

# The 21<sup>st</sup> Century Warehouse: Automation Prepares for the Future

Sponsored by:

**The  
Automation  
Alliance**

Presented by:

**Bill Leber, Swisslog Logistics  
Brian Keiger, KUKA Systems  
Sarah Carlson, Daifuku Webb**



# The Automation Alliance- MHI.org



Automated Storage/Retrieval Systems



Automatic Guided Vehicle Systems



Conveyor & Sortation Systems



Integrated Systems & Controls Council



Order Fulfillment Solutions

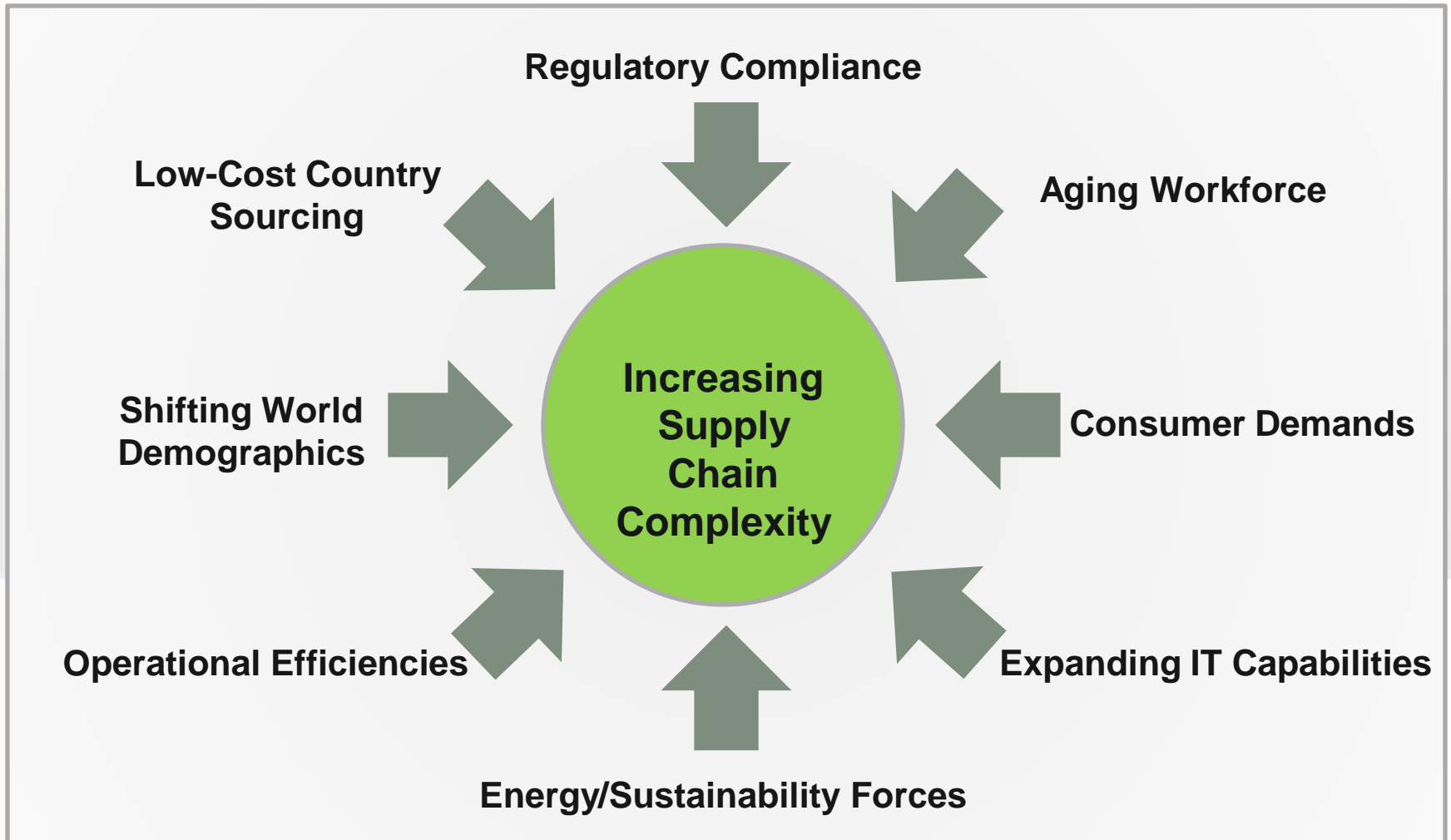
# The 21<sup>st</sup> Century Warehouse

## Automation Prepares for the Future

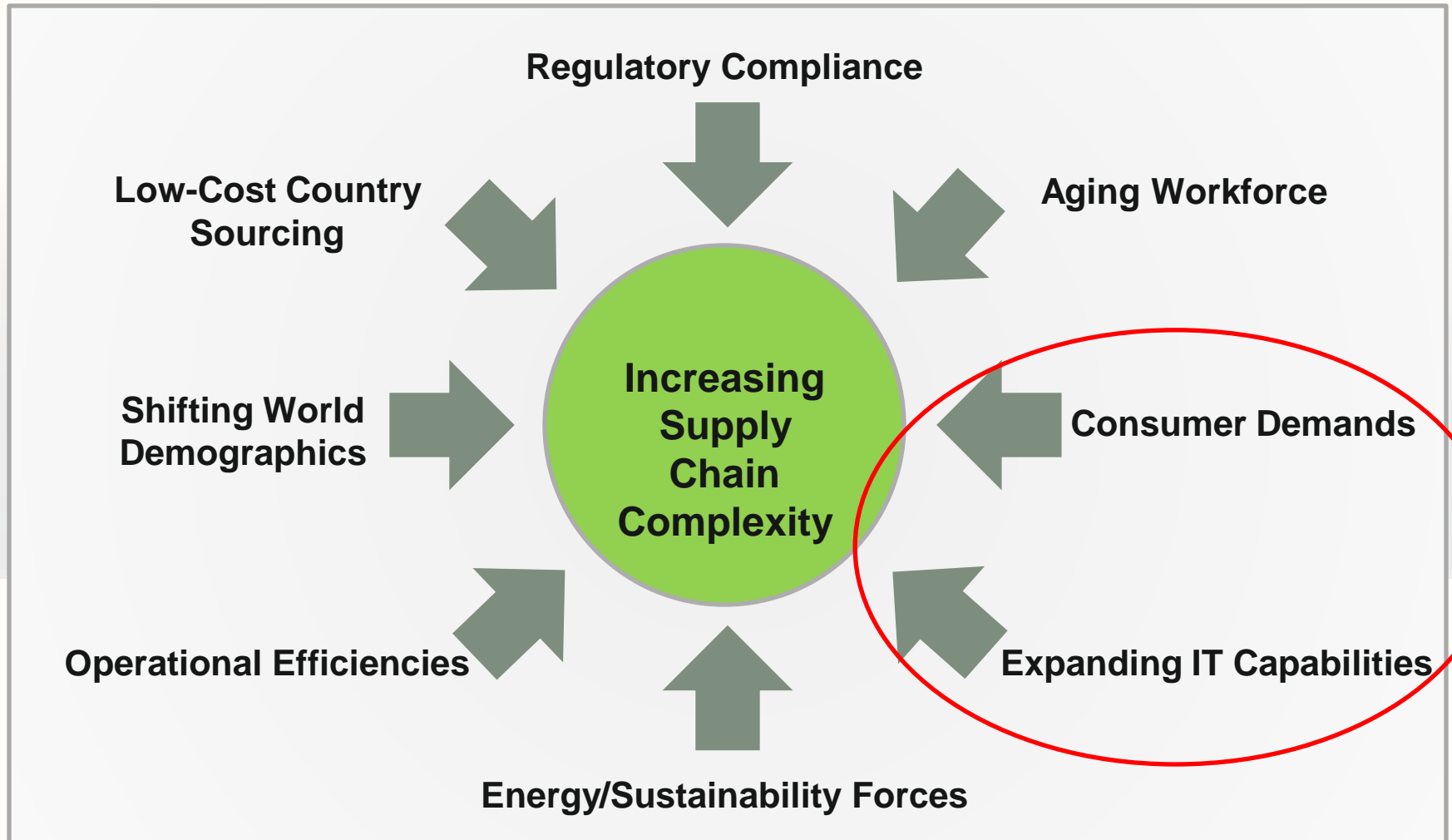
*Trends, constraints, and regulations which are driving the changes in the warehouse, and the technologies that are available to make them run more efficiently.*

