The Evolution of Automation

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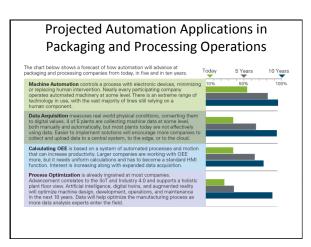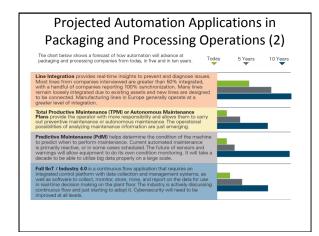PMMI

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Six Trends Driving Plant Floor Automation

- Lack of skilled labor, labor shortages.
- Global increase in product demand.
- Rising demand for flexible manufacturing.
- Producing products with consistent quality.
- Overall operating cost reductions.
- Smart machine technology and co-bots.

Slide 1

TOP 5 Operational Improvements That End Users Want to Achieve From Automation

41% Run Multiple Sizes

33% Reduce Labor

29% Measure Line Efficiency to Maximize Uptime

24% Shorter Runs

22% Minimize Changeover Time

Slide 2

Projected Automation Applications in Packaging and Processing Operations

The chart below shows a forecast of how automation will advance at packaging and processing companies from today, in five and in ten years.

Today   5 Years   10 Years

10%   50%   100%

Machine Automation controls a process with electronic devices, minimizing or replacing human intervention. Nearly every participating company operates automated machinery at some level. There is an extreme range of technology in use, with the vast majority of lines still relying on a human component.

Data Acquisition measures real world physical conditions, converting them to digital values. 4 of 5 plants are collecting machine data at some level, both manually and automatically, but most plants today are not effectively using data. Easier to implement solutions will encourage more companies to collect and upload data to a central system, to the edge, or to the cloud.

Calculating OEE is based on a system of automated processes and motion that can increase productivity. Larger companies are working with OEE more, but it needs uniform calculations and has to become a standard HMI function. Interest is increasing along with expanded data acquisition.

Process Optimization is already ingrained at most companies. Advancement correlates to the IIoT and Industry 4.0 and supports a holistic plant floor view. Artificial intelligence, digital twins, and augmented reality will optimize machine design, development, operations, and maintenance in the next 10 years. Data will help optimize the manufacturing process as more data analysis experts enter the field.

Slide 3

Projected Automation Applications in Packaging and Processing Operations (2)

The chart below shows a forecast of how automation will advance at packaging and processing companies from today, in five and in ten years.

Today   5 Years   10 Years

Line Integration provides real-time insights to prevent and diagnose issues. Most lines from companies interviewed are greater than 50% integrated, with a handful of companies reporting 100% synchronization. Many lines remain loosely integrated due to existing assets and new lines are designed to be connected. Manufacturing lines in Europe generally operate at a greater level of integration.

Total Productive Maintenance (TPM) or Autonomous Maintenance Plans provide the operator with more responsibility and allows them to carry out preventive maintenance or autonomous maintenance. The operational possibilities of analyzing maintenance information are just emerging.

Predictive Maintenance (PdM) helps determine the condition of the machine to predict when to perform maintenance. Current automated maintenance is primarily reactive, or in some cases scheduled. The future of sensors and warnings will allow equipment to do its own condition monitoring. It will take a decade to be able to utilize big data properly on a large scale.

Full IIoT / Industry 4.0 is a continuous flow application that requires an integrated control platform with data collection and management systems, as well as software to collect, monitor, store, mine, and report on the data for use in real-time decision making on the plant floor. The industry is actively discussing continuous flow and just starting to adopt it. Cybersecurity will need to be improved at all levels.

Slide 4

Six Reasons Why Automation is a Gradual Adoption Process

- Utilizing data for operational improvements will take years and will require educating the industry on how to gather it, use it, store it, and apply it.
- With automation costs decreasing, companies of all sizes will have an easier time achieving an acceptable ROI.
- Disparate and legacy systems persist and need to be connected, but upgrading can be expensive.
- IT and OT convergence for common strategies is still emerging. (Operational technology-the hardware and software dedicated to detecting or causing changes in physical processes through direct monitoring and/or control of physical devices such as valves, pumps, etc.).
- Open platform standards are evolving.
- Cybersecurity, in a layered systems approach, will help alleviate security issues.

Slide 1

The Challenges: Cost Justification, Workforce Education, Open Communications

End Users Say...

They Are Challenged With:

- **Justifying capital expenses** to advance automation.
- **Developing the technical skills** to implement and support automated machinery and software.
- **Partnering** with the right suppliers.

OEMs Say...

They Are Challenged With:

- **Encouraging a top level vision** that supports automation changes.
- **Growing applications** for collaborative robotics.
- **Finding engineers** to work with smart machines.

Technology Suppliers Say...

They Are Challenged With:

- **Moving to open communication standards** for IIoT and architectural standards.
- **Educating the industry** on what's possible with digitalization and the convergence of all elements of manufacturing talking together.
- **Technical competency** and a willingness for customers to invest in automation.

