What is Supply Chain Management?

Professor Ladimer S. Nagurney
Department of Electrical and Computer Engineering
University of Hartford
June 29, 2013

UNIVERSITY OF HARTFORD

LeadAmerica™

What is a Supply Chain?

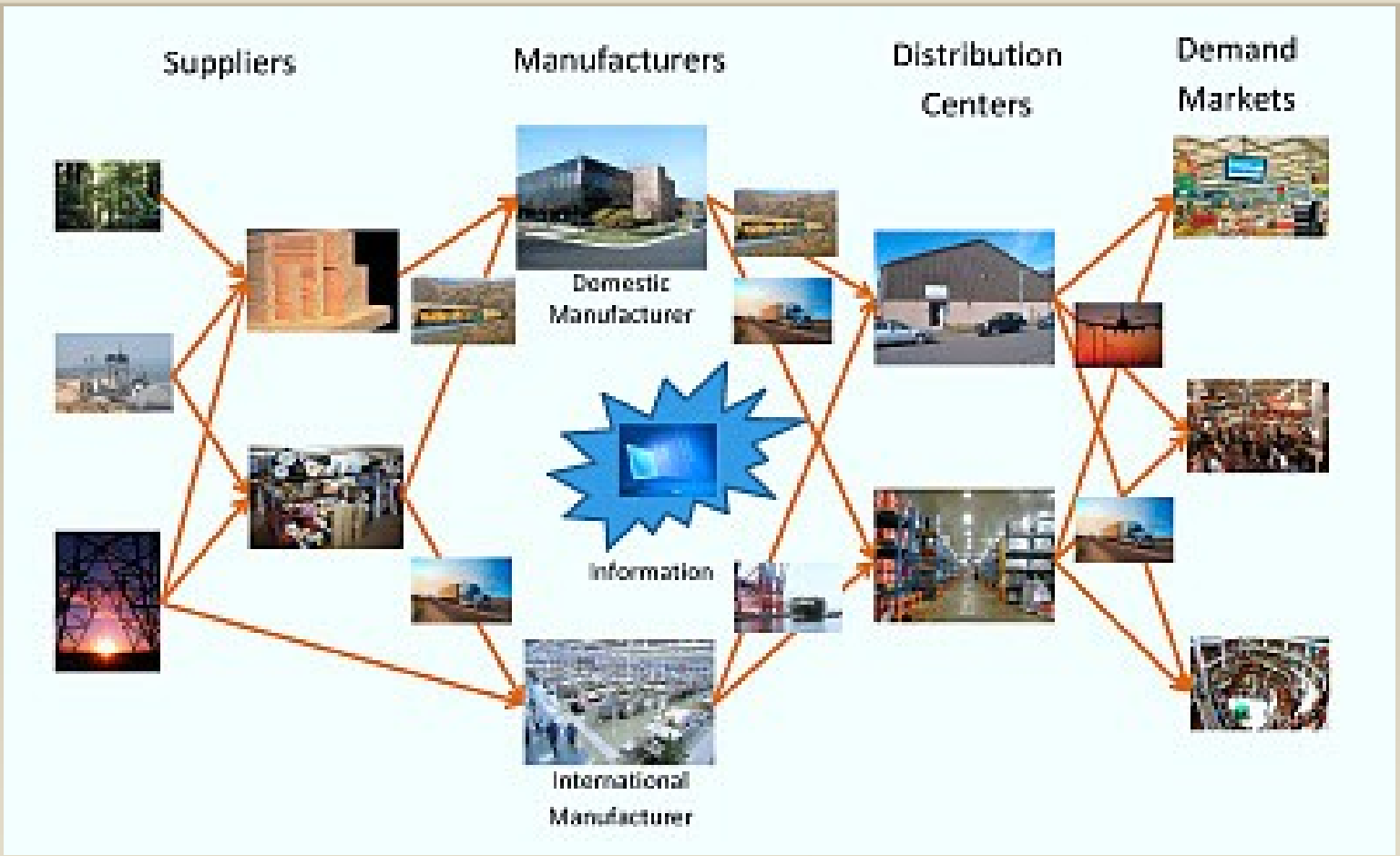
A supply chain consists of the flow of products and services from:

- Raw materials suppliers *-to-*
- Component and intermediate manufacturers/producers *-to-*
- Final product manufacturers/assemblers *-to-*
- Wholesalers and distributors *-to-*
- Retailers *-to-* *The Customer*

Connected by transportation and storage activities, and

Integrated through information, planning, and integration activities

What is a Supply Chain?



Paradigm Shift

Pre-1990s - Most firms were vertically oriented. The firm's employees performed all functions from product conceptualization thorough final sale and delivery. All manufacturing was done within the firm. There was *Central Control* of all operations.

1990s – Transportation costs dropped so that manufacturing could be performed anywhere in the world where the costs were appropriate. Outsourcing became a popular choice for manufacturing and assembly.

Today's Paradigm

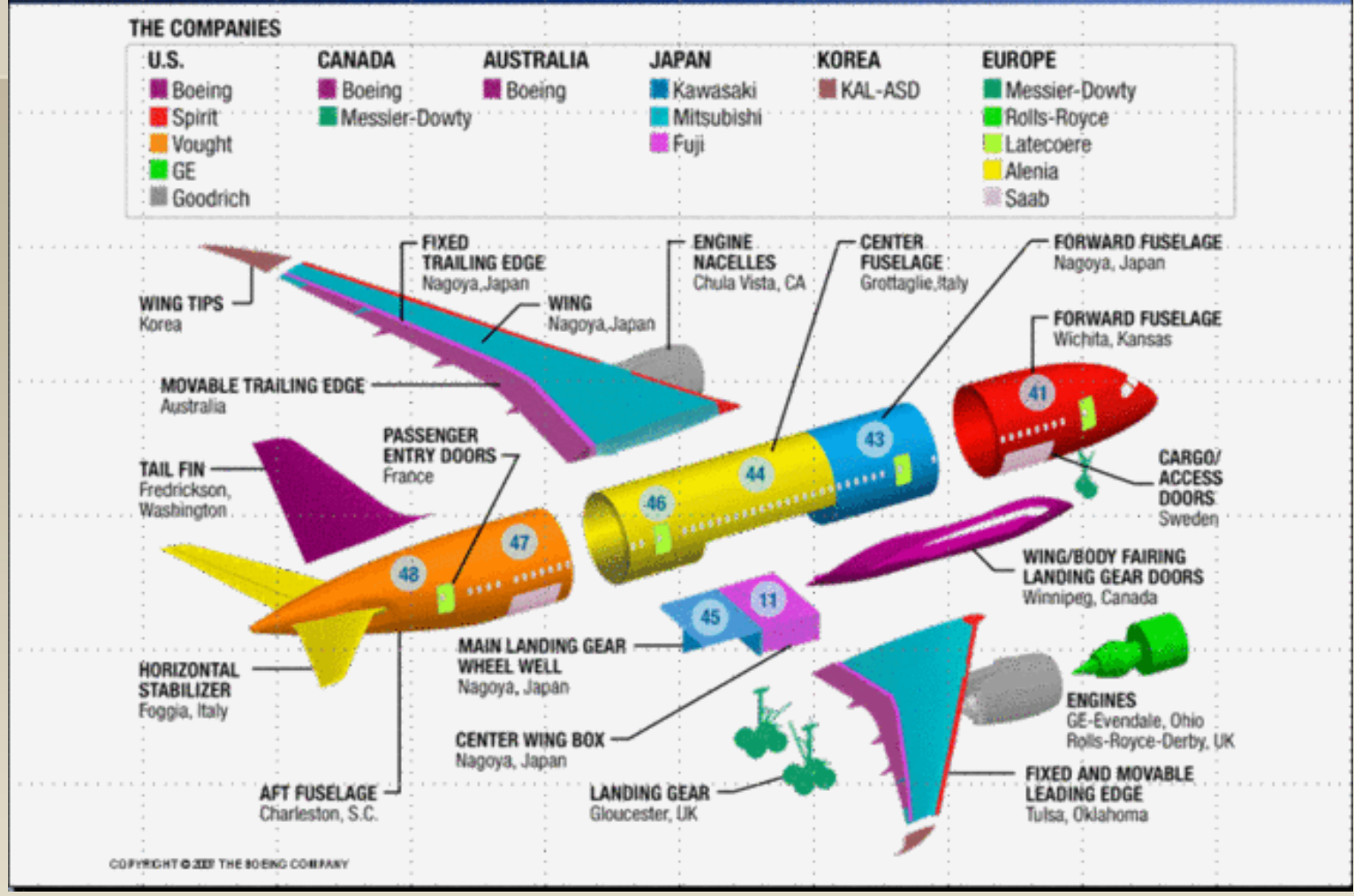
Firms outsource design/manufacturing whenever and wherever and whenever appropriate. The firms are concerned about the environmental and societal effects of the product manufacturing and the effect of outdated products.