*Where to go to learn more.....*

# Global Market Drivers

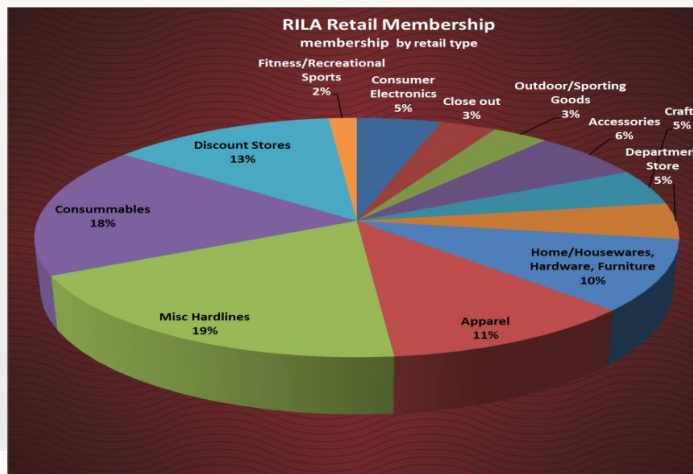


# Global Market Drivers



# Consumer Demands

- Retail → RILA Annual Supply Chain Conference
  - RILA represents the leading retail corporations in the US



- Key conference presentations
  - State of the Retail Supply Chain Study
  - Retailing 2015 - New Frontiers



AUBURN  
COLLEGE OF BUSINESS  
*Supply Chain Management*



# RETAIL MARKET TRENDS

- **Increasing Complexity & Speed of Change**
  - Shifting demographics
  - Better educated consumers
  - New channel formats
  - Customized 'standard' product offerings
  - Faster Product introductions
  - Shorter life-cycles
- **Breaking the 80/20 Rule**
  - No longer will 20% of SKU's be 80% of sales
  - 'Longer tale' demand items
    - increasing share of sales & profits



# Beverage Market Example

## Regional Distributor ~ 6 million cases/year

- Convenience & Grocery Stores
- Restaurants





# Beverage Market Example

## Regional Distributor ~ 6 million cases/year

- Convenience & Grocery Stores
- Restaurants

2009 – “We don’t need to stock more than ~350 SKUs, there is only so much room on the shelves at our customers”



# Beverage Market Example

## Regional Distributor ~ 6 million cases/year

- Convenience & Grocery Stores
- Restaurants

2009 – “We don’t need to stock more than ~350 SKUs, there is only so much room on the shelves at our customers”

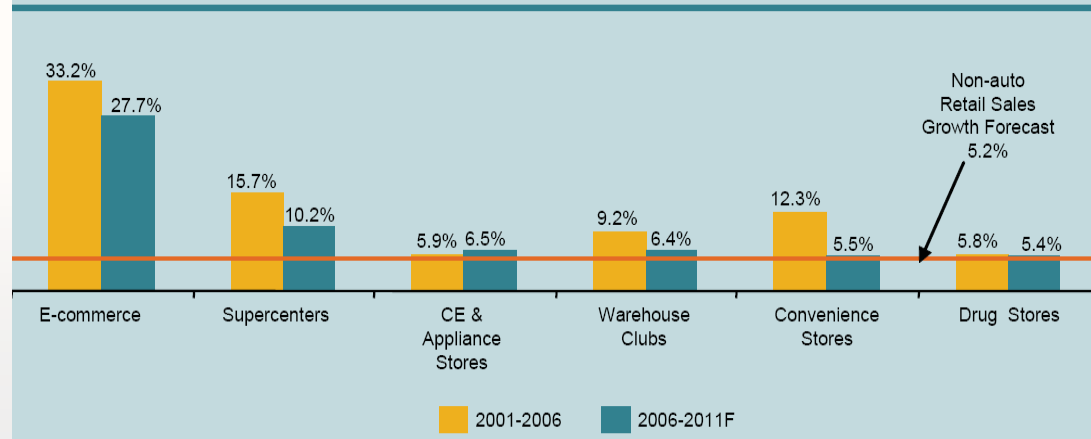
2012 – “ Now we are stocking ~600 SKUs as the market for small brands has really taken off”



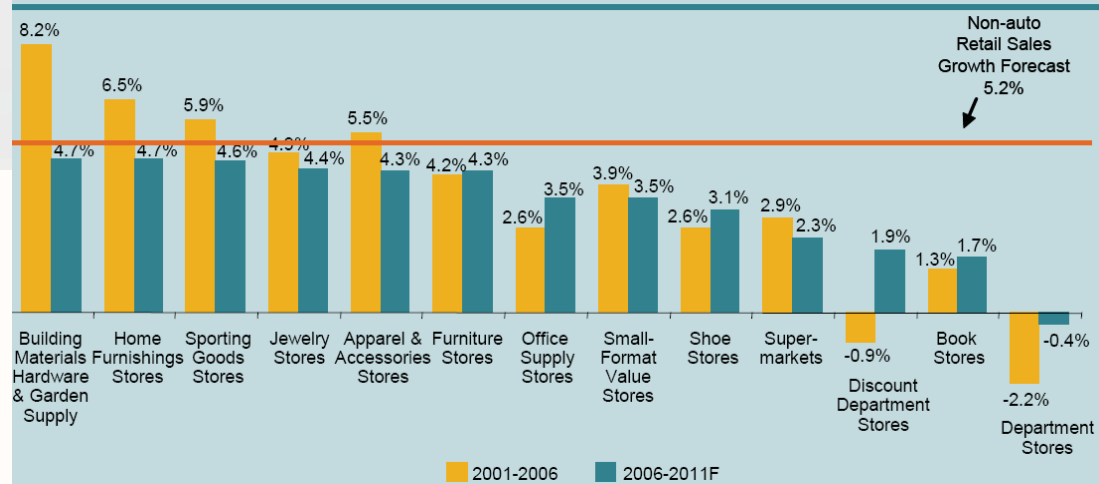
# RETAIL MARKET TRENDS

- **Retail Runway 'Runs Out'**
  - Major retailers running out of room in core concepts
  - Growth rates slowing or shrinking
- **New growth from:**
  - New Concepts/ Categories
  - New Customer Segments
  - Multi-Channel Experience

