

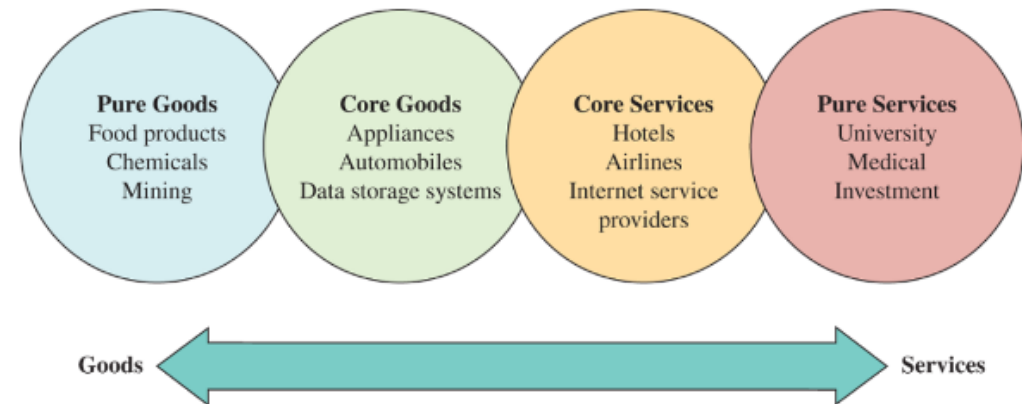
AI/ML Applications in Operations & Supply Chain

Milan Kumar

IIM Visakhapatnam

The Goods-Services Continuum

- **Goods** are physical items produced by business organisation
- **Services** are activities that provide some combinations of time, location, form and psychological value



Supply chain demand and variability

- Over the long run the average inflow to a firm must equal the average outflow



- However, the volatility of the inflow can differ substantially from the volatility of the outflow





What is a Supply Chain?

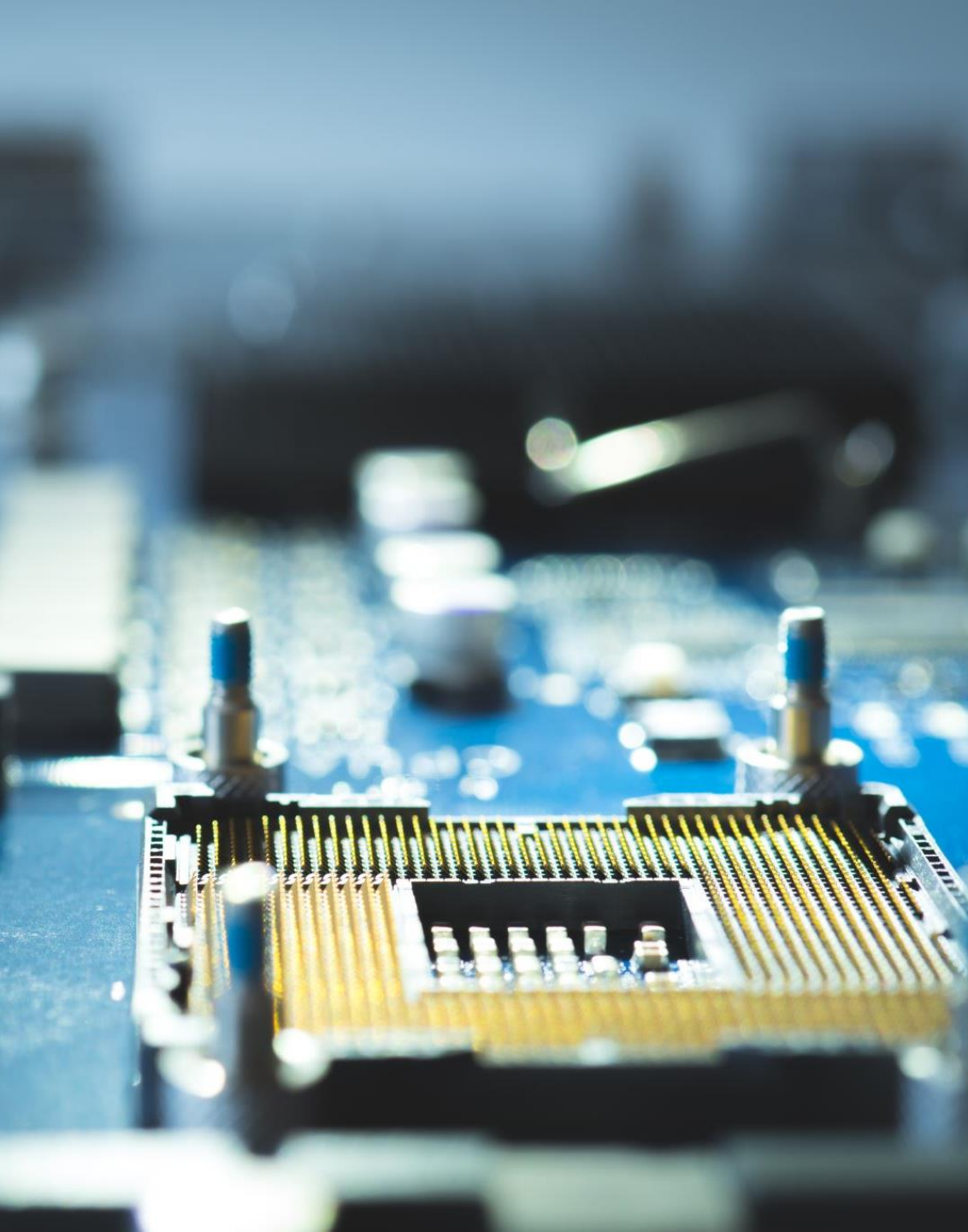
Flow of products and services from:

- Raw materials manufacturers
 - Intermediate products manufacturers
 - End product manufacturers
 - Wholesalers and distributors and
 - Retailers
- Connected by transportation and storage activities
 - Integrated through information, planning, and integration activities
 - Cost and service levels



What Is Supply Chain Management?

- Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements.



Two Other Formal Definitions

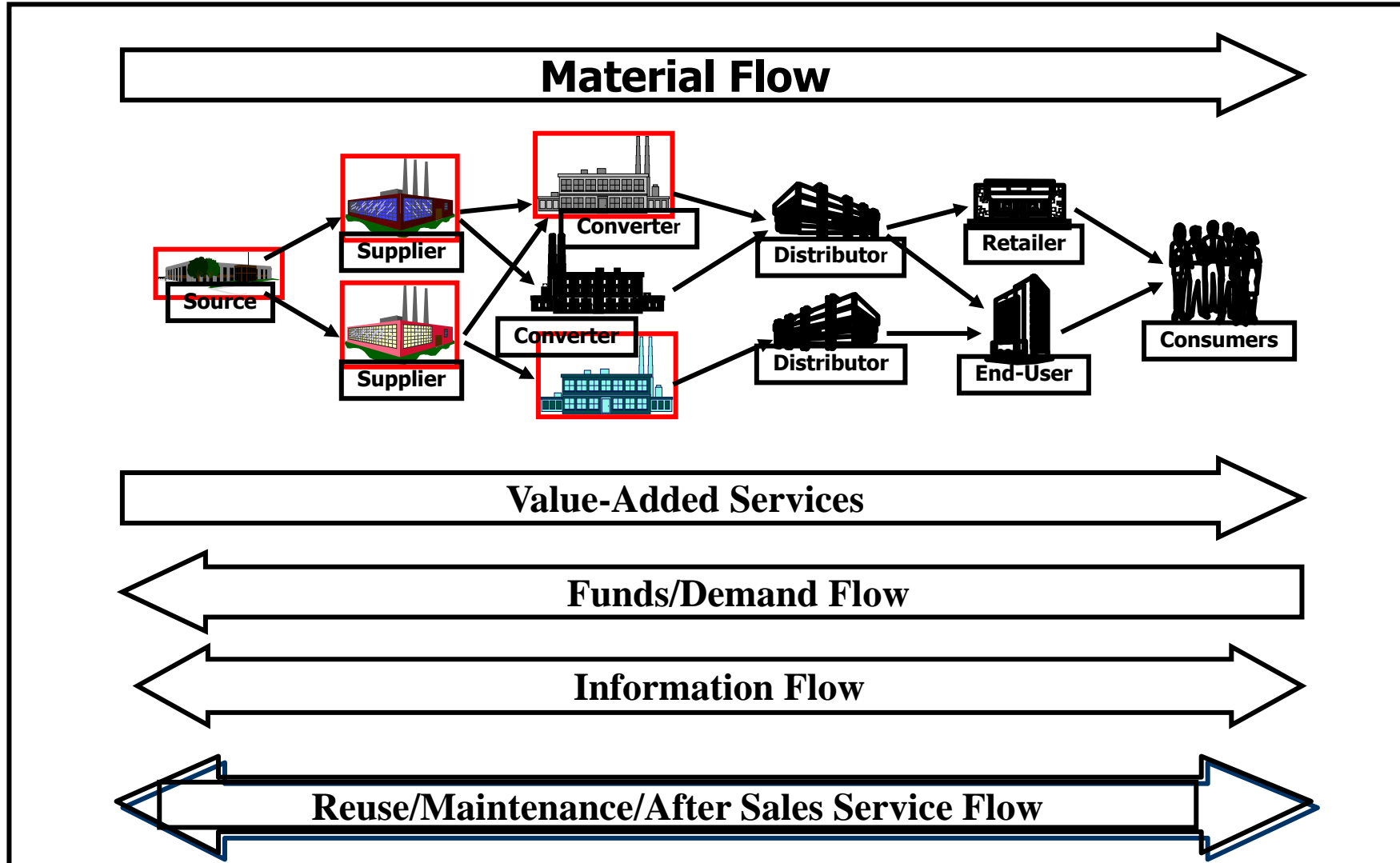
The design and management of seamless, value-added process across organizational boundaries to meet the real needs of the end customer