Corporate Social Responsibility – Reverse Logistics

Often a product a user receives will never be handled by an employee of the firm whose name is on its label.

Partners Across The Globe Are Bringing The 787 Together

787 DREAMLINER



New paradigm

A firm in a supply chain focuses activities in its area of specialization and enters into voluntary and trust-based relationships with supplier and customer firms.

All participants in the supply chain benefit.

Boundaries are dynamic and extend from *the firm's suppliers' suppliers to its customers' customers* (i.e., second tier suppliers and customers).

Supply chains now deal with reverse logistics to handle returned products, warranty repairs, and recycling.

Manufacturing and Product Shipment are Global!

Outsourcing

Outsourcing: moving some of the firms internal activities and decisions to outside providers

Question: When should the firm outsource activities?

Examples of outsourcing

Toshiba has outsourced manufacturing to Solectron.

GM has outsourced its interior design to Delphi.

Many firms outsource problem solving to McKinsey & Co.

Advertising is often outsourced completely.

Many companies outsource logistics and transportation.

What Is the Goal of Supply Chain Management?

Supply chain management is concerned with the efficient integration of suppliers, factories, warehouses and stores so that merchandise is produced and distributed:

- In the right quantities
- To the right locations
- At the right time

In order to

- Minimize total system cost
- Satisfy customer service requirements

Right Quantity–Right Time–Right Place

Why Isn't Supply Chain Management Easy?

Conflicting Objectives of Different Parties

Need for Global Optimization

Conflicting Objectives

1. Purchasing
   - Stable volume requirements
   - Flexible delivery time
   - Little variation in mix
   - Large quantities
2. Manufacturing
   - Long run production
   - High quality
   - High productivity
   - Low production cost

Conflicting Objectives

3. Warehousing
   - Low inventory
   - Reduced transportation costs
   - Quick replenishment capability
4. Customers
   - Short order lead time
   - High in stock
   - Enormous variety of products
   - Low prices

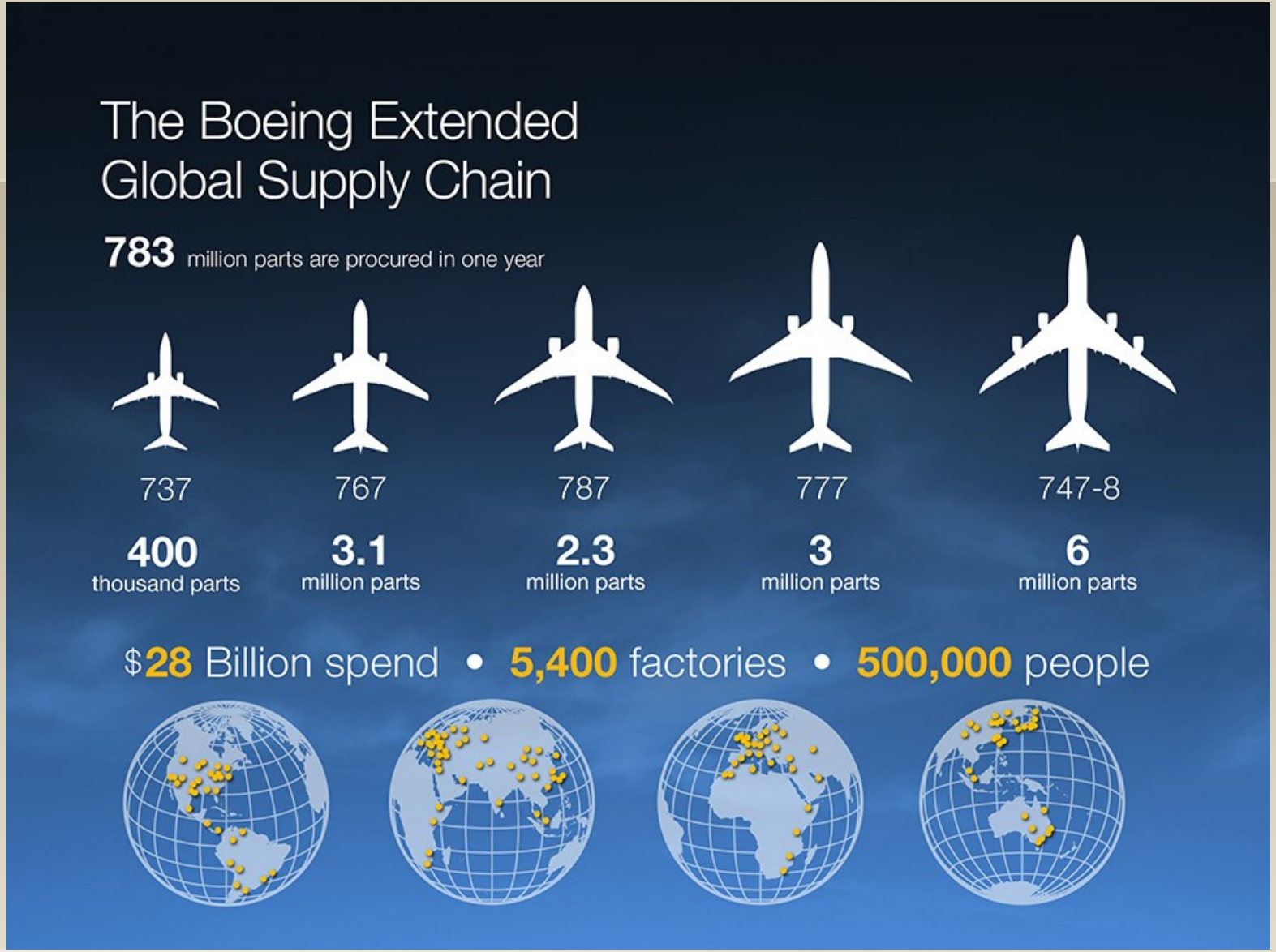
Local Optimization vs Global Optimization

Why Optimization is Hard

Need not only optimize each process or part, but

Must do so simultaneously

Including Transportation, Warehousing, Disposal, and Shrinkage Costs


The Boeing Extended
Global Supply Chain
783 million parts are procured in one year
737
400 thousand parts
767
3.1 million parts
787
2.3 million parts
777
3 million parts
747-8
6 million parts
$28 Billion spend • 5,400 factories • 500,000 people

Why Transportation is important!

It is estimated that the grocery industry could save $30 billion (10% of operating cost) by using effective logistics strategies.

A typical box of cereal spends more than three months getting from factory to supermarket.

A typical new car spends 15 days in transit from the factory to the dealership, although actual travel time is 5 days.

National Semiconductor Supply Chain

- Production
  - Produces chips in six different locations: four in the US, one in Britain and one in Israel
  - Chips are shipped to seven assembly locations in Southeast Asia.
- Distribution
  - Final product are shipped worldwide to 100s of facilities Id
  - 20,000 different routes
  - 12 different airlines are involved
  - 95% of the products are delivered within 45 days
  - Remaining 5% are delivered within 90 days.

Can't we just forecast demand for a product?

Forecasting is always wrong

The longer the forecast horizon the worse the forecast

End item forecasts are even more wrong

Why Can't We Deal with Uncertainty?

Matching supply and demand is difficult.

