>

More connected devices than people
Opportunities

Intelligent Systems for a More Connected World

WHAT ARE INTELLIGENT SYSTEMS?

Intelligent Systems are devices that transform how we travel, shop, make things and more.

CONNECTED

7 Connected Devices per Person
By 2020 each person will own an average of 7 connected devices.

COMMUNICATIONS

71% of Shoppers are Multi-Channel based on respondents planning their 2011 holiday shopping.

RETAIL

23.6M Connected Cars
23.6 million cars will have Internet access by 2016, rising from 8.7 million in 2010.

VEHICLES

#2 Data Breach
Medical data disclosure is the second most breached source of data.

MEDICAL

#30% Annual Growth Rate
Projected increase in connected machine-to-machine devices over the next 5 years.

INDUSTRIAL
Enabling Technology

State of the Art of IoT

RFID

Sensor

Smart Tech

Nano Tech

To identify and track the data of things

To collect and process the data to detect the changes in the physical status of things

To enhance the power of the network by devolving processing capabilities to different part of the network.

To make the smaller and smaller things have the ability to connect and interact.
Case Study

First show on "female foeticide" gathered 14 million responses from all sources.

Perfect example how Big Data can be used to deliver maximum impact on society.

Impact

1,249,440,319 Connections
14,972,514 Responses
9,319,034 Community members
What Makes it Big Data?

Volume, Velocity and Verity

- **Validity**: Is the data correct and accurate for the intended usage?

- **Veracity**: Are the results meaningful for the given problem space? Veracity deals with uncertain or imprecise data.

- **Volatility**: How long do you need to store this data?
What Makes it Big Data?

- Volume
- Velocity
- Variety

SOCIAL
BLOG
SMART METER

187.6
Data Volume: Growing Exponentially

- **Humanity Passes 1 Zettabyte Mark in 2010**
  A zettabyte is $1,000,000,000,000,000,000,000$ bytes (that's 21 zeroes for those counting), or one trillion gigabytes. That's enough data to fill 75 billion 16-gigabyte-sized iPads.

- **Estimated Global Data Volume:**
  - 2012: 1.8 ZB
  - 2015: 7.9 ZB

- **The world's information doubles every two years**

- **Over the next 10 years:**
  - The number of servers worldwide will grow by 10x
  - Amount of information managed by enterprise data centers will grow by 50x
  - Number of “files” enterprise data center handle will grow by 75x

Source: [http://www.emc.com/leadership/programs/digital-universe.htm](http://www.emc.com/leadership/programs/digital-universe.htm), which was based on the 2011 IDC Digital Universe Study
Applications for Big Data Analytics

- Smarter Healthcare
- Multi-channel
- Finance
- Log Analysis
- Homeland Security
- Traffic Control
- Telecom
- Search Quality
- Manufacturing
- Trading Analytics
- Fraud and Risk
- Retail: Churn, NBO
Organizational Transformation
IPM for Process Industries

People

Systems

Equipment

Collaboration
IPM for Process Industries

Creating Lasting Impressions
Digital Infrastructure in Industrial Revolution 4.0

Digital Integrated Manufacturing Unit

- Stores
- HR
- Finance
- Manufacturing
- Purchase
- Sales
Digital Manufacturing in New Plant

Integrated Manufacturing

Coal Handling
CFBC TG

Oxygen Plant
ClO₂ Plant

Chipper House
Pulp Mill
PD Plant
Coating Plant

Evaporator
Recovery Boiler
Causticizing Plant
Lime Kiln

Rewinder

Godown

Converting Dispatch

Paper Machine

DCS-1
(ABB)

DCS-2
(SIEMENS)

PMS
Intelligent MCC

Intelligent MCC

ERP

JK PAPER ....... Creating Lasting Impressions

Slide No. - 24
Automation Scenario at JKPM

Manufacturing

Quality

Utility

Environment

Business
## Kappa Analyzer

<table>
<thead>
<tr>
<th>Area</th>
<th>Pulp Mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salient features of Automation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Continues Quality Monitoring</td>
</tr>
<tr>
<td></td>
<td>✓ Savings of Chemical due to online kappa measurement and control.</td>
</tr>
<tr>
<td></td>
<td>✓ Four Stream analyzer.</td>
</tr>
</tbody>
</table>

![Image of Kappa Analyzer](image-url)
Advantages:
✓ Continuous Monitoring of Quality
✓ Easy Trouble Shooting
✓ Break Event Library
✓ Analyzing Each Break Events
## Automation in Hydraulic system

