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# **Strategies for Lean Supply Chains: *Lessons from a decade of projects at the University of Michigan***

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## Outline

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- Action-Based Learning at Michigan
- Lean and Supply Chain Management
- Sample Insights from projects



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Leading in thought and action.

## ■ Tauber Manufacturing Institute (TMI)

- Joint between Engineering and Business
- Focus: Lean Manufacturing and Supply Chain
- About 275 projects over 14 years
- Clients:
  - GM / Ford / TRW Automotive / Borg Warner
  - Steelcase / Cummins / General Cable / Raytheon
  - Alcoa / Boeing / Honeywell / Lockheed Martin
  - Intel / Dell / Pall Corp / McKinsey / AT Kearney
  - Pfizer / GE Medical / Guidant / Merck / Cordis / Eli Lilly





- **Multidisciplinary Action Projects (MAP)**
  - Part of core MBA curriculum
  - Projects span all business disciplines
  - About 1100 projects across 500 businesses worldwide over last 13 years
  - Operations Focused Projects: Process Improvement, Supply Chain.
  - Sample clients with Supply Chain focus:
    - Wal-Mart / Kmart / Target / Borders
    - GM / Ford / Daimler Chrysler / Cisco / DTE



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Leading in thought and action.

## ■ Executive Programs @ Ross School

- Leadership in Plant Operations
- Supply Chain Management
- Project Management

<http://execed.bus.umich.edu/execdev/default.aspx>

## ■ Ten-Day Certificate Program in Lean Logistics

- Joint with Engineering school

<http://cpd.engin.umich.edu>



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## What is Lean?

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A system that continually searches for and eliminates waste throughout the total enterprise & the value chain



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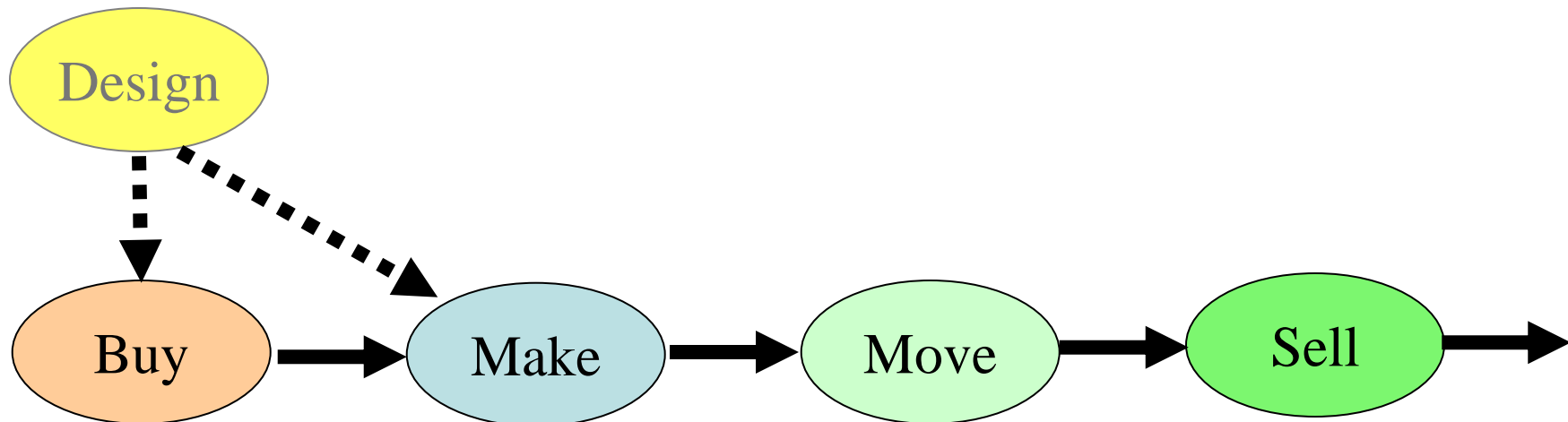
## Holistic view of Supply Chain

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- SCM is the effective management of
  - Material flows
  - Information flows
  - Financial flowsto maximize overall value generated.

