

SOLVE FOR X.

Step by Step Guide to Implementing the Supply Chain of the Future

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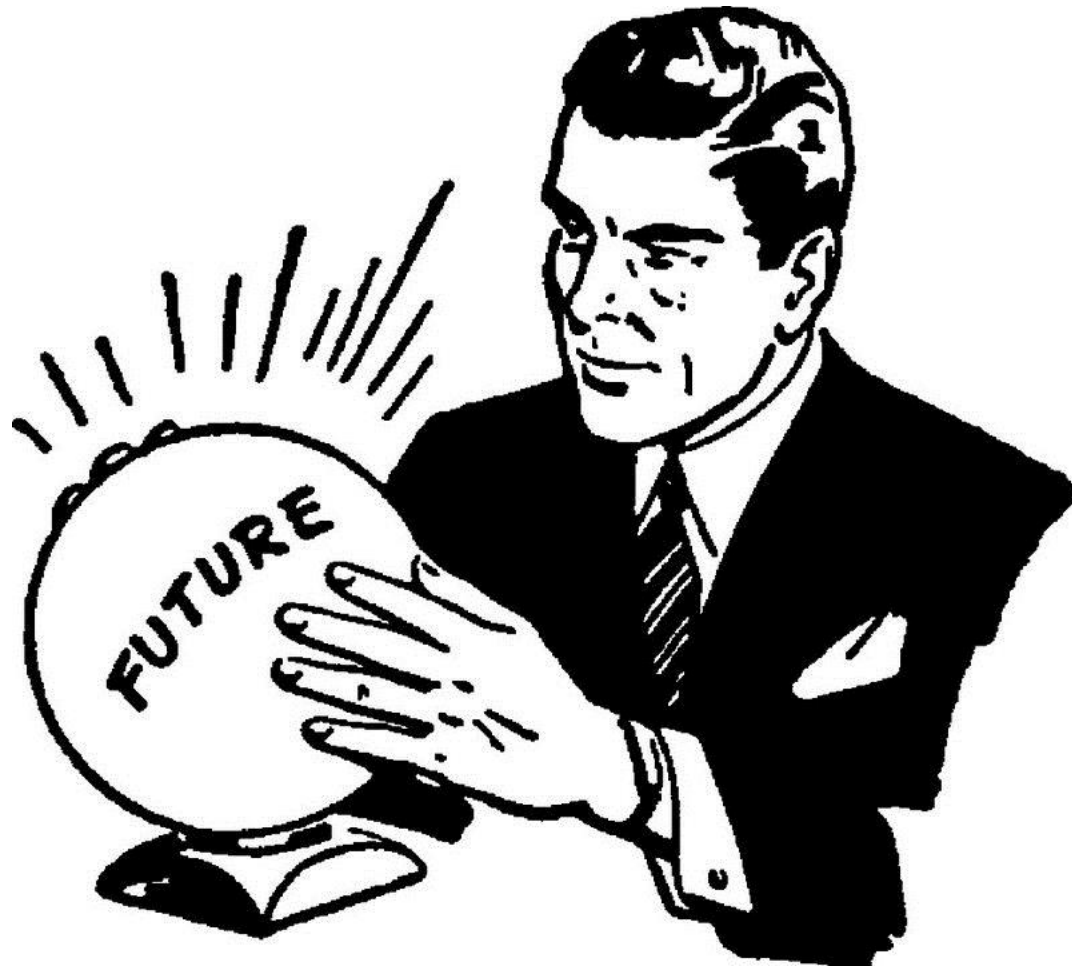


SOLVE FOR X.

What does the Supply Chain of the Future Look Like?



SOLVE FOR X.



MHI.

THE INDUSTRY THAT MAKES SUPPLY CHAINS WORK®

The Future According to the Experts

“The logistics industry is entering a new era. Over the next decade, disruptive forces, including technology and operational constraints, threaten to fundamentally change the rules of the game.”



Rick Blasgen, Direct Connection - 2016 Special Issue of CSCMP's Supply Chain Quarterly

Let's Ask the Professors

Dadzie and Johnson, writing in the Journal of Business Logistics on future automation plans:

Majority (51% +) of executives surveyed where considering:

- High Speed Sortation
- Conveyors
- Picking Systems

Approximately 30% considering:

- Automated Storage and Retrieval
- Robotic Vehicles



Does this sound familiar?

“There has been a dramatic change in the overall business climate, including the rising cost of money and labor, fierce global competition, and rapid technological sophistication.”