Institute for Supply Management

Managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer

The Supply Chain Council

SCM Definition

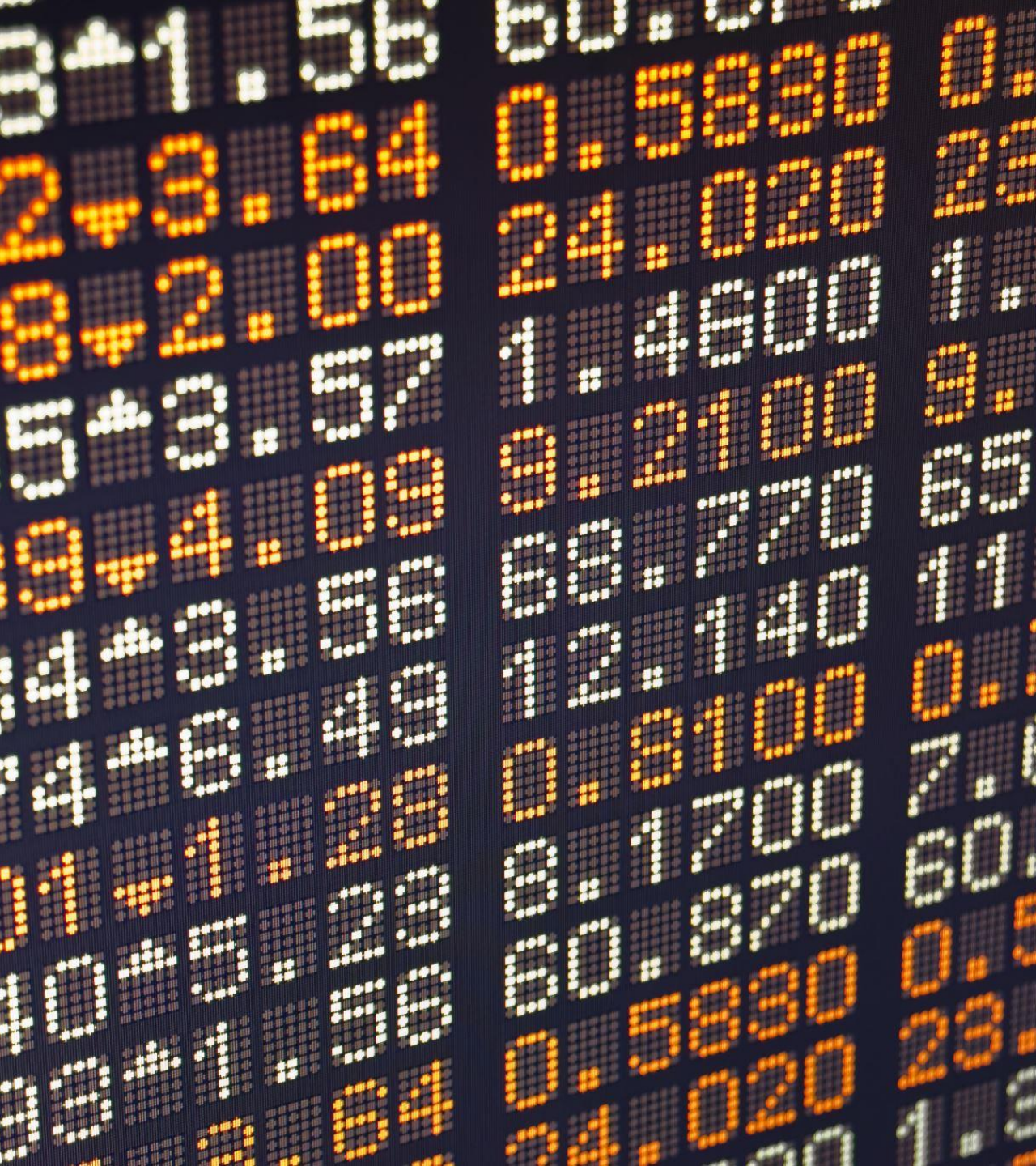




The Objective of a Supply Chain (1 of 3)

- Maximize net value generated

Supply Chain Surplus = Customer Value – Supply Chain Cost



The Objective of a Supply Chain (2 of 3)

- Example: a customer purchases a wireless router from Best Buy for \$60 (revenue)
- Supply chain incurs costs (convey information, produce components, storage, transportation, transfer funds, etc.)
- Difference between \$60 and the sum of all of these costs is the supply chain profitability
- Supply chain profitability is total profit to be shared across all stages of the supply chain
- Success should be measured by total supply chain surplus, not profits at an individual stage



The Objective of a Supply Chain

(3 of 3)

- Customer is the only source of revenue
- Sources of cost include flows of information, products, or funds between stages of the supply chain
- Effective **supply chain management** involves the management of supply chain assets and product, information, and fund flows to grow the total supply chain surplus

Customer Needs and Implied Demand Uncertainty

Customer Need	Causes Implied Demand Uncertainty to ...
Range of quantity required increases	Increase because a wider range of the quantity required implies greater variance in demand
Lead time decreases	Increase because there is less time in which to react to orders
Variety of products required increases	Increase because demand per product becomes less predictable
Required service level increases	Increase because the firm now has to handle unusual surges in demand
Rate of innovation increases	Increase because new products tend to have more uncertain demand
Number of channels through which product may be acquired increases	Increase because the total customer demand per channel becomes less predictable

Key Issues in Supply Chain Management

- Distribution network configuration
 - How should management select a set of warehouse locations and capacities, determine production levels for each product at each plant, and set transportation flows between facilities
 - Want to minimize total production, inventory, and transportation costs and satisfy service level requirements
- Inventory control
 - What is the optimum inventory level
 - Can demand uncertainty be reduced
 - What inventory turnover ratio should be used
- Supply chain flexibility
 - Flexibility can be a powerful tool to gain competitive advantage
 - How can the firm achieve flexibility?

Key Issues in Supply Chain Management Continued

- Production sourcing
 - Must balance transportation and manufacturing costs
- Supply contracts
 - In traditional supply chain strategies, each party in the chain focuses on its own profit
 - Causes them to make decisions without regard to other supply chain partners
 - Can supply chain contracts be used to optimize the entire supply chain performance
- Distribution strategies
 - How much should a firm centralize (or decentralize) their distribution system
 - What transportation methods should be used