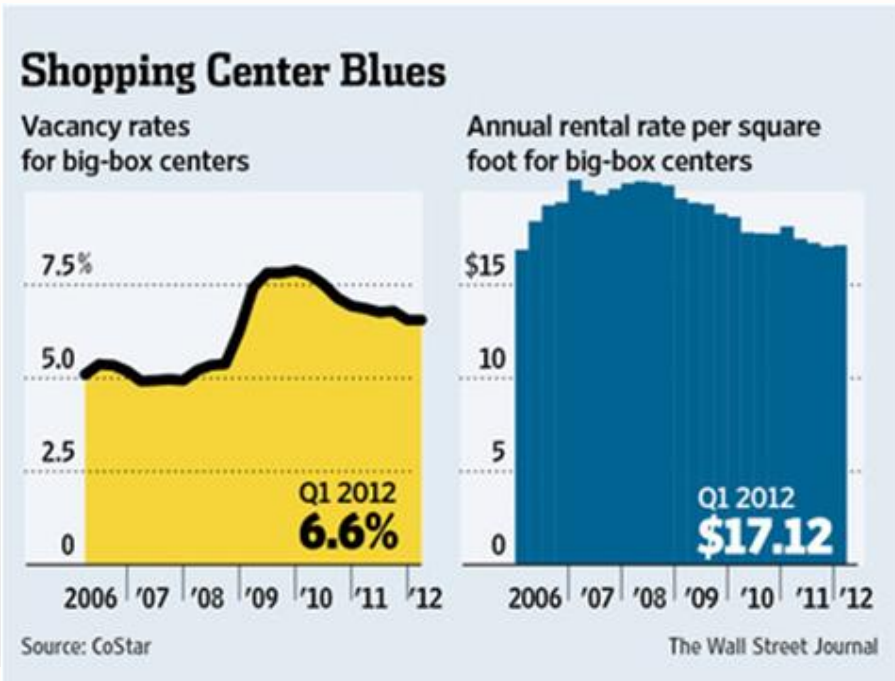
Formats with Above Average Sales Growth Outlook



Formats with Below Average Sales Growth Outlook



# RETAIL MARKET TRENDS



Harvard Business Review

December 2011

## Retail Isn't Broken. Stores Are

An Interview with Ron Johnson by Gardiner Morse

## Wealth Wire

About Metals Inflation Finance Economy

## Is the Big Box Store Dead?

THE WALL STREET JOURNAL

WSJ.com

COMMERCIAL REAL ESTATE | June 12, 2012, 5:03 p.m. ET

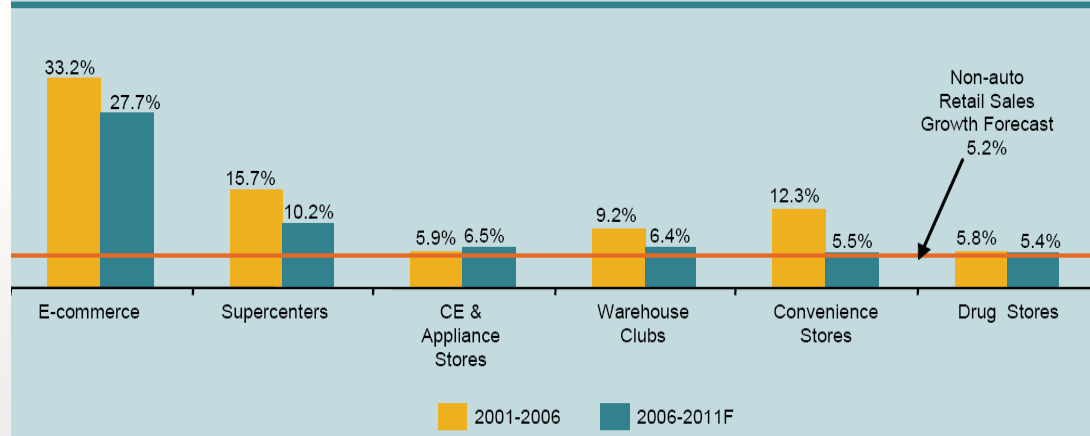
## Big-Box Space Remains Hard to Fill

# RETAIL MARKET TRENDS

- **‘Sustainability’ Drives Downsizing**

- Increased demands for localization, segmentation and customization
- Different packaging/delivery
- Urbanization, smaller format

Formats with Above Average Sales Growth Outlook



Formats with Below Average Sales Growth Outlook



# RETAIL MARKET TRENDS

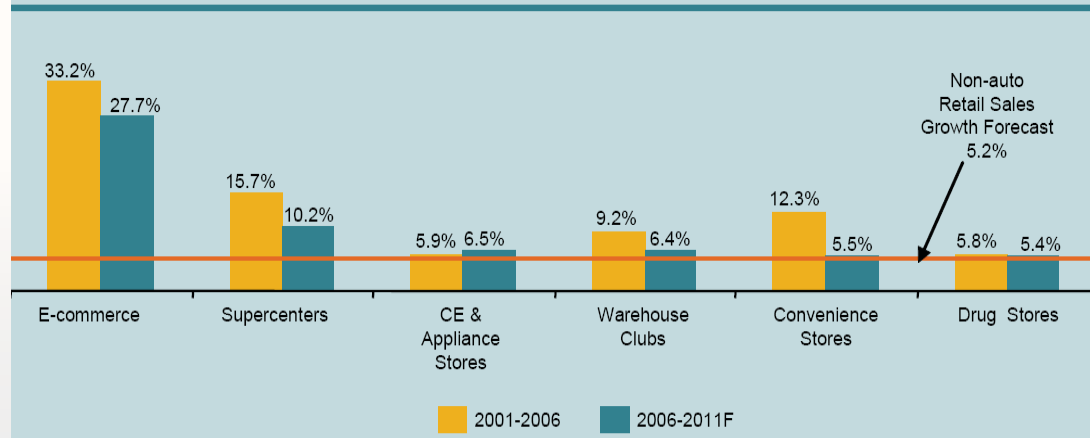
- **‘Sustainability’ Drives Downsizing**

- Increased demands for localization, segmentation and customization
- Different packaging/delivery
- Urbanization, smaller format

- **Supply Chain Evolution**

- Past driven by mass merchandising
- Future more niche oriented
- Focus on ‘fast movers only’ will result in **Lost Sales**

Formats with Above Average Sales Growth Outlook



Formats with Below Average Sales Growth Outlook



## Wal-Mart's ready to do battle



After alienating shoppers by removing too much variety from its stores, Wal-Mart is bringing back about 8,500 items to its merchandise mix.