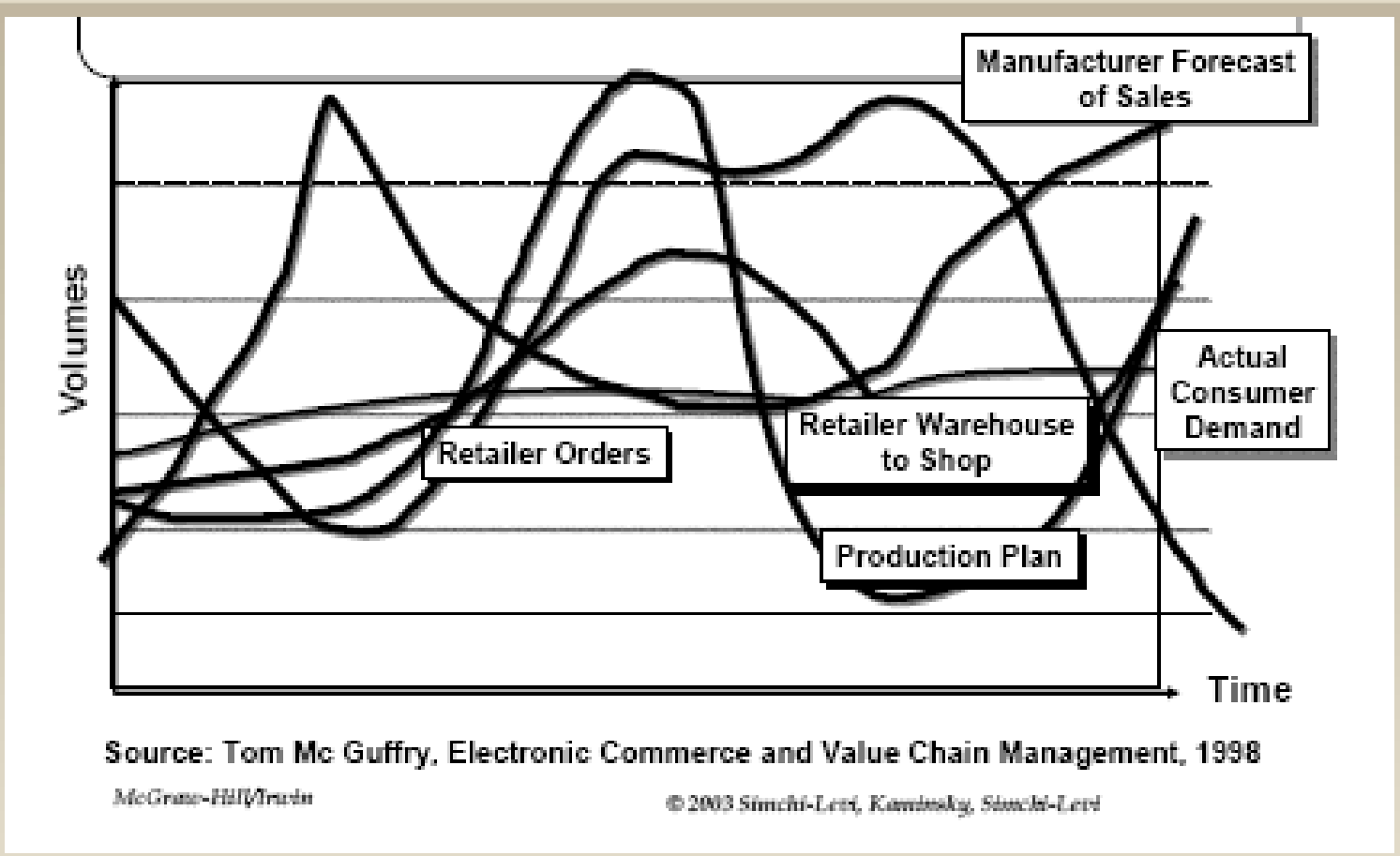
Forecasting doesn’t solve the problem.

Inventory and back-order levels typically fluctuate widely across the supply chain.

Demand is not the only source of uncertainty:

- Lead times
- Yields
- Transportation times
- Natural Disasters
- Component Availability

What About Variability?



Source: Tom Mc Guffry, Electronic Commerce and Value Chain Management, 1998

Supply Chain Disruption

Small fire in Mew Mexico Chip Factory causes shortages of Cell Phones months later.

Nokia

Ericsson

Philips factory
in New Mexico

Source: *The Resilient Enterprise*

Why Supply Chain Management Is Important?

Cost savings and better coordination of resources are reasons to employ Supply Chain Management

- Reduced Bullwhip Effect- the magnified reduction of safety stock costs based on coordinated planning and sharing of information
- Collaborative planning, forecasting, and replenishment activities reduce the Bullwhip Effect and lead to better customer service, lower inventory costs, improved quality, reduced cycle time, better production methods, and other benefits.

But haven't we known about SCM for a long time?

1950s & 1960s

U.S. manufacturers focused on mass production techniques as their principal cost reduction and productivity improvement strategies

1960s-1970s

New computer technology lead to development of Materials Requirements Planning (MRP) to coordinate inventory management and improve internal communication

1980s & 1990s

Intense global competition led U.S. manufacturers to adopt

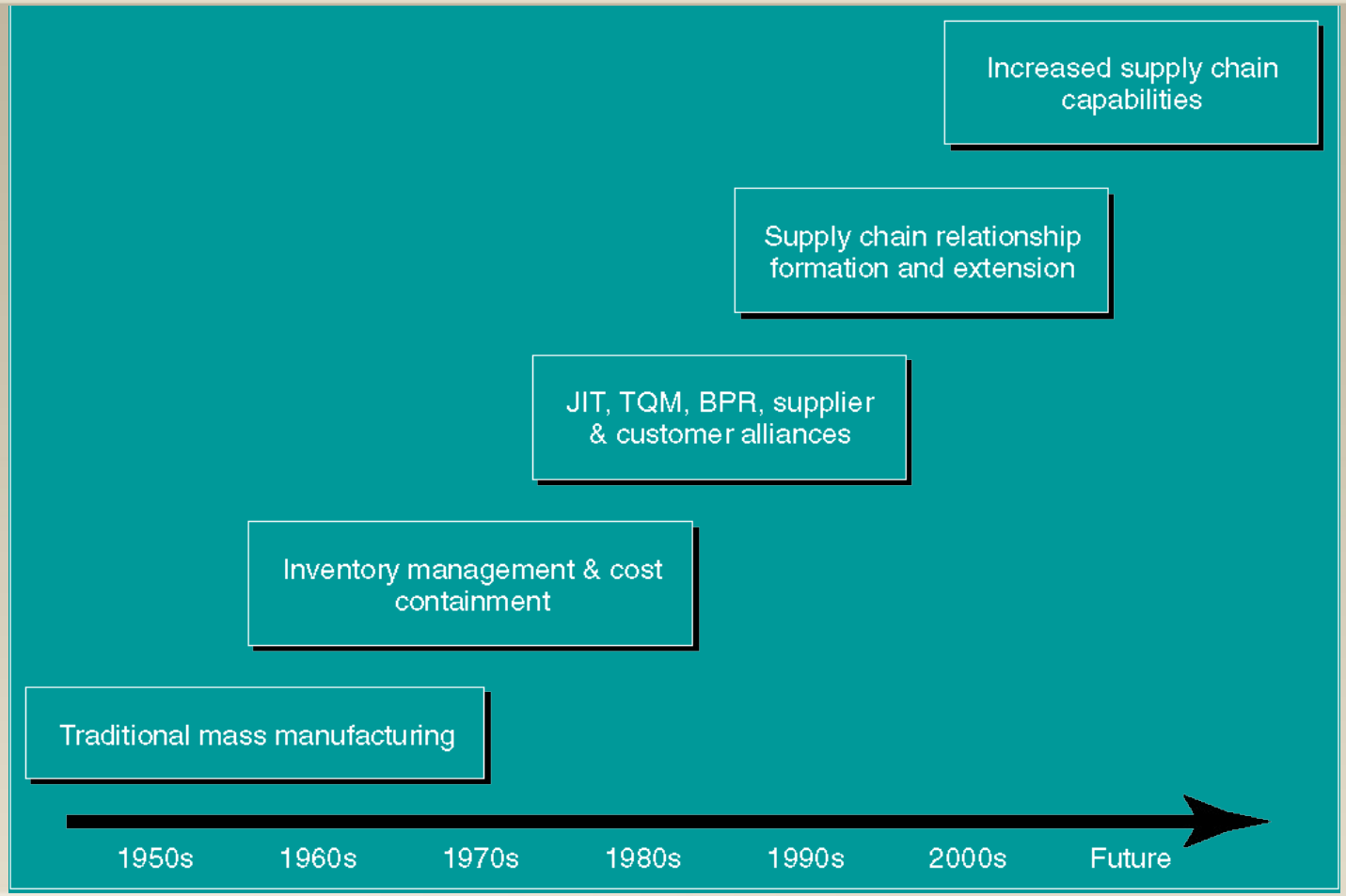
- Supply Chain Management along with
- Just-In-Time (JIT),
- Total Quality Management (TQM),
- and
- Business Process Reengineering (BPR) practices

2000s and Beyond

Firms will rely more on ***third-party service providers (3PLs)*** to improve purchasing and supply management

Wholesalers/retailers will focus on transportation and logistics more & refer to these as ***quick response, service response logistics,*** and ***integrated logistics***

Origins of Supply Chain Management



How will Supply Chain Management Effect an Engineer's Job!