## Challenges

- Multiple stakeholders across multiple stages, local vs. global optimization





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## Recent Trends

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- Increased Globalization
- Increased Risk
- Increased Variety
- Rapid dissemination of Information Technology
- Environmental Issues

**WORLD**  
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# Supply Chain Management Online University

2006 Webinar Series

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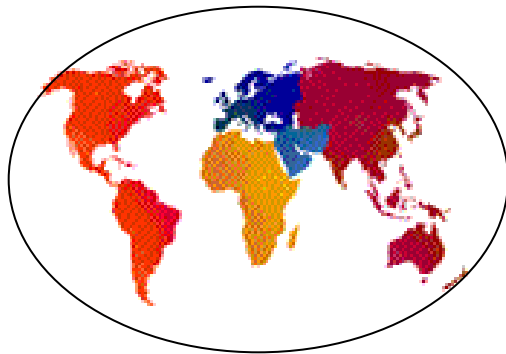
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**Globalization** Risk Variety Information Technology Environmental Issues

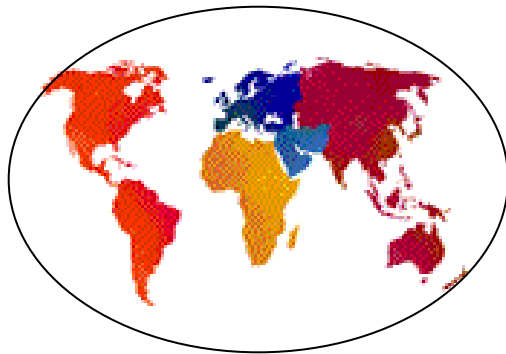


## Globalization

1500-1840: 10 m.p.h

**Globalization** Risk Variety Information Technology Environmental Issues

# Globalization



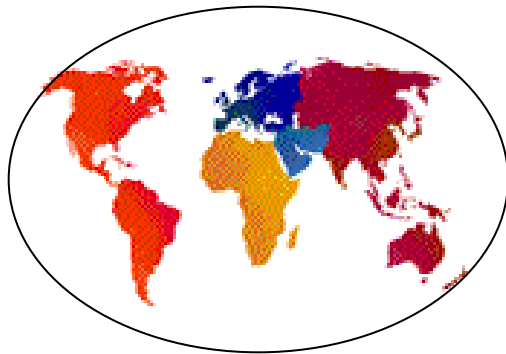
1500-1840: 10 m.p.h

1850-1930: 35-65 m.p.h.



**Globalization** Risk Variety Information Technology Environmental Issues

# Globalization



1500-1840: 10 m.p.h

1850-1930: 35-65 m.p.h.



1950: 300-400 m.p.h.





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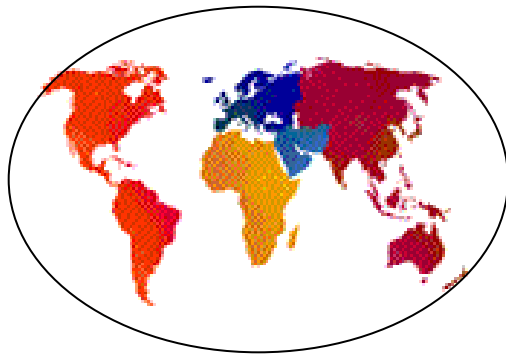


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**Globalization** Risk Variety Information Technology Environmental Issues

# Globalization



1500-1840: 10 m.p.h

1850-1930: 35-65 m.p.h.



1950: 300-400 m.p.h.



1980: 600 m.p.h.



Globalization **Risk** Variety Information Technology Environmental Issues

## Increased Risk

- Financial Risks
  - Exchange rates, inflation, tariffs, ...
- Terror, Disaster, Security ...
  - Supply disruptions
  - Long lead times
  - Production shut-downs



*How to structure a supply chain to minimize the impact?*



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Globalization Risk **Variety** Information Technology Environmental Issues

## Increased Variety

Item	Early 70s	Late 90s
Personal Computer Models	0	400
McDonald's menu items	13	43
Frito-Lay Chips	10	78
Colgate toothpastes	2	17
Contact Lens types	1	36
Bicycle types	8	31
Running Shoe styles	5	285

Source: The Right Stuff - America's Move to Mass Customization, Fed. Reserve Bank of Dallas, 1998 Annual Report

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## Increased Variety ...

*New product introductions of consumer packaged goods: 1980 vs. 1998*

	1980	1998
Food Products	2,112	10,803
Household Items	400	1,001
Beverages	393	2,944
Health and Beauty aids	1,294	9,509
Pets	138	439
Miscellaneous	77	269
<b>GRAND TOTAL</b>	<b>4,414</b>	<b>24,965</b>