- 2009 – Retailers reduce product offerings in wake of the recession
- NEW YORK (2011) – On Monday, Wal-Mart announced it is bringing back thousands of products that were unceremoniously dumped from stores, saying it is ready to roll up its sleeves to win the lowest-price battle with its rivals.

➤ 8500 SKUs added back

# ORDER FULFILLMENT IMPLICATIONS

- Less single SKU pallets, more case storage & handling
  - Less case storage at point of sale, move to more piece handling
  - High and ever growing SKU environment
  - Smaller scale, more distributed operations
- *“Superior distribution will help define retail success in an era of global reach, niche retailing and accelerated lifestyles”*





# Market Driver → Expanding IT Capabilities

## Historical Perspective – 1847

# Market Driver → Expanding IT Capabilities

## Historical Perspective – 1847

"Everything comes if a man will only wait."

- Benjamin Disraeli



# Market Driver → Expanding IT Capabilities

## Historical Perspective – 1847

"Everything comes if a man will only wait."

- Benjamin Disraeli



## Today

"Click on it, and get it now"

- Any consumer



# Market Driver → Expanding IT Capabilities

## Historical Perspective – 1847

"Everything comes if a man will only wait."

- Benjamin Disraeli



## Today

"Click on it, and get it now"

- Any consumer

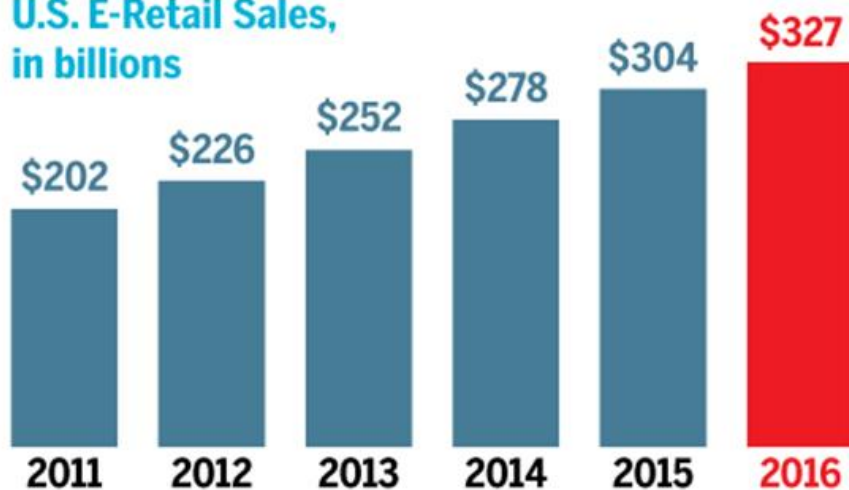


- With a credit card  
& internet access



# E-Commerce Impact

U.S. E-Retail Sales,  
in billions



## U.S. E-commerce Sales: 2011-2016

Online consumers will increase their spending 62% by 2016, according to Forrester Inc.

Source: Forrester Inc.

## CSCMP 2013 Annual Meeting – “Logistics of E-Commerce”

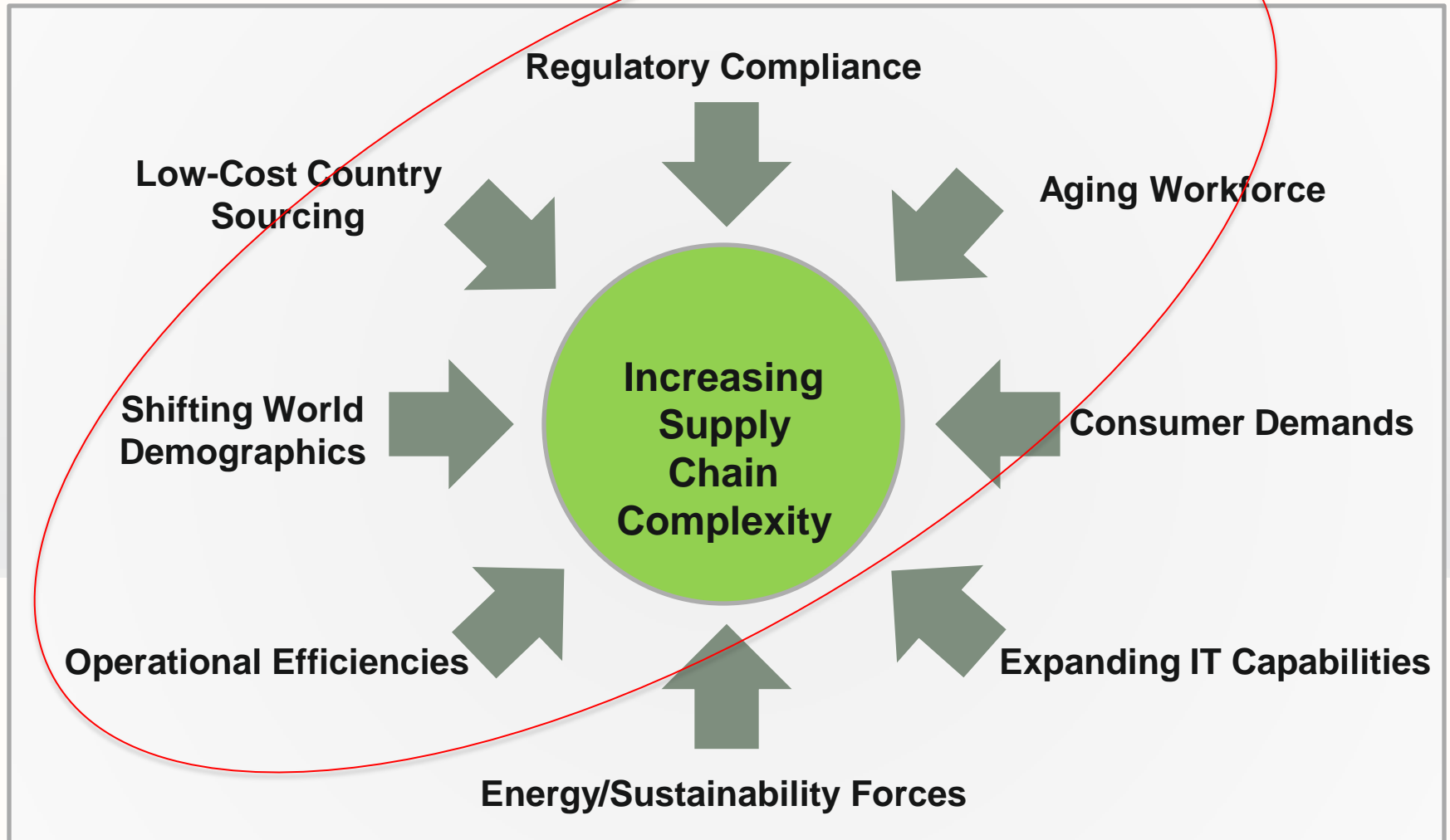
- Overall U.S. Status of DCs
  - Insufficient Fulfillment capacity for small orders
  - Outdated technology
  - Many Obsolete Bulk Distribution Systems