Purchasing Trends:

- ***Long term relationships***
- ***Supplier management -*** improve performance through
  - **Supplier evaluation** (determining supplier capabilities)
  - **Supplier certification** (third party or internal certification to assure product quality and service requirements)
- ***Strategic partnerships -*** successful and trusting relationships with top-performing suppliers

How will Supply Chain Management Effect an Engineer's Job!

Operations Trends:

Demand management- match demand to available capacity

- Linking buyers & suppliers via ***MRP*** and ***ERP*** systems
- Use ***JIT*** to improve the ***pull*** of materials to reduce inventory levels
- Employ ***TQM*** to improve quality compliance among suppliers

How will Supply Chain Management Effect an Engineer's Job!

Distribution Trends:

- **Transportation management-** tradeoff decisions between cost & timing of delivery/customer service via truck, rail, water & air
- **Customer relationship management-** strategies to ensure deliveries, resolve complaints, improve communications, & determine service requirements
- **Network design-** creating ***distribution networks*** based on tradeoff decisions between cost & sophistication of distribution system

Important Elements of Supply Chain Management

Integration Trends:

- **Supply Chain Process Integration -** when supply chain participants work for common goals. Requires intra-firm functional integration. Based on efforts to change attitudes & adversarial relationships
- **Supply Chain Performance Measurement -** Crucial for firms to know if procedures are working

Current Trends in Supply Chain Management

Expanding the Supply Chain

- U.S. firms are expanding partnerships and building facilities in foreign markets
- The expansion involves:
  - ***Breadth*** - foreign manufacturing, office & retail sites, foreign suppliers & customers
  - ***Depth*** - second and third tier suppliers & customers

Current Trends in Supply Chain Management

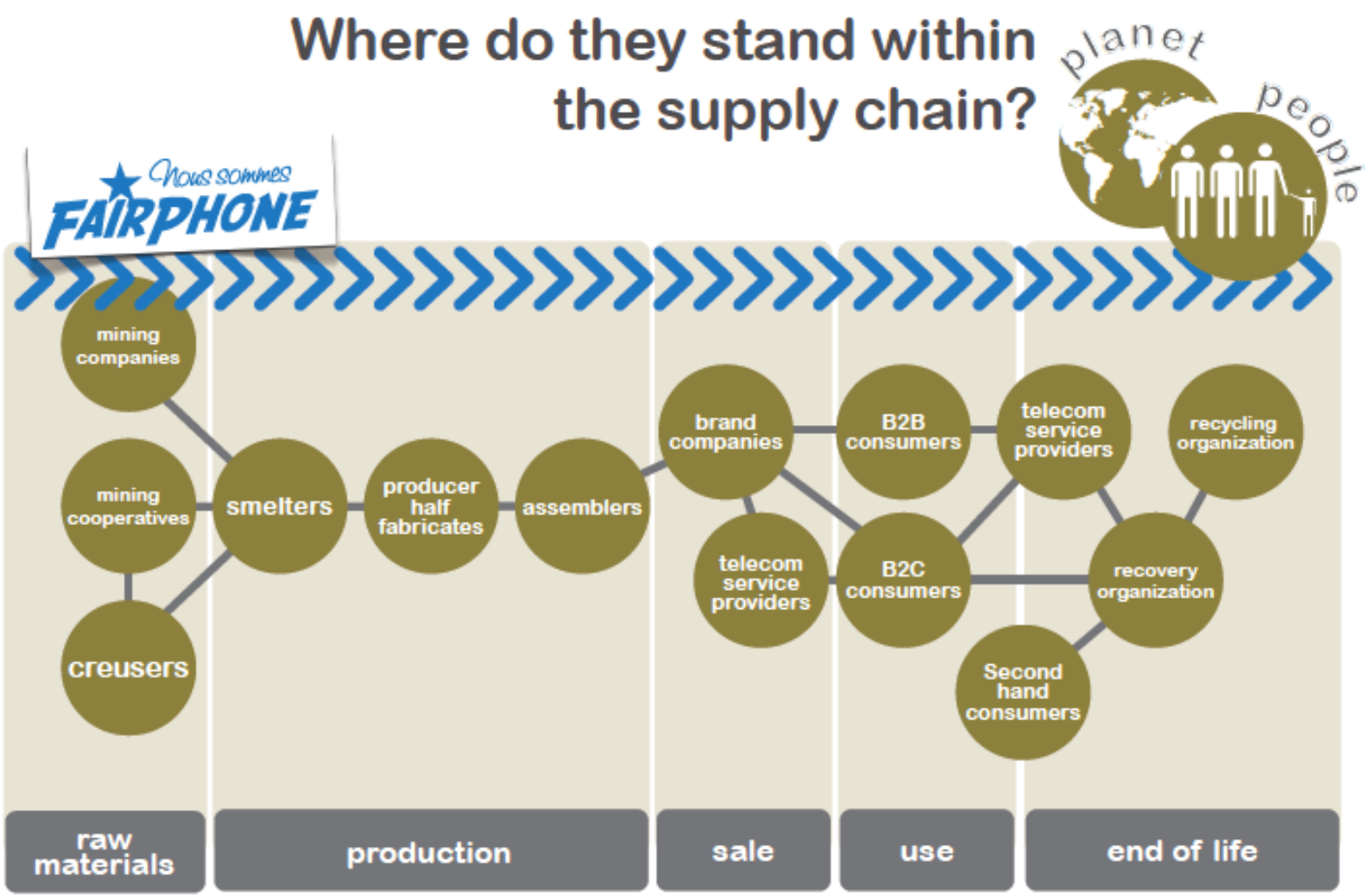
Increasing Supply Chain Responsiveness

- Firms increasingly need to be more flexible and responsive to customer needs.
- Supply chains need to ***benchmark*** industry performance and meet and improve on a continuous basis.
- Responsiveness improvement will come from more effective and faster product & service delivery systems.

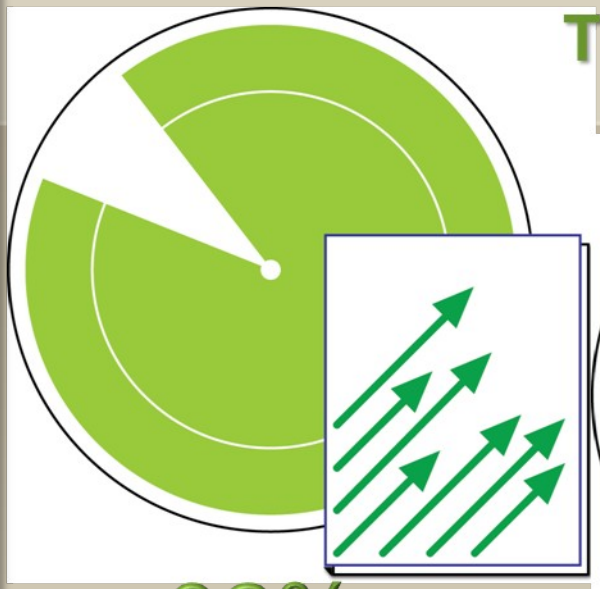
The Greening of Supply Chains

- Producing, packaging, moving, storing, delivering and other supply chain activities can be harmful to the environment
- Supply chains can work harder to reduce environmental degradation
- A large majority (75%) of U.S. consumers are influenced by a firm's environmental friendliness reputation
- Recycling and conservation are a growing alternative in response to high cost of natural resources.