Dadzie, K.Q. and Johnston, W.J., Innovative Automation Technology in Corporate Warehousing Logistics.
Journal of Business Logistics.

“The factors underlying logistics costs and trends are shifting, and the logistics industry is entering a new era . . .” – As Rick Blasgen’s quote was rephrased in CSCMP Supply Chain Quarterly

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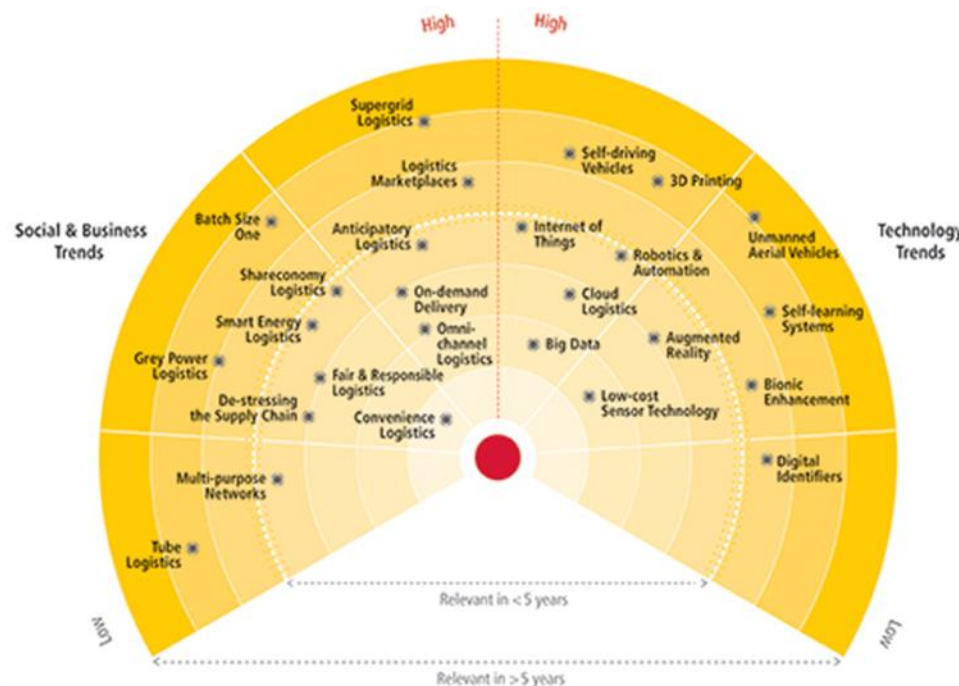
OK here is the full reference from JBL. . .

Dadzie, K. Q., Johnston, W., J., (1991) Innovative automation technology in corporate warehousing logistics. Journal of business logistics, vol: 12 No:1, 1991. PP: 63-82.

We have been talking about the new era of logistics for 25 years.

SOLVE FOR X.

While well intentioned, industry thought leadership gives us an idea of what is out there, but not always how to use those technologies that are the, “Next Big Thing . . .”



Source: DHL Trend Radar - http://www.dhl.com/en/about_us/logistics_insights/dhl_trend_research/trendradar.html

SOLVE FOR X.