Slide 2

Legacy Systems

New Technology is Not Limited to New Machines; Legacy Systems Can be Upgraded

Program Conversions
The challenge is legacy software not connecting well. Programs need to be converted and it's a daunting task. End users have to determine which is best - upgrade existing system or buy new.

Upgrades to the Interface System
Legacy machines still have value and retrofits are done to upgrade interface systems with electrical signals to allow bi-directional data exchange internally or with the cloud.

Servo Usage
Servo usage has a built in ability to review torque cycles for maintenance information.

Equipment That is 15-20 Years Old or Newer
Data buses like Ethernet, Profibus, Modbus, and Sercos can be upgraded on a machine if it's 15-20 years old or newer. Controls can be upgraded as well.

For older systems it's possible to upgrade gateways to provide data collection, but there's more security on new machines today with limited user access for making changes.

Lower Cost Sensor Solutions for Small and Mid Sized (SMEs) Manufacturers

In many instances, end users can work with what is on the plant floor and **digitally enable** processes.

Adding **inexpensive sensors** to machines can provide real-time alerts when consumables are running low or when temperatures are out of range. This proactive monitoring and management can help manufacturers maximize uptime, quality control, and output.

Inexpensive Sensors
Can help manufacturers maximize uptime, quality control, and output.

Some legacy systems can hinder automation advancements and tend to get delegated to intermittent usage because of obsolete part issues.

Slide 3

Interactive/Intuitive HMIs, Smarter Sensors, and Safety Improvements

Software and Machine Technologies That End Users Are Looking For

- Interactive/Intuitive HMI
- Smarter Sensors
- Safety Improvements
- Standard Communications Protocol
- Software Compatibility
- Clean-In-Place (CIP)
- Integrated Condition Monitoring
- Fully Integrated Connectivity
- Overall Equipment Efficiency (OEE)

0% 10% 20% 30% 40%

Source:PMMI-pmmi.org/research

Software and Machine Technology Improvements Underway At OEMs and Technology Suppliers

- Clear and simple instructions on the HMI; intuitive, with graphics and a dashboard view.
- More mobile connectivity, in order to see a dashboard on the HMI from a smart phone or tablet.
- Sensors are moving from optical sensing into more magnetic sensing to achieve greater reliability.
- Open safety; fully automated safety communications for flexible production lines.
- Intuitive programming software.
- Software compatibility to achieve more production and less maintenance.
- Rapid changeover and cleanability for flexible production.
- Self tuning or self calibration for more machine flexibility for varied product applications.
- Digital simulation in controllers to simulate robotics and motion control on the line.
- Greater access and analysis of real-time machine performance data to calculate OEE.

Slide 4

The Use of Robots Will Continue to Increase Due to Lower Cost Collaborative Robots

Predictions for Increased Robotic Use on the Front of the Line

- 13% Depalletizing
- 25% Product processing; cutting coating, feeding
- 40% Direct product handling; filling, dosing, pick & place

Predictions for Increased Robotic Use on the End of the Line

- 50% Secondary packaging; tray packing, cartoning, case packing
- 50% Palletizing

90%
Of participating companies are using robotics somewhere on the line, and predict usage to continue to rise.

TOP 5 Expected Operational Improvements From Machine Data Collection

❶ Increase uptime	• Reconcile disparate devices	• Labor staffing
❷ Manage production schedules	• Waste reduction	• Monitor usage cycles
❸ Predict and correct potential failures	• Monitor machine states	• Reduce changeover times
❹ Measure production counts	• OEE	• Improve quality
❺ Improve run rates and throughput	• Batch control	• Parts usage

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IT and OT Need to Unify Networks and Systems

Suggestions for IT and OT to Work Together Toward Achieving Cybersecurity

➤ Agree that data privacy is a concern to both.
➤ Open a line of communications to discuss reducing downtime.
➤ Assess the complexities of automation together.
➤ Respect the needs of both departments.
➤ Share the benefits and concerns about opening up data while still ensuring security.
➤ Consider the option of a 3rd party cybersecurity partner.

38.9% Of companies utilize cross training between IT and OT, according to a 2017 Automation World Survey.

96% Of end users rely on IT to be responsible for the cybersecurity policies and to handle the selection and implementation of security solutions.

IT/OT Different Points of View
IT seeks the **newest, fastest computing hardware and software** for the benefit of the entire company, while OT deals with the **physical value of the company** with technology spanning decades and legacy systems that often remain in use.

☛ *IT (Information Technology) • OT (Operational Technology)*

IT/OT Will Converge
IIoT forces IT and OT to collaborate, which adds complications at both the department level and the computing level. IIoT is not just a communications issue, but a far bigger strategic proposition.

Actionable Steps
Future Survival Demands Moving Forward On the Path to Automation

Most CPG leaders consider digital technologies to be a priority, but need **help to define a clear strategic vision** linked to actions.

There is opportunity now to **help companies assess and understand** the variables that will be fed into a machine-learning model to avoid any mis-steps in keeping operations flexible.

Engineering staff is declining
Labor skills are lacking
Repetitive tasks are being replaced by robots
Capital budgets are increasing
Data acquisition is rapidly advancing

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THANK YOU!