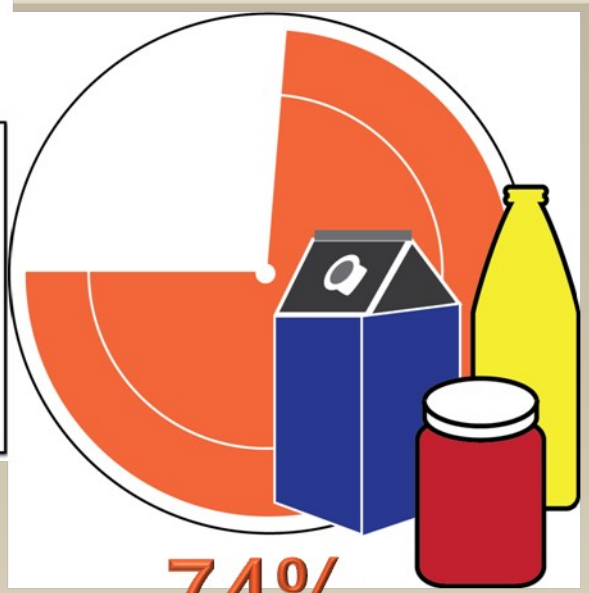
Product Recycling



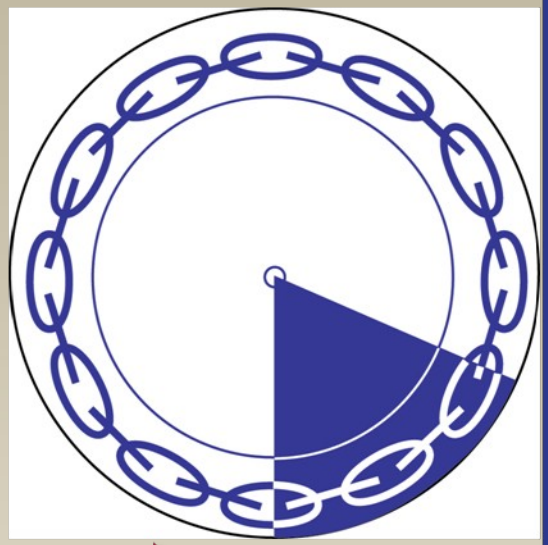
The State of the Green Supply Chain



92%
publicly share their sustainability goals



74%
make sustainability brand promises



BUT ONLY **20%**
apply sustainability goals to their entire value network

Supply Chain Insights
www.supplychaininsights.com

Reducing Supply Chain Costs

Cost reduction achieved through:

- Reduced purchasing costs
- Reducing waste
- Reducing excess inventory, and
- Reducing non-value added activities

Continuous Improvement through

- **Benchmarking-** improve over competitors' performance
- Trial & error
- Increased knowledge of supply chain processes

Conflict Minerals

Conflict minerals are minerals that are mined illegally to finance hostilities in the Democratic Republic of Congo or 9 countries surrounding Congo.

US Secretary of State has determined that these minerals must be removed from US products

Companies examine their supply chain for traces of *conflict minerals*, that is tantalum, tin, tungsten, and gold from mines in central Africa