# E-Commerce Challenges Warehouses

- Large SKU counts with a long, slow-moving tail
- High and unpredictable growth
- High penalty for poor performance (Brand damage)
- Uncertain business terrain that demands flexible and adaptive solutions
- Demand for real-time and accurate inventory visibility
- Small number of order lines per order
- High returns from end customer
- Extreme peak season volumes



# Global Market Drivers



# Energy/Sustainability

- In 2010, GTM Research conducted a survey of 74 supply chain executives
- 75% of respondents said their company's environmental stance will significantly impact customer relationships within the next 3 years
- Energy efficiency is by far the most popular sustainable supply chain activity due to:
  - Relative ease with which energy efficiency programs can be implemented
  - Measurable cost savings
  - Carbon footprint reductions
  - Recent volatility in energy prices





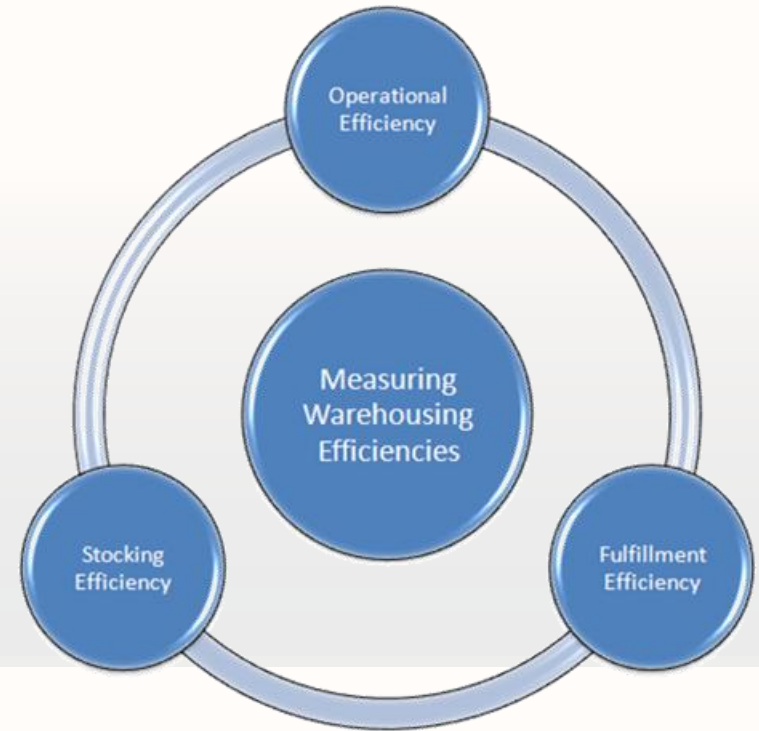
# Energy Savings

- Many companies have not yet integrated the systems that manage their environmental information with those that manage their supply chain activities
- This is an opportunity for automated system integrators and suppliers to help companies improve energy savings in the 21<sup>st</sup> century warehouse



# Operational Efficiencies

- More companies view warehousing operations as a competitive advantage making operational efficiency more important than ever
- Warehouses are one of the most labor intensive parts of supply chains
- In the past, improving efficiency meant adding more people
- Today and in the future, it's adding automation and software that enable fewer people to do more tasks with better information



© Vivek Sehgal, 2009, All Rights Reserved

# Operational Efficiencies

- A recent Forrester Research survey found that 92% of participants cited “improving operational efficiency” as their top priority
- 46% of the same survey group named “changing processes and people behavior” as the most difficult obstacle to achieving their goals
- Companies saved money during the recession; money that could be spent on automating warehouses



# Shifting World Demographics



# Effects of New World Demographics

- More of the world's population can be regarded as “middle class” meaning they are now demanding and consuming products at a level not seen before
- This will lead to a significant increase in exports worldwide
- Companies must remain flexible and adaptable to meet those needs and stay competitive



# Regulatory Compliance

- Constant changes in national and international regulations affect supply chain management
- Governments around the globe are imposing regulations affecting reverse logistics functions
  - *European Union's End of Life Vehicle (ELV) Directive, which mandates recovery and recycling targets of 95% by 2015 for vehicles that are no longer usable*
- Forces warehouses to be as flexible as possible for both forward and reverse supply chains



# Aging Population

- In the U.S., by 2016, **40%** of the work force will disappear
- Only **20%** will be available to replace it
- 15-to-24 age bracket grew at an anemic **0.3%** rate since 2005, generating less than **1/20** of total growth

## Aging of the US Population



Source: US Bureau of Census. 65+ in the United States. 1996.

# Aging Workforce

- Between 1977 and 2009, employment of workers 65 and older increased **101%**
- The number of employed men 65 and older rose **75%**, but employment of women 65 and older increased by nearly twice as much climbing **147%**
- Older workforce will affect the warehouse in ergonomics and decreasing manual labor





# Dwindling Workforce

- Projections show the labor force will grow by a so-so 1.2% annual rate from 2011 to 2015, down from 1.5% for 2006 to 2010, then fall to a feeble **0.7%** from 2016 to 2020 and continue to decrease
- Even the most bearish economic report would forecast that demand for labor will grow at rates faster than that