Key Issues in Supply Chain Management Continued

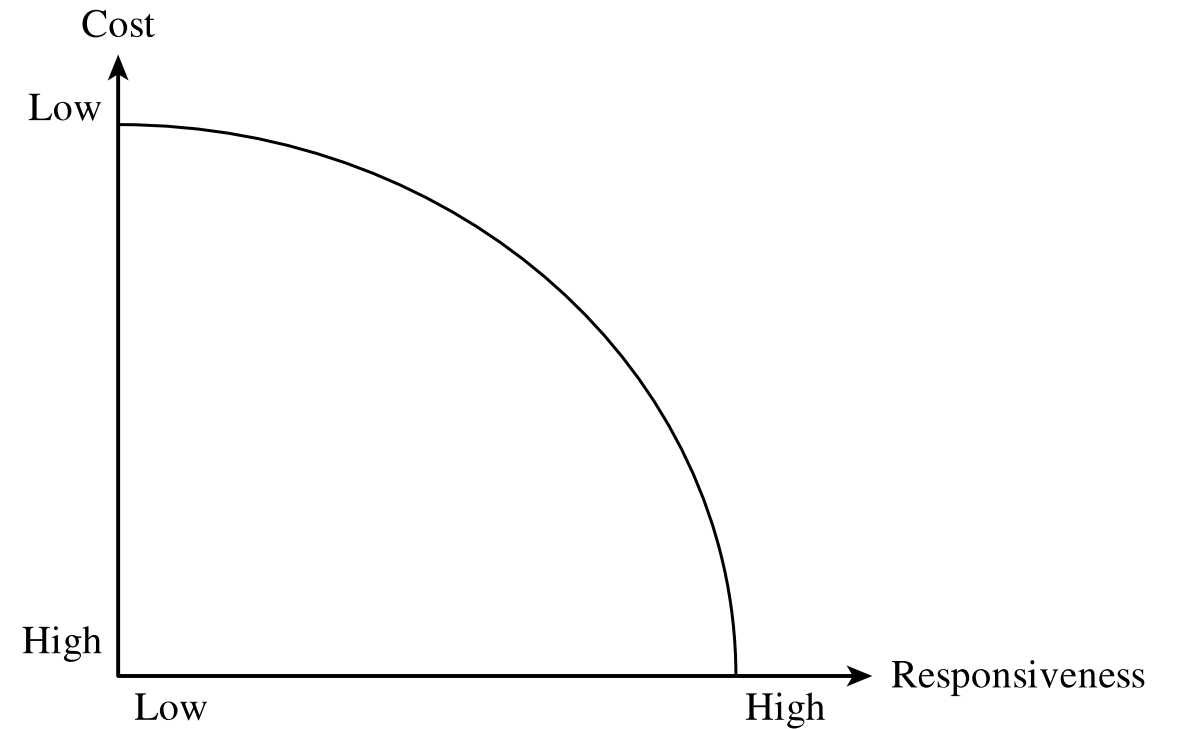
- Supply chain integration and strategic partnering
 - Designing and implementing a globally optimal supply chain is quite difficult
 - However, in today's competitive markets, most companies have no choice
 - How can integration be achieved successfully
- Outsourcing and offshoring strategies
 - What should be done internally and what should be purchased from outside suppliers
 - How to deal with the risks of outsourcing/offshoring
 - If the firm decides not to outsource, does it make sense to move facilities to the Far East
- Product design
 - Effective design plays several critical roles in the supply chain
 - May effect inventory holding and transportation costs
 - When is it work redesigning a product

Key Issues in Supply Chain Management Continued

- Information technology and decision-support systems
 - The primary issue in supply chain management is not whether data can be received, but what data should be transferred
- Customer value
 - In recent years, this measure has superseded measures such as quality and customer satisfaction
 - How is it measured
- Smart pricing
 - In recent years, a number of manufacturers, retailers, and carriers have applied a variation of revenue management to improve supply chain performance
 - How can this be done
- Sustainability
 - Corporate social responsibility offers an opportunity for new revenue streams, additional efficiencies, and unique branding