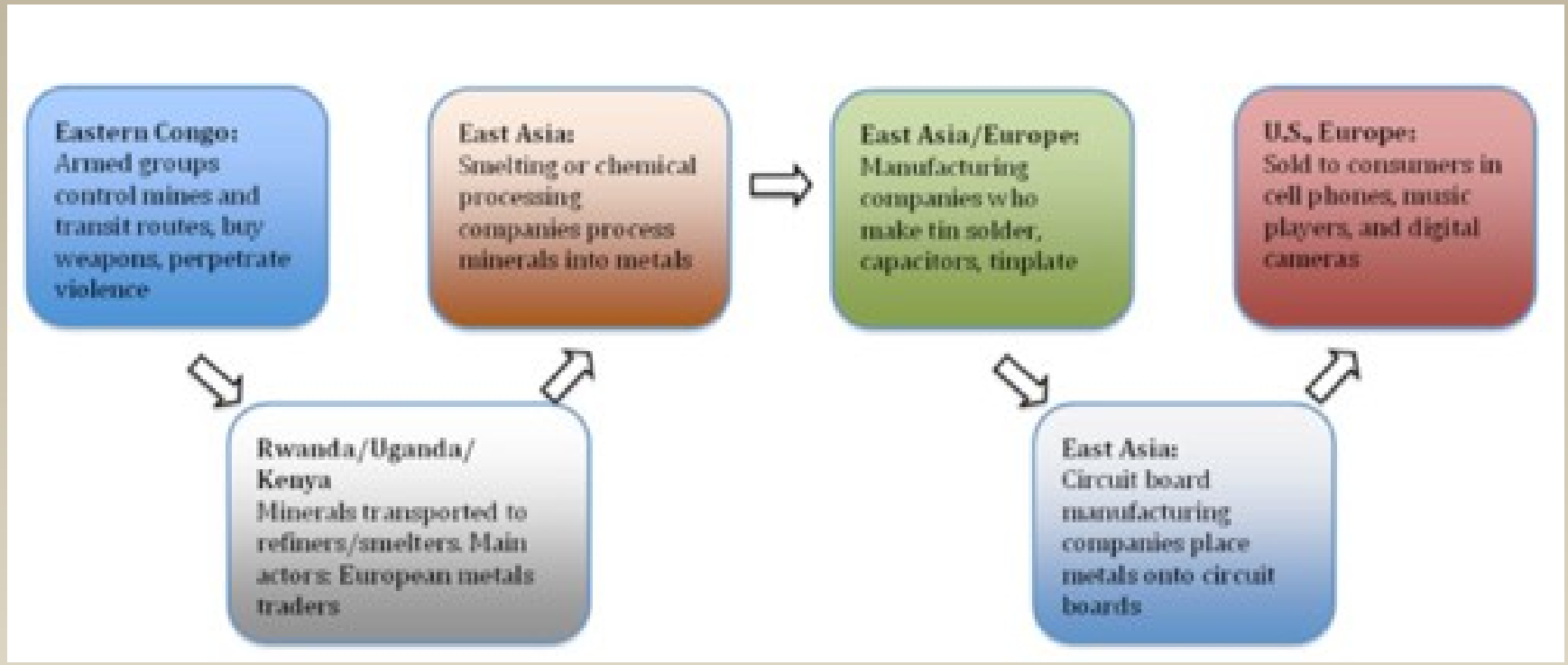
Conflict Minerals

Rules require firms to

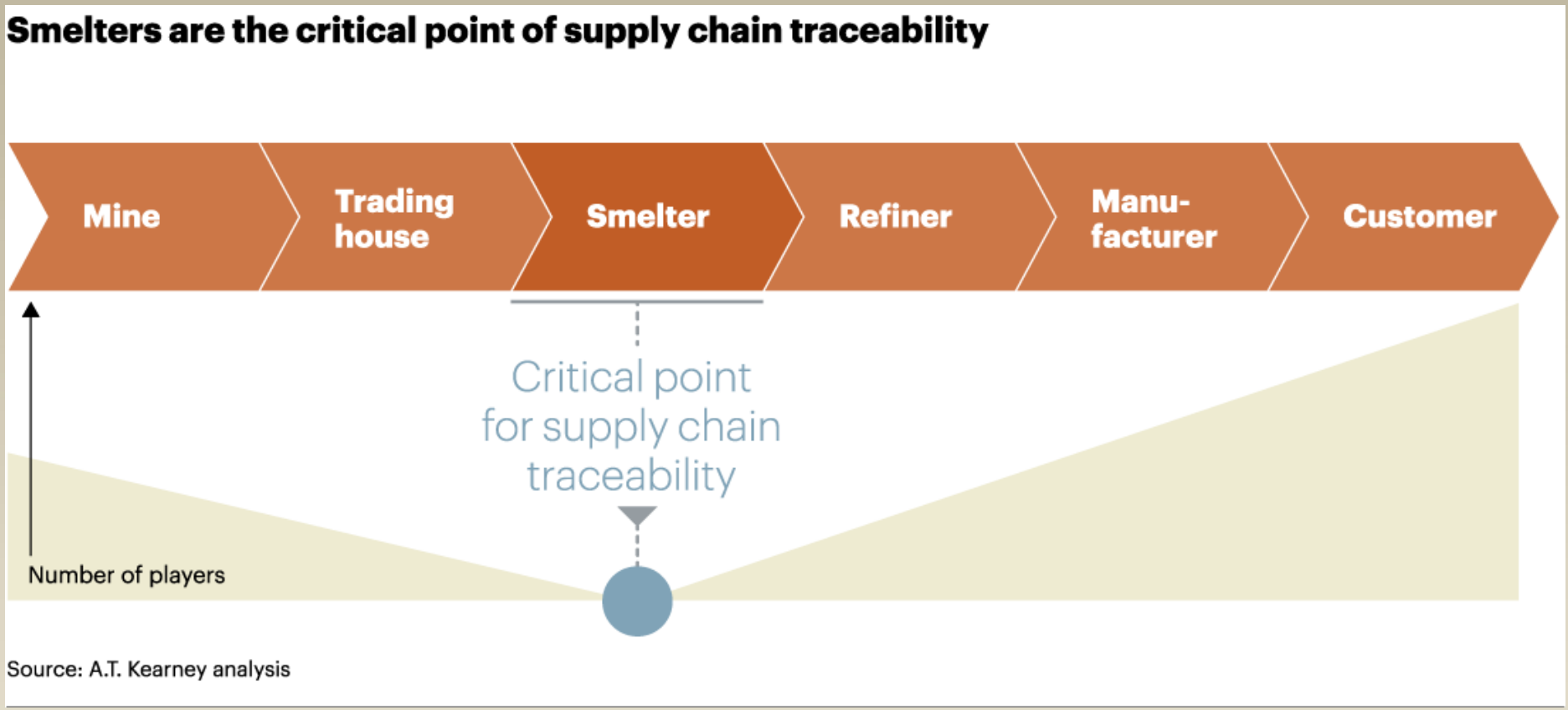
1. Determine whether the minerals are absolutely needed for the product
2. Determine where the minerals came from, either conflict-region and recycled or scrap from that region
3. Exercise due diligence regarding the source and chain of custody of there minerals.

Apple can map its supply chain to the smelter. (Transport Topics – March 18, 2013)

Congo Conflict Materials Supply Chain



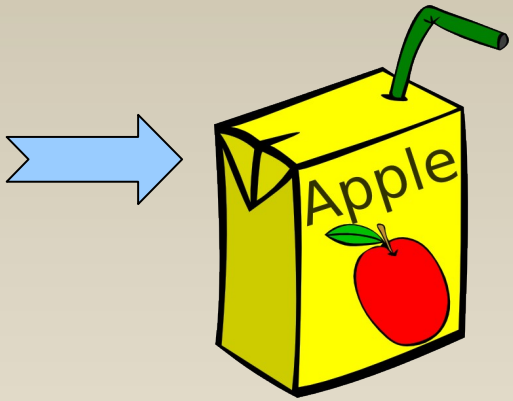
We can Protect Against using Conflict Materials