$$\begin{aligned}
 & -\frac{1}{2}\partial_\nu g_\mu^a \partial_\nu g_\mu^a - g_s f^{abc} \partial_\mu g_\mu^b g_\mu^c - \frac{1}{4} g_s^2 f^{abc} f^{ade} g_\mu^b g_\mu^c g_\mu^d g_\mu^e + \\
 & \frac{1}{2} i g_s^2 (\bar{q}_i^\mu \gamma^\mu q_j^\mu) g_\mu^a + \bar{G}^a \partial^2 G^a + g_s f^{abc} \partial_\mu \bar{G}^a G^b g_\mu^c - \partial_\nu W_\mu^+ \partial_\nu W_\mu^- - \\
 & M^2 W_\mu^+ W_\mu^- - \frac{1}{2} \partial_\nu Z_\mu^0 \partial_\nu Z_\mu^0 - \frac{1}{2 c_w^2} M^2 Z_\mu^0 Z_\mu^0 - \frac{1}{2} \partial_\mu A_\nu \partial_\mu A_\nu - \frac{1}{2} \partial_\mu H \partial_\mu H - \\
 & \frac{1}{2} m_h^2 H^2 - \partial_\mu \phi^+ \partial_\mu \phi^- - M^2 \phi^+ \phi^- - \frac{1}{2} \partial_\mu \phi^0 \partial_\mu \phi^0 - \frac{1}{2 c_w^2} M \phi^0 \phi^0 - \beta_h \left[\frac{2 M^2}{g^2} + \right. \\
 & \left. \frac{2 M}{g} H + \frac{1}{2} (H^2 + \phi^0 \phi^0 + 2 \phi^+ \phi^-) \right] + \frac{2 M^4}{g^2} \alpha_h - i g c_w [\partial_\nu Z_\mu^0 (W_\mu^+ W_\nu^- - \\
 & W_\nu^+ W_\mu^-) - Z_\mu^0 (W_\mu^+ \partial_\nu W_\nu^- - W_\nu^- \partial_\mu W_\mu^+) + Z_\mu^0 (W_\nu^+ \partial_\nu W_\mu^- - \\
 & W_\nu^- \partial_\nu W_\mu^+)] - i g s_w [\partial_\nu A_\mu (W_\mu^+ W_\nu^- - W_\nu^+ W_\mu^-) - A_\nu (W_\mu^+ \partial_\nu W_\mu^- - \\
 & W_\nu^- \partial_\nu W_\mu^+) + A_\mu (W_\nu^+ \partial_\nu W_\mu^- - W_\nu^- \partial_\mu W_\mu^+)] - \frac{1}{2} g^2 W_\mu^+ W_\mu^- W_\nu^+ W_\nu^- + \\
 & \frac{1}{2} g^2 W_\mu^+ W_\nu^- W_\nu^+ W_\mu^- + g^2 c_w^2 (Z_\mu^0 W_\mu^+ Z_\nu^0 W_\nu^- - Z_\mu^0 Z_\nu^0 W_\mu^+ W_\nu^-) + \\
 & g^2 s_w^2 (A_\mu W_\mu^+ A_\nu W_\nu^- - A_\mu A_\nu W_\mu^+ W_\nu^-) + g^2 s_w c_w [A_\mu Z_\nu^0 (W_\mu^+ W_\nu^- - \\
 & W_\nu^+ W_\mu^-) - 2 A_\mu Z_\mu^0 W_\nu^+ W_\nu^-] - g \alpha [H^3 + H \phi^0 \phi^0 + 2 H \phi^+ \phi^-] - \\
 & \frac{1}{8} g^2 \alpha_h [H^4 + (\phi^0)^4 + 4 (\phi^+ \phi^-)^2 + 4 (\phi^0)^2 \phi^+ \phi^- + 4 H^2 \phi^+ \phi^- + 2 (\phi^0)^2 H^2] - \\
 & g M W_\mu^+ W_\mu^- H - \frac{1}{2} g \frac{M}{c_w^2} Z_\mu^0 Z_\mu^0 H - \frac{1}{2} i g [W_\mu^+ (\phi^0 \partial_\mu \phi^- - \phi^- \partial_\mu \phi^0) - \\
 & W_\mu^- (\phi^0 \partial_\mu \phi^+ - \phi^+ \partial_\mu \phi^0)] + \frac{1}{2} g [W_\mu^+ (H \partial_\mu \phi^- - \phi^- \partial_\mu H) - W_\mu^- (H \partial_\mu \phi^+ - \\
 & \phi^+ \partial_\mu H)] + \frac{1}{2} g \frac{1}{c_w} (Z_\mu^0 (H \partial_\mu \phi^0 - \phi^0 \partial_\mu H) - i g \frac{s_w}{c_w} M Z_\mu^0 (W_\mu^+ \phi^- - W_\mu^- \phi^+) + \\
 & i g s_w M A_\mu (W_\mu^+ \phi^- - W_\mu^- \phi^+) - i g \frac{1-2 c_w^2}{2 c_w} Z_\mu^0 (\phi^+ \partial_\mu \phi^- - \phi^- \partial_\mu \phi^+) + \\
 & i g s_w A_\mu (\phi^+ \partial_\mu \phi^- - \phi^- \partial_\mu \phi^+) - \frac{1}{2} g^2 W_\mu^+ W_\mu^- [H^2 + (\phi^0)^2 + 2 \phi^+ \phi^-] - \\
 & \frac{1}{2} g^2 \frac{1}{c_w^2} Z_\mu^0 Z_\mu^0 [H^2 + (\phi^0)^2 + 2 (2 s_w^2 - 1) \phi^+ \phi^-] - \frac{1}{2} g^2 \frac{s_w^2}{c_w} Z_\mu^0 \phi^0 (W_\mu^+ \phi^- + \\
 & W_\mu^- \phi^+) - \frac{1}{2} i g^2 \frac{s_w^2}{c_w} Z_\mu^0 H (W_\mu^+ \phi^- - W_\mu^- \phi^+) + \frac{1}{2} g^2 s_w A_\mu \phi^0 (W_\mu^+ \phi^- + \\
 & W_\mu^- \phi^+) + \frac{1}{2} i g^2 s_w A_\mu H (W_\mu^+ \phi^- - W_\mu^- \phi^+) - g^2 \frac{s_w}{c_w} (2 c_w^2 - 1) Z_\mu^0 A_\mu \phi^+ \phi^- - \\