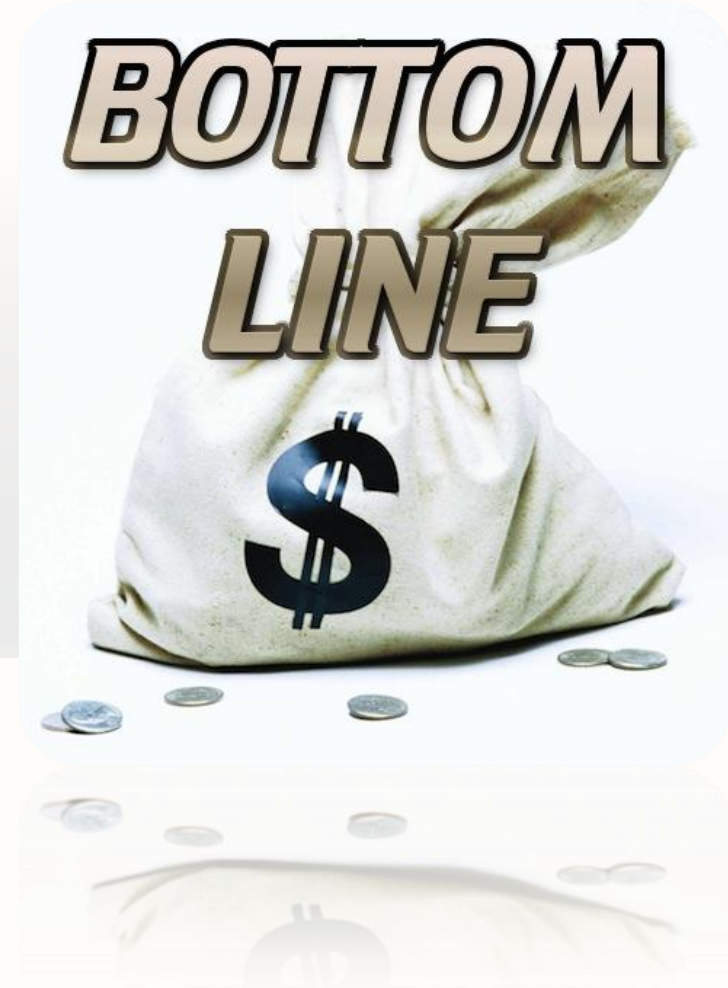
# Aging Workforce – Future Issues

- Great boomer retirement wave
- No longer a “someday” problem but a reality **here and now**
- The average retirement age in 2010 was **62.1**
- Late boomers, who are now 45 to 54, outnumber early boomers 55 to 65 by almost **1/4**
- The retirement wave will rise throughout this decade, cresting around **2023**



# Aging Workforce Bottom Line

- However you respond to labor shortages, all you can do is soften their impact
- Shortages will **increase**, especially as the continuing shift to a knowledge-based economy places greater demands on employees
- New labor force will present a different skill set, more **technology-enabled**



# Defining the Process

**Value Chain Analysis** – Examines the processes and costs related to each element of the chain. It provides management with an understanding of which activity(ies) create or can create the company's competitive advantage(s).

**Supply Chain** – The linked set of resources and processes that begins with the sourcing of raw materials and extends through the delivery of end items to the final customer.

**Business Strategy** – Is how the company is going to create a competitive advantage within the Value System that it is competing in.

# The World is Dynamic

In today's market, only one thing remains constant: *Change*

- Global competition – *constant threat of new competitors*
- Growth of emerging markets – *opportunities or challenges*
- Existing competitors are changing or evolving
- Increased supply chain complexity
- Shorter product life cycles
- Dynamic material and logistic costs

Business strategies must **evolve** and **adapt** to the dynamic environment in order for companies to remain competitive

Supply chains need to evolve to compliment the business strategy changes in order to deliver the maximum value at the lowest possible cost

# Adaptive Supply Chain

A new portal into supply chain visibility

- *www.web.com, mobile apps, and social media*
- *Inventory availability*
- *Order status*
- *Product evaluation prior to purchase*
- *Consumer reviews and comments*



# A Changing Warehouse

In with the new, out with the old . . .

## The Warehouse of the Future:

- Delivers all three

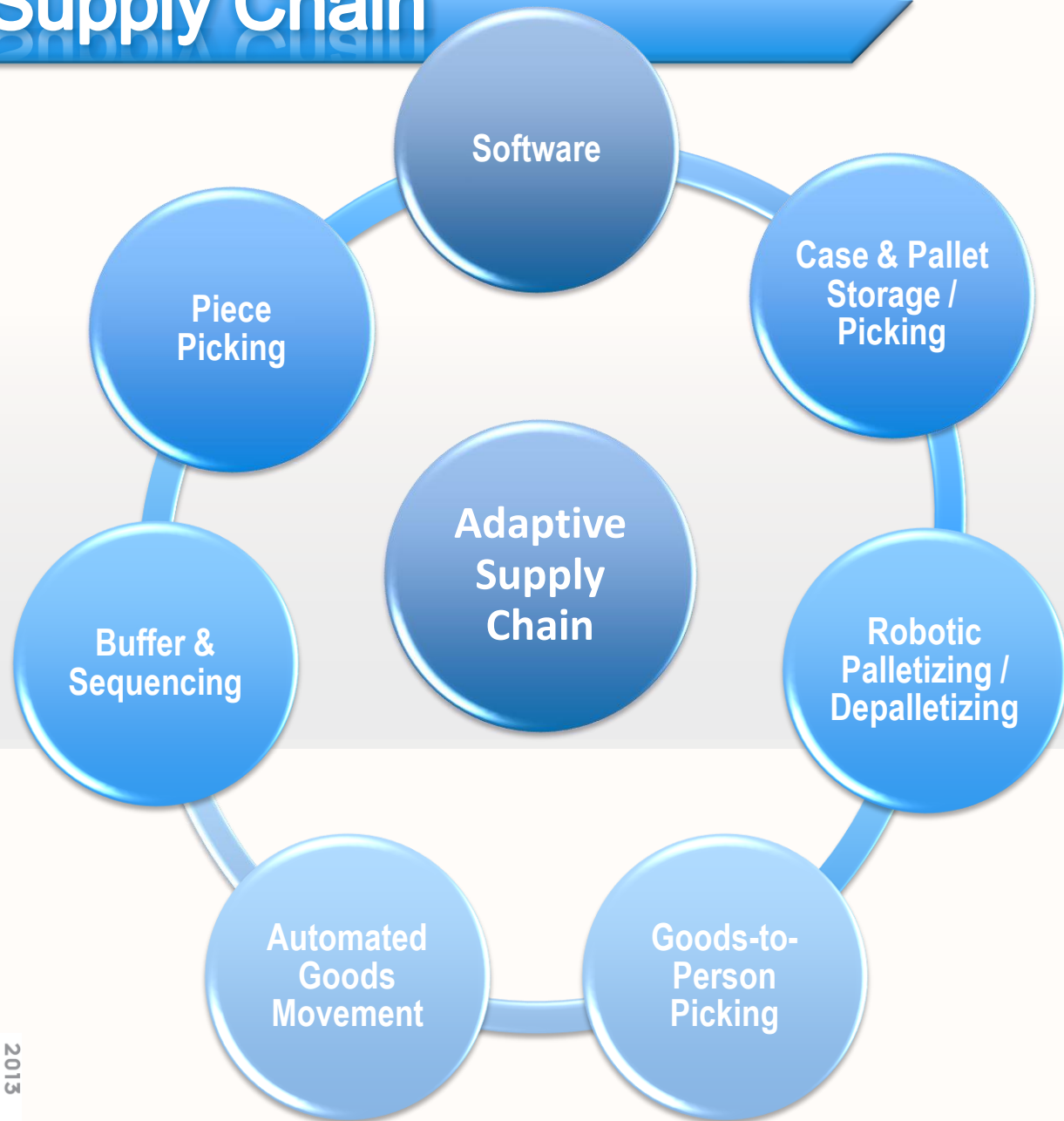
***“You can have it fast, good, and cheap - pick any two.”***