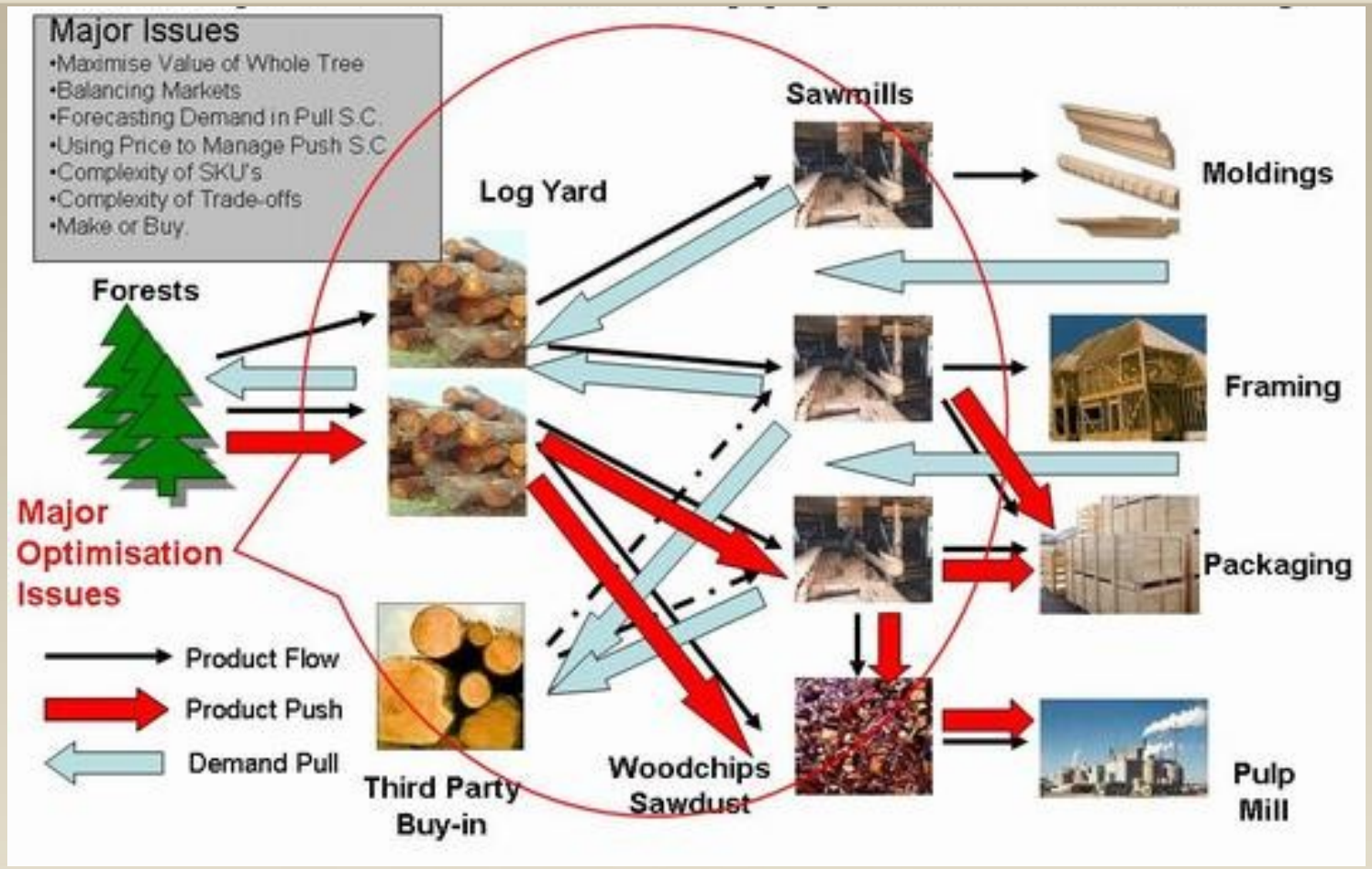
Apple Juice Supply Chain

Supply Chain

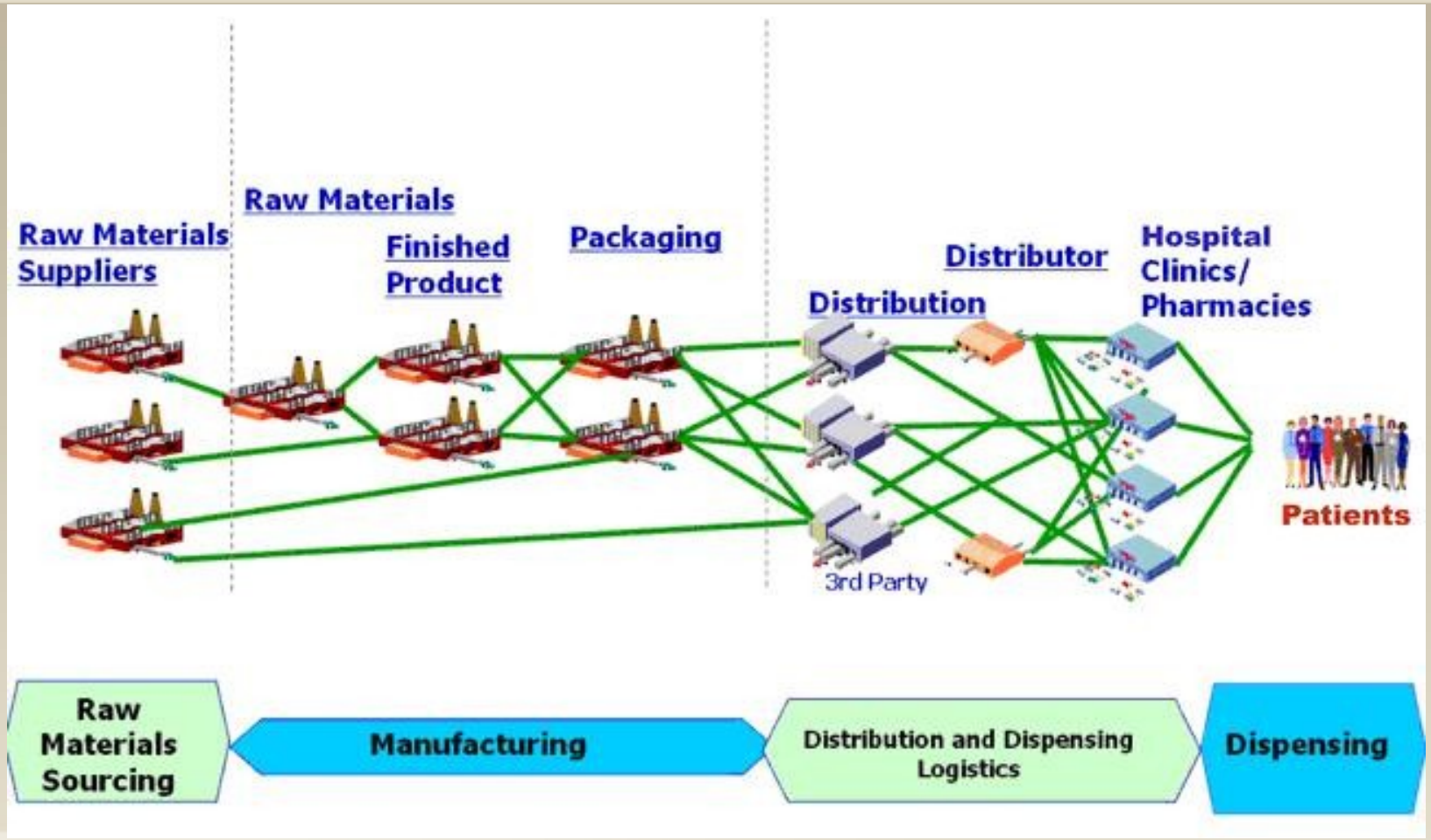
Apple Farm › Apple Juicing Plant › National Distribution Centre (NDC) › Regional Distribution Centre (RDC) › Shops, Supermarkets, Vending Machines