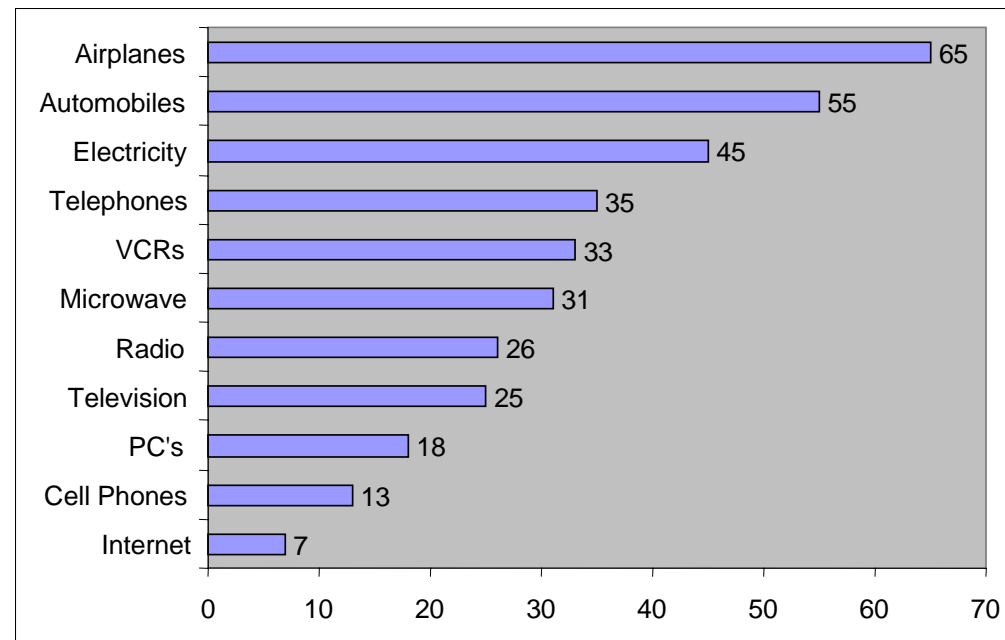
## Implications ...

Globalization Risk Variety **Information Technology** Environmental Issues

## Rapid Dissemination of Information Technology

Years to achieve 25% population penetration in the U.S.

*Year 1 = Year Invented*





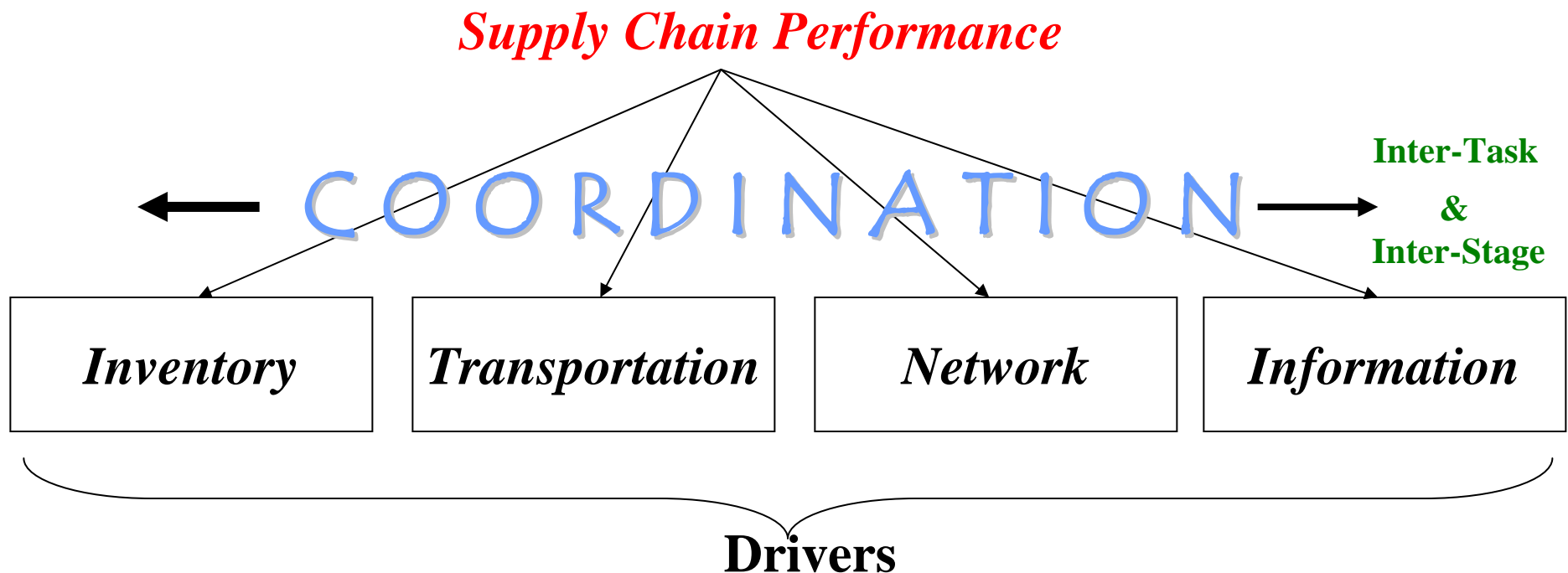
Globalization Risk Variety Information Technology **Environmental Issues**

## **Environmental Issues**

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- Recycling & Product Recovery
  - Converting an “open-loop” supply chain to a “closed-loop” supply chain
- Impact on design, sourcing, manufacturing, logistics & distribution