### Manual Process vs. Embedded Controls

<table>
<thead>
<tr>
<th>Area</th>
<th>Paper Machine-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salient Features</td>
<td>• Reduce the cabling due to Profibus.</td>
</tr>
<tr>
<td></td>
<td>• High Accuracy due to Embedded flow and pressure control in the valve.</td>
</tr>
<tr>
<td></td>
<td>• Programming/parameterization with PC software</td>
</tr>
<tr>
<td></td>
<td>• Fail Safe Position</td>
</tr>
</tbody>
</table>
Automatic Slitter adjustment

<table>
<thead>
<tr>
<th>Area</th>
<th>Rewinder - Paper Machine-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salient Features</td>
<td>• Automatic Set Changing Process</td>
</tr>
<tr>
<td></td>
<td>• No manual intervention</td>
</tr>
<tr>
<td></td>
<td>• Precision control</td>
</tr>
<tr>
<td></td>
<td>• Enhance Safe work environment</td>
</tr>
</tbody>
</table>
### Automatic Storage and Retrieving System

#### Manual vs Automatic

<table>
<thead>
<tr>
<th>Area</th>
<th>Converting Section</th>
</tr>
</thead>
</table>
| Salient Features | • Vertical storage  
                   | • Order management  
                   | • Transport management  
                   | • Stock management  
                   | • Location Management  
                   | • Optimized material flow  
                   | • Graphical monitoring logging facilities of movements & events |
Power Management System (PMS)

Advantages of PMS

✓ Load Shedding on Frequency Drop, Power Loss.
✓ Monitoring of running loads.
✓ Status of all breakers and relays.
✓ Integration with DCS

PMS Monitoring Station

- Load Shedding on Frequency Drop, Power Loss.
- Monitoring of running loads.
- Status of all breakers and relays.
- Integration with DCS
The significant features of the Power management systems as,
✓ Load Shedding on Frequency Drop, Load Difference and Power Loss.
✓ Manual Load Shedding.
✓ Communication with all relays.
✓ Monitoring of running loads.
✓ Status of all breakers and relays.
✓ Alarm and events logging.
✓ Shift/Day/Monthly Reports & Energy Reports
Wireless LAN Among Distant AAQMS

J K P M 2 (AAQMS 2)
J K P M (AAQMS 1)
Central Station XR PREMIUM

SAM WI

LAN Communication

✓ SO₂ – AF 22M
✓ NOₓ – AC 32M
✓ CO – CO 12M
✓ RSPM – MP 101 LCD (PM_{2.5}/PM_{10})

DIGITAL Display

RSPM 30.5 μg/m³
In OPP & PSI following technologies are being used as,
✓ Business Intelligence
✓ Data mining
✓ Big data
✓ Historian
✓ Multi dimensional analysis
✓ Operator assistance
✓ Asset management
✓ Soft and smart sensor
✓ Advance process control
✓ Daily management
✓ Regulatory control and many others
Benefits

✓ Powerful signal processing & statistical data analysis
✓ High potential saving in chemical usage
✓ Optimized controlled loop for process stability
✓ Less variation
✓ Reduction in waste
✓ Increased equipment availability & reliability
Quality Management

Quality Planning

Quality Improvement

Quality Assurance

Quality Control
LiDAR: What and Why?

- LiDAR stands for Light Detection and Ranging
- LiDAR is not only replacing conventional sensors, but also creating new methods

**Ariel LiDAR System & Components**

- Aircraft
- Scanning laser emitter-receiver unit
- Differentially-corrected GPS
- Inertial measurement unit (IMU)
- Computer

![Image showing Ariel LiDAR system and components](image-url)
Challenges

✓ System integration
✓ Safety and security of the network
✓ Supply chain synchronization
✓ Support services
✓ Disposal of E-waste
JKPM received ‘National Safety Award’ for achieving Accident Free Year 2016 by DGFSALI (Director General Factory Advice and Labour Institute), Government of India.

JK Paper Mills was recognized as ‘Energy Efficient Unit’ & ‘The Innovative Project’ at 19th National Award for Excellence in Energy Management held during 29-31st August 2018 at Hyderabad organized by CII.


JKPM bagged winners award in “MURA” 3M Competition organized by CII on 29th & 30th October 2018.
Industry 4.0 is closely related with the Internet of Things (IoT), Cyber Physical System (CPS), Information and Communications Technology (ICT), Enterprise Architecture (EA), and Enterprise Integration (EI).

It increases the digitization of manufacturing with CPS.

As a result, it will accelerate industry to achieve unprecedented levels of operational efficiencies, growth in productivity and product quality.
THANK YOU