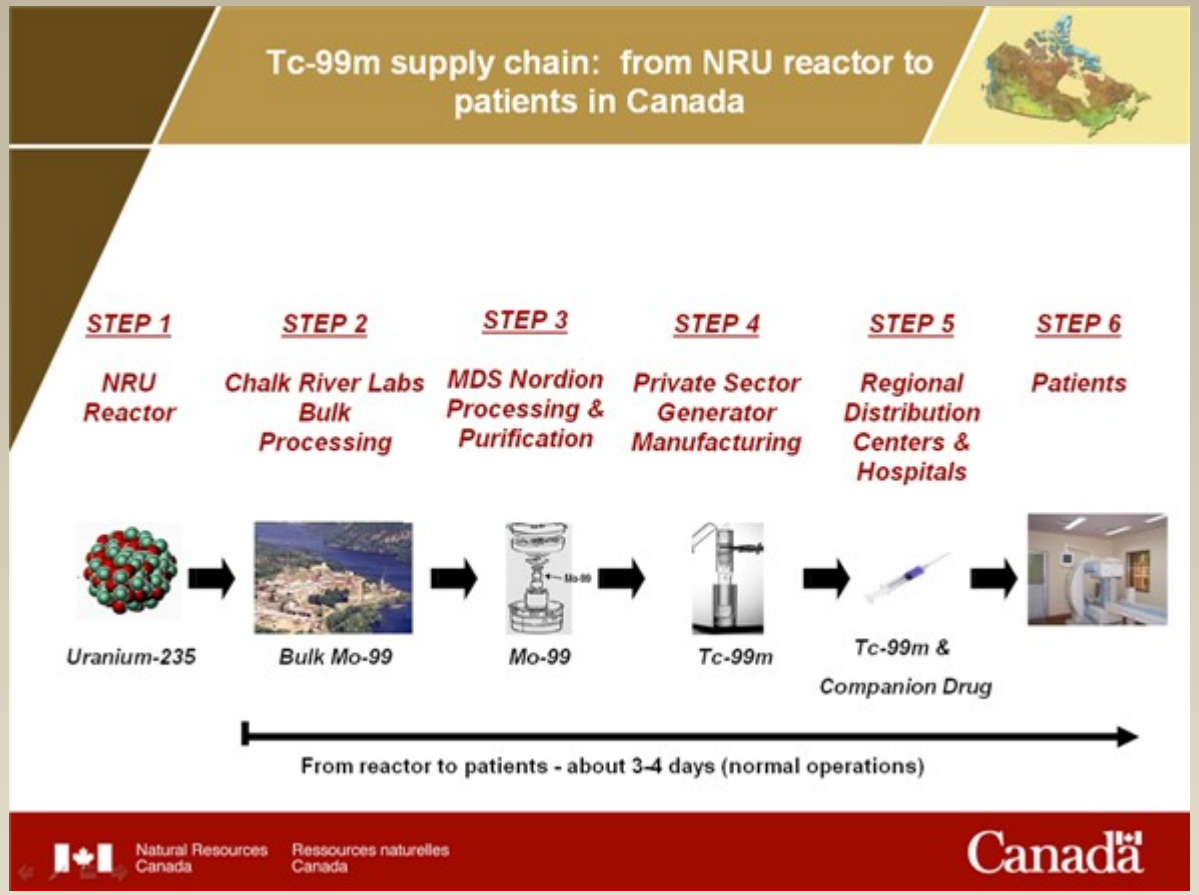
Forestry Supply Chain

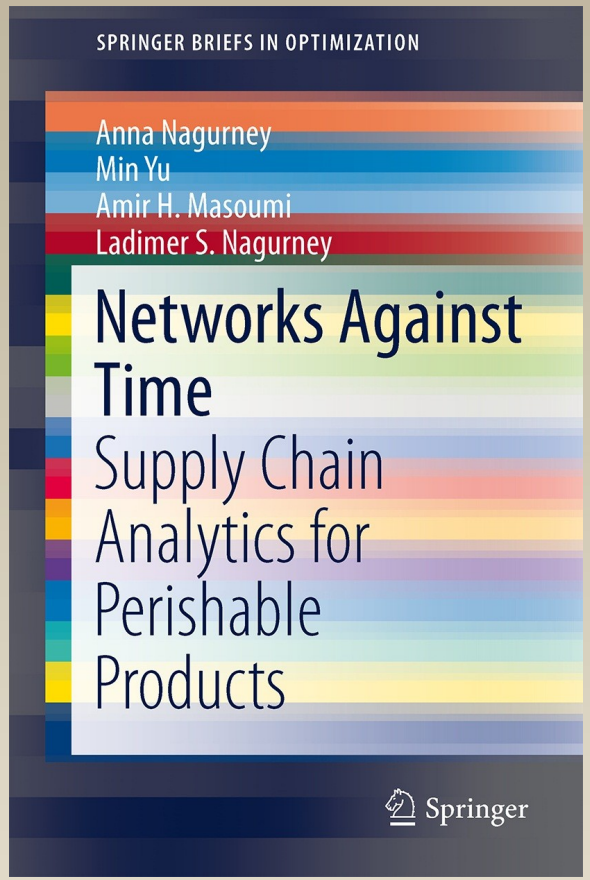


Pharmaceutical Supply Chain

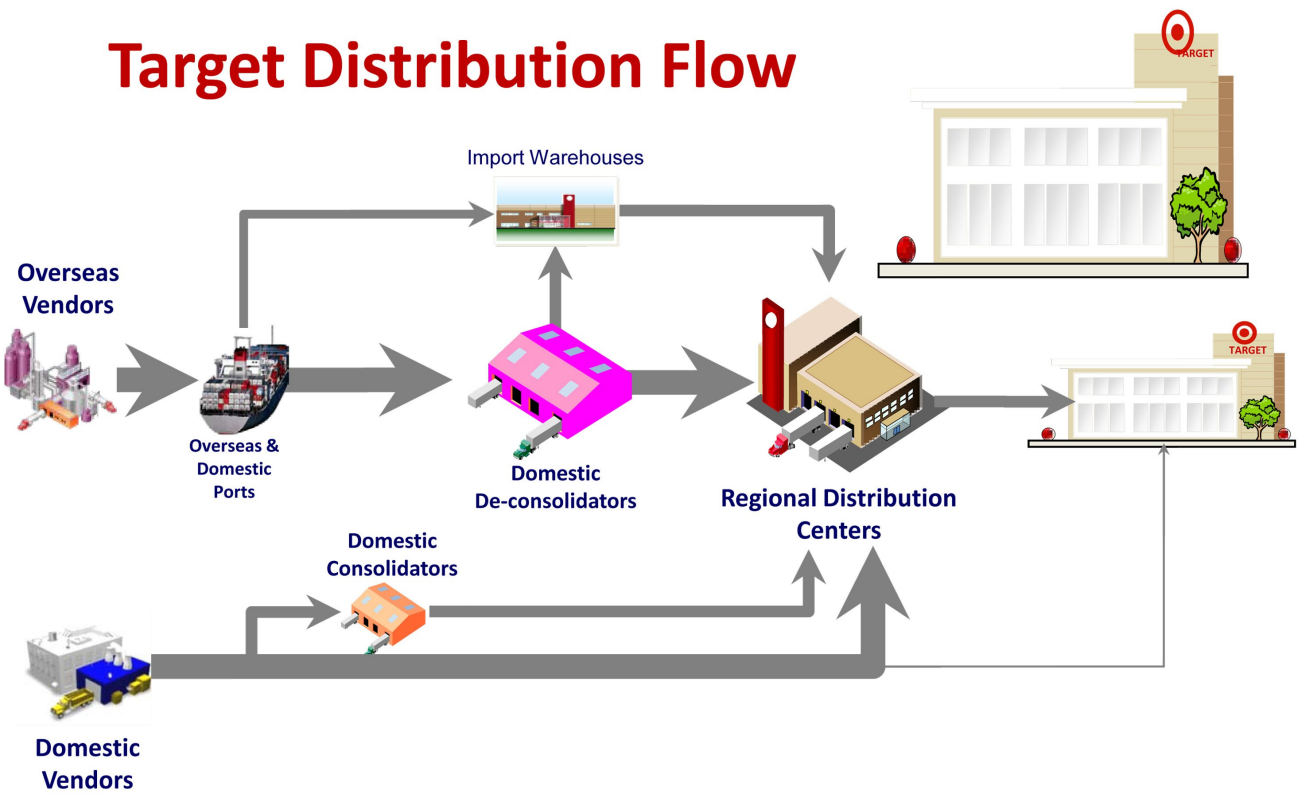


Medical Nuclear Supply Chain
MO-99 --- TC-99m



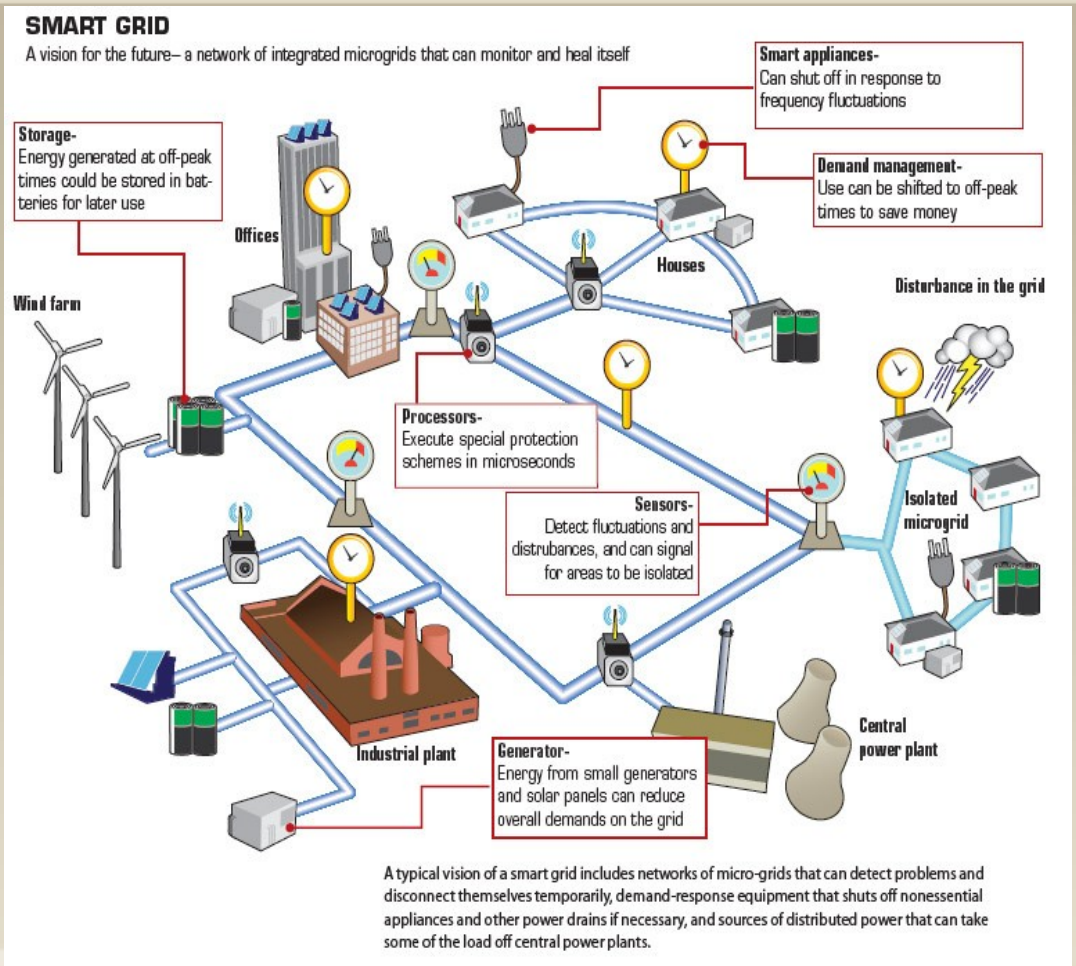


Target Distribution Flow



Why | How | Process | Differences | Results

The Smart Grid is a Supply Chain!




Supply Chain Strategy
Supply Chain Planning
Supply Chain Enterprise Applications
Asset Management
Procurement
Product Lifecycle Management
Logistics
Supply Chain Management

References

A. Nagurney, M. Yu, A. H. Masoumi, L. S. Nagurney, *Networks Against Time: Supply Chain Analytics for Perishable Products,* Springer 2013

Slides from *Principles of Supply Chain Management: A Balanced Approach* by Daniel A. Glaser-Segura, PhD

Slides from Introduction to Supply Chain Management, by David Simchi-Levi, Philip Kaminsky, and Edith Simchi-Levi

Slides from *Basics of Supply Chain Management,* Stevens Institute of Technology

- Engineering Degrees: Biomedical, Civil, Computer, Electrical, and Mechanical Engineering.
- Joint Acoustical Engineering and Music degree with the Hartt School (the Conservatory at the University of Hartford)
- Engineering Technology Degrees: Architectural Engineering Technology, Audio Engineering Technology, Computer Engineering Technology, Electronic Engineering Technology, and Mechanical Engineering Technology
- All degrees are offered in the context of a Comprehensive University that includes schools of Art, Music, Business, Education, and Health Sciences

For more information on the University of Hartford

http://www.hartford.edu

Contact the College of Engineering, Technology, and Architecture

http://www.hartford.edu/ceta

cetainfo@hartford.edu

Thanks and Questions