## How can a supply chain respond?





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## Sample Insights from the projects

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- Lean and Supply Chain Integration
- Supply Chain Visibility



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## Sample Insights from the projects

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- **Lean and Supply Chain Integration**
  - Your supply chain is only as strong as your weakest node & link
  - Strengthen the node using lean concepts
  - Strengthen the link through better communication
- Supply Chain Visibility

## # 1: Lean SCM ... Example 1

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- Large juice manufacturer.
- Problem: Large inventory levels (WIP and finished goods) of juice, low productivity, high cost.
- Plant management blames supply chain
  - Misguided marketing campaigns
  - Lack of communication between marketing and manufacturing
  - Plant production schedules exhibit the “bullwhip”
- And yet ...

## # 1: Lean SCM ... Our findings

- **Plant very inefficient**
  - Significant downtime
  - No visual management
  - Poor flow
- **Consequently**
  - High levels of work in process
  - High levels of scrap and rework
  - Order fill rates below 70% in promotion periods



**Put your own house in order first!!**



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## # 1: Lean SCM ... Example 2

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- Pharmaceutical manufacturer runs a high mix plant in the U.S., supplies to demand from distribution.
- U.S. plant not lean
  - Plant takes 4-6 weeks to fill orders
  - Very long set-up times
  - Plant has poor flow: Process steps are far from each other and large delays in between different process steps.
  - Large variability

## # 1: Lean SCM ... Our findings

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- A TMI lean effort in the plant results in significant local improvements
  - Setup, cleanup times cut significantly
  - Process uptimes improved
  - New pull system cuts WIP and process times significantly.
- Yet the full potential of these improvements were unrealized



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## # 1: Lean SCM ... Our findings

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- Distribution does not take into account process issues in ordering
- When distribution places an order, not clear if this is an order for replenishing safety stock levels or a true customer order waiting to be filled.
- Firm forced to rush every order from distribution despite improvements causing inefficiencies in the plant.



## Lean and Supply Chain Integration

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- Firms cannot have efficient supply chains unless the nodes of the supply chain (plants, warehouses etc.) are lean.
- Firms can make great progress in improving a particular node (e.g., a plant) to become a lot leaner but this has limited effect unless the whole supply chain is systematically improved.



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## Sample Insights from the projects

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- Lean and Supply Chain Integration
- **Supply Chain Visibility**
  - Hype: RFID is panacea, Need continuous visibility
  - Forget the hype; focus on problem-driven solutions



## # 2: Supply Chain Visibility (Example 1)

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- Problem: Ocean shipments have large lead time variability [e.g., 19-30 days] with consequences for costs of inventory, expediting, etc.
- Potential rewards for variability reduction: Upwards of \$10M per year
- Company's Original Assumptions:
  - Causes: *Weather conditions, Port congestion, Ocean container handoffs*
  - Solution: *Continuous Tracking System*



## #2: Supply Chain Visibility ... Our Findings

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- Continuous Tracking Systems exist but implementation is complex limiting its usefulness
- Event based solution:
  - Which events create the largest variability? E.g., voyage selection.
  - Solution: single point visibility of voyage selection reduces variability by 50%.
  - Simpler solution, easily implementable, and immediate benefits

## # 2: Supply Chain Visibility (Example 2)

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- Problem: Presently airfreight capital equipment @ high cost.
- Internal Proposal: Explore Ocean freight; internal customers skeptical (no visibility, more potential for damage, etc.)
- To build confidence of internal customers: Need visibility
- Possible Solutions: RFID, Wireless sensor networks, GPS, etc.

## #2: Supply Chain Visibility ... Our Findings

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- Best solution: GPS + Data Logger (off-the shelf)
- Savings Opportunities:
  - Transportation costs: Conversion from air to ocean freight
  - Reduction in lost / split / mis-delivered shipments
  - Improve workforce efficiency to do root cause
  - Cost recoveries by identification of damage point / possession



## # 2: Supply Chain Visibility (Example 3)

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- Problem:
  - Lack of sub-tier (beyond Tier-1) visibility
  - Problem resolution required Tier-1 cooperation
  - Tardy (30-40 days) resolution
  - Limits pro-active actions
- Internal Proposals: RFID / Internet Exchange



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## #2: Supply Chain Visibility ... Our Findings

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- Best solution: 2-D barcode
- Savings Opportunities:
  - Better read accuracy in the plant
  - Smaller size will cope with increasing miniaturization of components
  - With BOM data, OEM can identify and diagnose problems quickly
  - Can implement proactive solutions
  - Savings in process costs



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## Conclusion

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- Action-Based Learning at Michigan
- A framework for Lean Supply Chain
- Sample Insights:
  - Lean Supply Chain, Supply Chain Visibility



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# ??Questions??

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