*~ Lawrence Dean Shemesh*

- . . . is automated



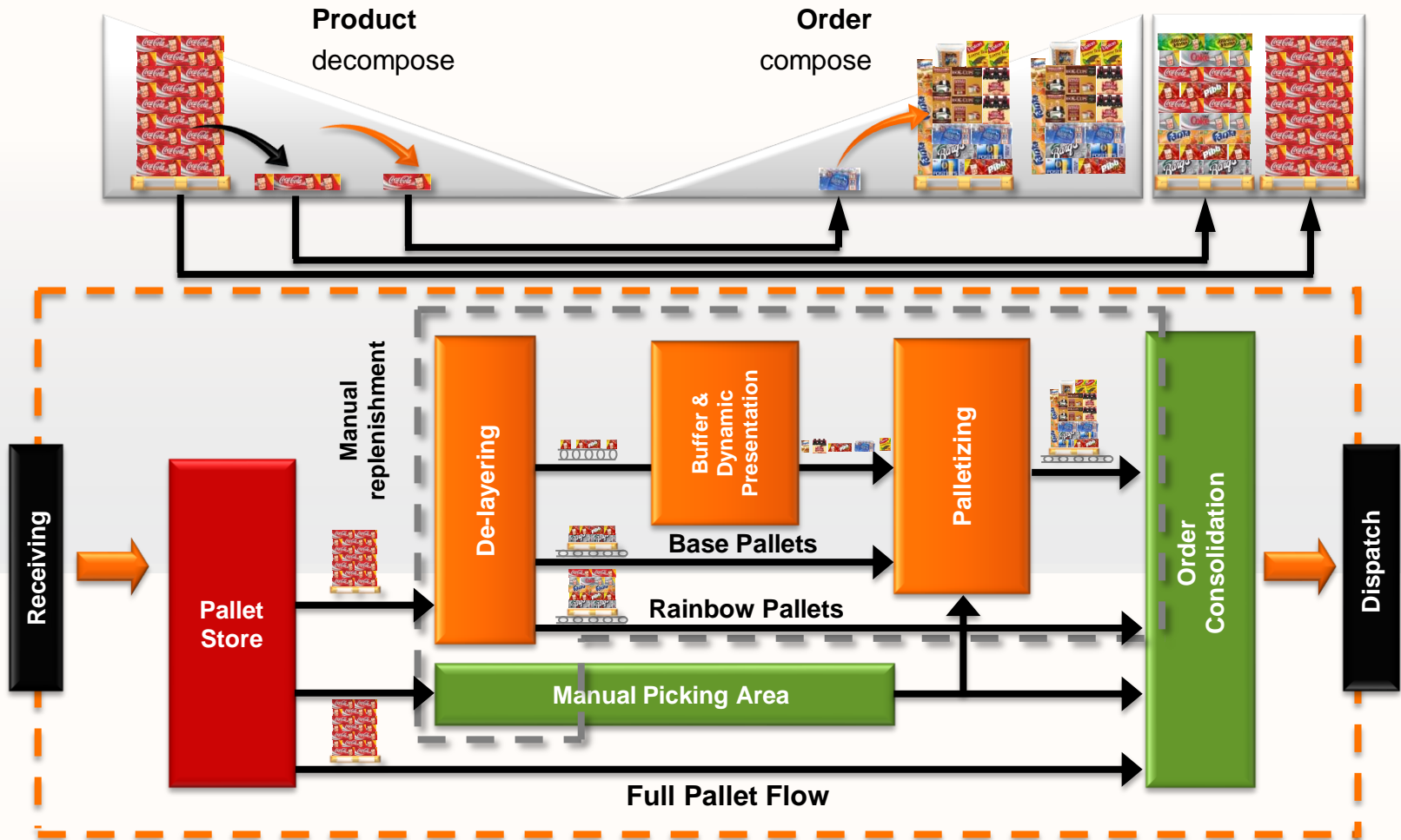
# Adaptive Supply Chain





# Automated Warehouse Flow

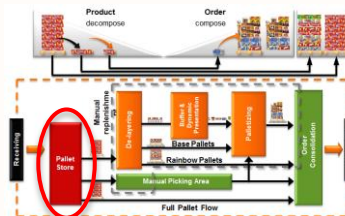
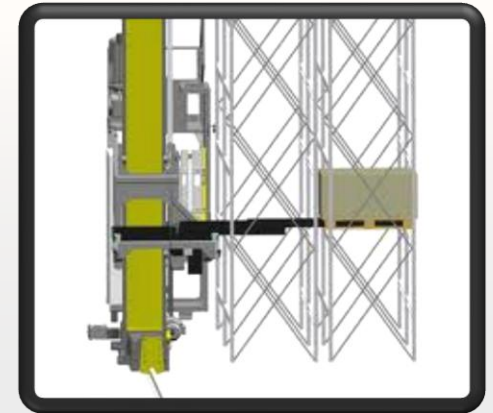
Food & Beverage / Retail



# Adaptive (Flexible and Scalable)

## Pallet Store

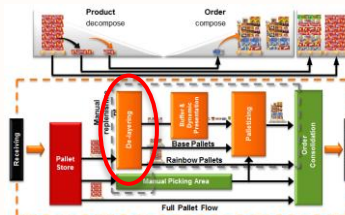
- Pallet AS/RS Features
  - Fully Automatic Storage
  - Single / Double Mast
  - Single / Multiple Deep
- Pallet AS/RS Benefits
  - **Storage and Retrieval** - store, handle and retrieve with speed
  - **Improve order picking accuracy**
  - **Lean inventory management** - Reduce product spoilage or damage
  - **High-Density Storage** - The smallest building footprint with maximum product storage



# Adaptive (Flexible and Scalable)

## De-Layering of Pallets

- Robotic De-Layering Features
  - Gentle Handling of Product
  - Speed – Up to 5 Layer Picks per Minute (1-3 Layers)
  - Feeds ORMs, Case Buffer Storage Systems, Rainbow Pallet Building Systems
- Robotic De-Layering Benefits
  - Handles Wide Range of Products and Package Types (Corrugated, Open Top, Shrink, Trays, etc.)
  - Increased Throughput due to Multiple Layer Picking Capability
  - High System Availability and Easy Operation



# Adaptive (Flexible and Scalable)

## Parts Store – Robotic Bin Storage and Retrieval

### High-Speed Picking



- High-speed, Goods-to-Person workstations can achieve 1000 picks per hour per person
- Workstations can be Pick only, or one step Pick & Pack.
- Multiple workstations have been integrated, including 'batch-pick or put' stations.