 & g^4 s_w^2 A_\mu A_\mu \phi^+ \phi^- - \bar{e}^\lambda (\gamma \partial + m_e^\lambda) e^\lambda - \bar{\nu}^\lambda \gamma \partial \nu^\lambda - \bar{u}_j^\lambda (\gamma \partial + m_u^\lambda) u_j^\lambda - \bar{d}_j^\lambda (\gamma \partial + \\
 & m_d^\lambda) d_j^\lambda + i g s_w A_\mu [- (\bar{e}^\lambda \gamma e^\lambda) + \frac{2}{3} (\bar{u}_j^\lambda \gamma u_j^\lambda) - \frac{1}{3} (\bar{d}_j^\lambda \gamma d_j^\lambda)] + \frac{i g}{4 c_w} Z_\mu^0 [(\bar{\nu}^\lambda \gamma^\mu (1 + \\
 & \gamma^5) \nu^\lambda) + (\bar{e}^\lambda \gamma^\mu (4 s_w^2 - 1 - \gamma^5) e^\lambda) + (\bar{u}_j^\lambda \gamma^\mu (\frac{4}{3} s_w^2 - 1 - \gamma^5) u_j^\lambda) + \\
 & (\bar{d}_j^\lambda \gamma^\mu (1 - \frac{8}{3} s_w^2 - \gamma^5) d_j^\lambda)] + \frac{i g}{2 \sqrt{2}} W_\mu^+ [(\bar{\nu}^\lambda \gamma^\mu (1 + \gamma^5) e^\lambda) + (\bar{u}_j^\lambda \gamma^\mu (1 + \\
 & \gamma^5) C_{\lambda\kappa} d_j^\kappa)] + \frac{i g}{2 \sqrt{2}} W_\mu^- [(\bar{e}^\lambda \gamma^\mu (1 + \gamma^5) \nu^\lambda) + (\bar{d}_j^\kappa C_{\lambda\kappa}^\dagger \gamma^\mu (1 + \gamma^5) u_j^\lambda)] + \\
 & \frac{i g}{2 \sqrt{2}} \frac{m_\lambda^2}{M} [- \phi^+ (\bar{\nu}^\lambda (1 - \gamma^5) e^\lambda) + \phi^- (\bar{e}^\lambda (1 + \gamma^5) \nu^\lambda)] - \frac{g}{2} \frac{m_\lambda^2}{M} [H (\bar{e}^\lambda e^\lambda) + \\
 & i \phi^0 (\bar{e}^\lambda \gamma^5 e^\lambda)] + \frac{i g}{2 M \sqrt{2}} \phi^+ [- m_\lambda^2 (\bar{u}_j^\lambda C_{\lambda\kappa} (1 - \gamma^5) d_j^\kappa) + m_\lambda^2 (\bar{u}_j^\lambda C_{\lambda\kappa} (1 + \\
 & \gamma^5) d_j^\kappa) + \frac{i g}{2 M \sqrt{2}} \phi^- [m_\lambda^2 (\bar{d}_j^\kappa C_{\lambda\kappa}^\dagger (1 + \gamma^5) u_j^\lambda) - m_\lambda^2 (\bar{d}_j^\kappa C_{\lambda\kappa}^\dagger (1 - \gamma^5) u_j^\lambda) - \\
 & \frac{g}{2} \frac{m_\lambda^2}{M} H (\bar{u}_j^\lambda u_j^\lambda) - \frac{g}{2} \frac{m_\lambda^2}{M} H (\bar{d}_j^\lambda d_j^\lambda) + \frac{i g}{2} \frac{m_\lambda^2}{M} \phi^0 (\bar{u}_j^\lambda \gamma^5 u_j^\lambda) - \frac{i g}{2} \frac{m_\lambda^2}{M} \phi^0 (\bar{d}_j^\lambda \gamma^5 d_j^\lambda) + \\
 & \bar{X}^+ (\partial^2 - M^2) X^+ + \bar{X}^- (\partial^2 - M^2) X^- + \bar{X}^0 (\partial^2 - \frac{M^2}{c_w^2}) X^0 + \bar{Y} \partial^2 Y + \\
 & i g c_w W_\mu^+ (\partial_\mu \bar{X}^0 X^- - \partial_\mu \bar{X}^+ X^0) + i g s_w W_\mu^+ (\partial_\mu \bar{Y} X^- - \partial_\mu \bar{X}^+ Y) + \\
 & i g c_w W_\mu^- (\partial_\mu \bar{X}^- X^0 - \partial_\mu \bar{X}^0 X^+) + i g s_w W_\mu^- (\partial_\mu \bar{X}^- Y - \partial_\mu \bar{Y} X^+) + \\
 & i g c_w Z_\mu^0 (\partial_\mu \bar{X}^+ X^- - \partial_\mu \bar{X}^- X^+) + i g s_w A_\mu (\partial_\mu \bar{X}^+ X^- - \partial_\mu \bar{X}^- X^+) - \\
 & \frac{1}{2} g M [\bar{X}^+ X^+ H + \bar{X}^- X^- H + \frac{1}{c_w^2} \bar{X}^0 X^0 H] + \frac{1-2 c_w^2}{2 c_w} i g M [\bar{X}^+ X^0 \phi^+ - \\
 & \bar{X}^- X^0 \phi^-] + \frac{1}{2 c_w} i g M [\bar{X}^0 X^- \phi^+ - \bar{X}^0 X^+ \phi^-] + i g M s_w [\bar{X}^0 X^- \phi^+ - \\
 & \bar{X}^0 X^+ \phi^-] + \frac{1}{2} i g M [\bar{X}^+ X^+ \phi^0 - \bar{X}^- X^- \phi^0]
 \end{aligned}$$