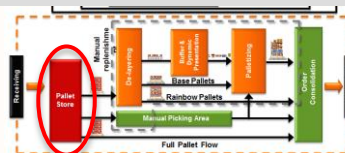
### Inventory Solution



- Simple, modular system that is easy to install and expand
- Proven solution new to the North American market.
- Highest density inventory storage available

### Highlights:

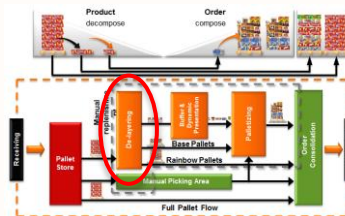
- Simple and Flexible solution with only two main components
- Workstations are designed with the specific customer needs in mind
- Easy expansion allows system to grow with your business
- Picking and Packing located adjacent to Storage.



# Adaptive (Flexible and Scalable)

## Buffering and Sequencing

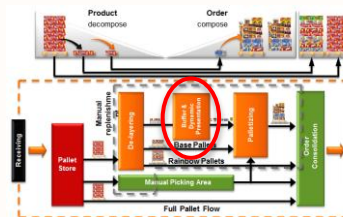
- Shuttle Technology Features
  - Multiple Shuttles Can Operate on 1 Level
  - Energy Efficient through Constant Power Regeneration
  - Can Sequence SKUs at Very High Rates
- Shuttle Technology Benefits
  - Dynamic Sequencing
  - Increased Throughput
  - Ease of Maintenance



# Adaptive (Flexible and Scalable)

## Buffering and Sequencing

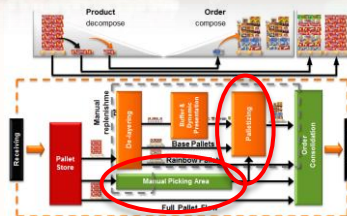
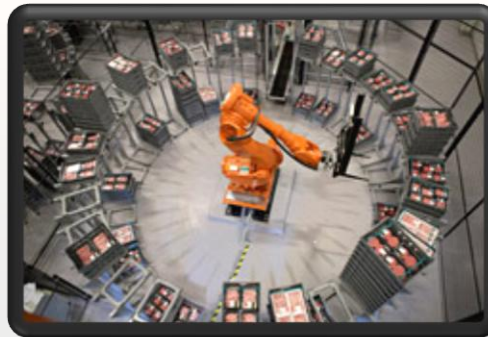
- Mini-Load Technology Features
  - Variety of Load Handling Methods
  - Space Efficient
  - Multiple Speed Options
- Mini-Load Technology Benefits
  - Small Footprint
  - Space Efficient
  - Ease of Maintenance



# Adaptive (Flexible and Scalable)

## Order Picking

- Manual Picking
  - Person to Goods
  - Zone to Zone
  - Goods to Person
- Automatic Picking
  - Robotic Picking
  - A-Frame



# Basic Principles of Picking Systems

## Principle

### Person to Goods



### Zone to Zone



### Goods to Person



### Fully Automatic



Personnel Expenses



Investment



Flexibility



Storage Density



Throughput



Price / Pick

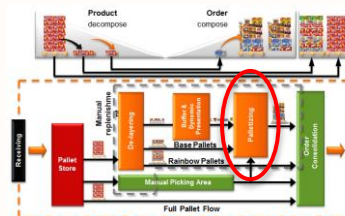




# Adaptive (Flexible and Scalable)

## Automatic Palletizing

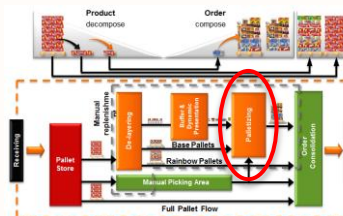
- Layer Palletizing
  - Rainbow Palletizing
  - Layer Forming / Palletizing
  - Downstacking Palletizer
- Mixed Case Palletizing
  - Single Case Palletizing
  - Row Palletizing



# Adaptive (Flexible and Scalable)

## Automated Sortation

- Line Sorters
  - Shoe Sorters
  - Pusher Sorters
  - Pop-Up Sorters
- Loop Sorters
  - Cross-Belt Sorters
  - Tilt Tray Sorters
- Robotic Sorters
  - Star Robot
  - FRS



# Adaptive (Flexible and Scalable)

## Automated Movement of Goods

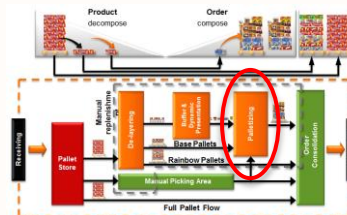
- AGVs

- Warehouse
- Production
- Packing
- Shipping



- Mobile Bots

- Parts Transport
- Rack/Cart Transport



# Adaptive (Flexible and Scalable)

## E-Commerce

### Methodology

- Discrete Orders
- Batch Orders
- Zone Routing
- Batch Pick and Consolidation

### Order Filling (Piece Picking)

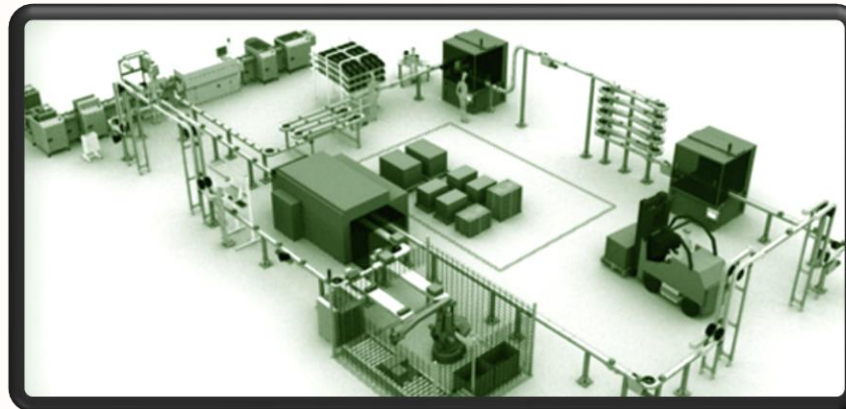
- Pick-and-Pass
- Shotgun Pick
- Bucket Brigade
- Batch Pick
- Pick-n-Put
- Goods-to-Person
- Pick-then-Sort
- Case Pallet Build



# Adaptive Supply Chain

## Summary

- Software, resource utilization
  - *Workload planning / balancing*
  - *Work in progress*
  - *Adjust process*
  - *Inventory accuracy*
- Automation / Technology
  - *Case & pallet store / picking*
  - *Robotic palletizing / depalletizing*
  - *Goods-to-person picking*
  - *Automated goods movement*
  - *Buffering & sequencing*
  - *Piece picking*
  - *Management software*
- React to anomalies
  - *Move order fillers*
  - *Trigger replenishment*
  - *Re-slot product*



## For More Information:

**Gary Forger, MHI Managing Executive**  
[gforger@mhi.org](mailto:gforger@mhi.org)

**Mike Ogle, MHI Managing Executive**  
[mogle@mhi.org](mailto:mogle@mhi.org)

**[www.MHI.org](http://www.MHI.org)**