Sometimes when we are asked to develop solutions for the future of our businesses, it can feel like solving a very, very, very long equation.

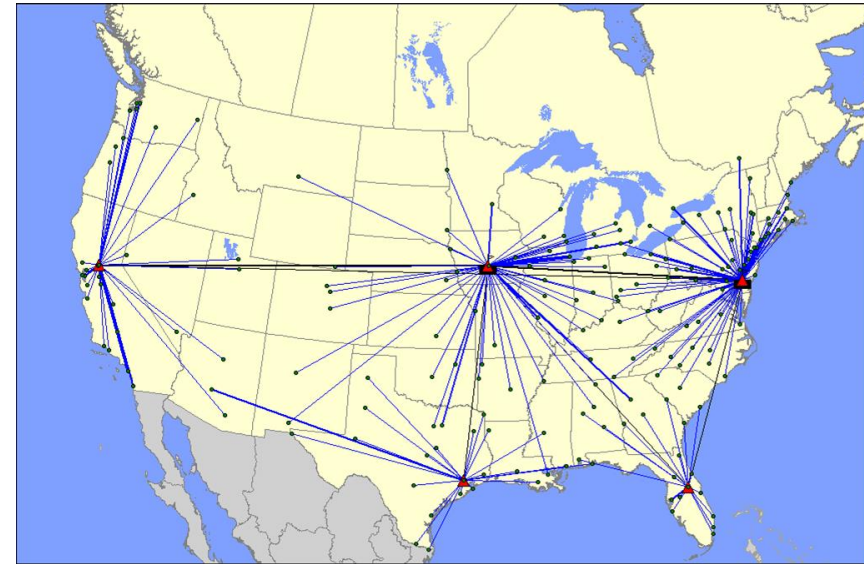
Can we solve for X here?

Agenda

- ARM yourself for Success in Developing the Supply Chain of the Future
 - A – Analyze
 - R – Retrofit
 - M – Mechanize
- Enablers to Developing the Supply Chain of the future

Analyze

- Step 1 – Analyze Past Performance
 - Inbound / Outbound Order Profiles
 - Customer Locations
 - Costs to Serve
 - Quality Metrics



Analyze

- Step 2 – Analyze Current Processes
 - Process Mapping
 - Value Stream Mapping
 - Process Improvement

Goal – Determine your Organizational DNA

Organizational DNA



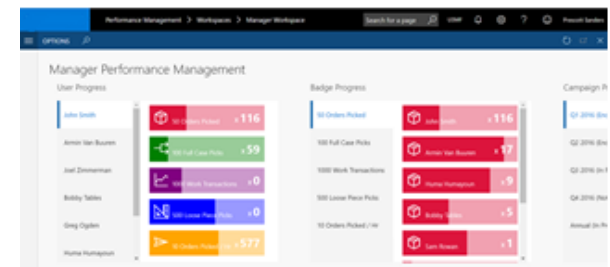
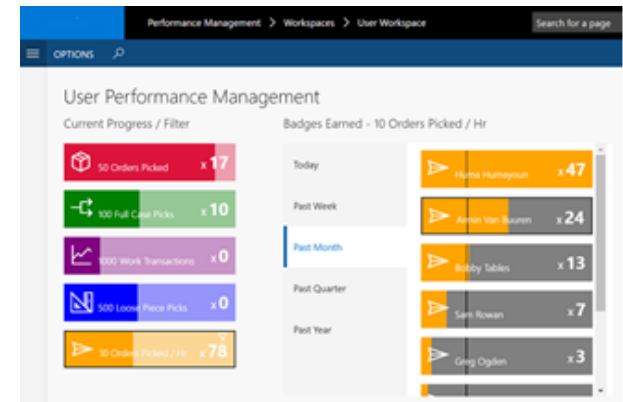
Analyze

- Step 3 – Develop Improved Processes
 - Without new systems or equipment, develop future state processes to:
 - Reduce cycle times
 - Eliminate waste
 - Improve customer satisfaction

This is a step many companies skip . . . To their own detriment.

Retrofit

- Step 4 – Automate Data Collection and Reporting
 - Update reports and reporting engines to deliver real time dashboards
 - Reduce time to produce monthly scorecards
 - Implement tools to highlight best and worst performing areas or individuals



Retrofit

- Step 5 – Add productivity enabling technologies to operations
 - Voice
 - Vision
 - Out of the box automation



Retrofit

- Step 6 – Replacing aging material handling and business systems
 - Invest in new bolt-ons for ERP systems or upgrades
 - Work with partners to design new sortation, storage, pick, pack and ship systems.
 - Add autonomous guided vehicles to fill in the gaps.

Retrofit

- Step 7 – Eliminate legacy technology and facilities
 - Replace mainframe or legacy ERP systems
 - Eliminate facilities that are not being brought up to current technology standards or that are now redundant
 - Minimize new labor needs with updated technologies

Goal – Get rid of products that can't easily interact.

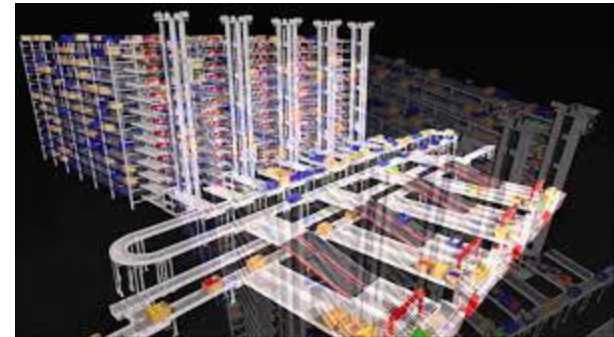
Mechanize

- Step 8 – Replace current equipment with cutting edge automation
 - Invest in Warehouse Control / Execution system
 - Automate put and pick selection equipment
 - Increase AGV usage



Mechanize

- Step 9 – Design new facilities around new systems and automation
 - Automated picking
 - Semi-automated receiving, putaway, and put to truck
 - Minimal labor usage



Mechanize

- Step 10 – Automate upstream and downstream with vendor processes and system interactions
 - Invest in automated ordering and payment systems
 - Develop Internet of Things (IoT) device interactions to report on stock outs, safety stock requirements, and downtime
 - Automate interactions with customers on order status and delivery notice

Review

ARM yourself for Success in Developing the Supply Chain of the Future

A – Analyze

R – Retrofit

M - Mechanize

Enablers

- Talent
 - We need a new generation of supply chain workers who can utilize the new technologies
- Technology Providers
 - Technology needs to work together
- Solution Providers
 - Will provide talent and be a conduit for the technology to get to market

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