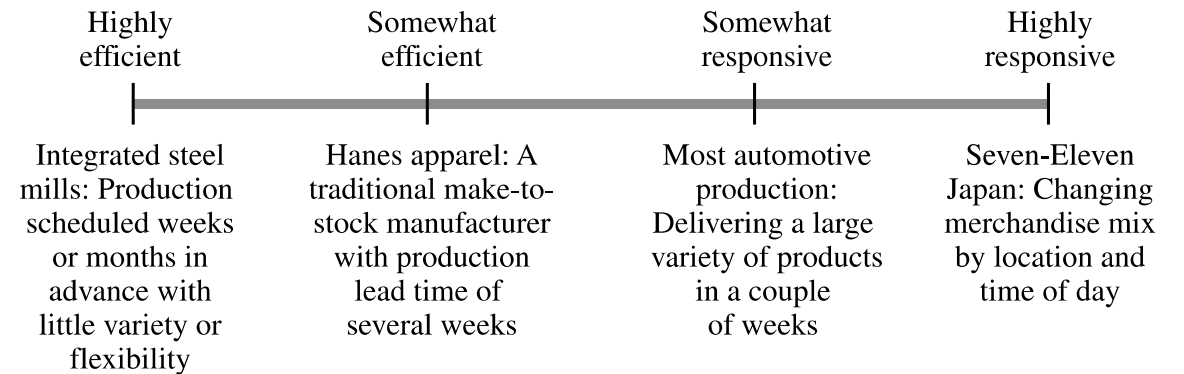


Cost- Responsiveness Efficient Frontier

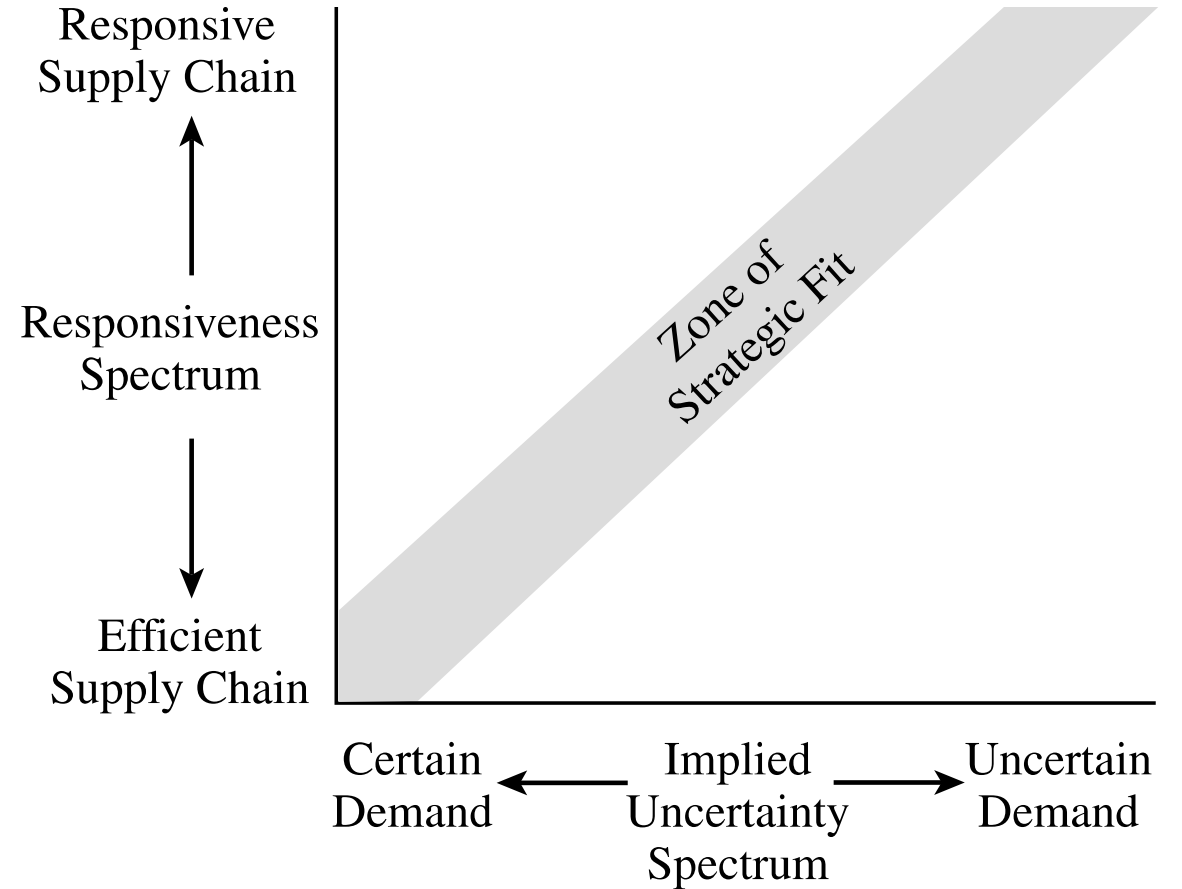




Responsiveness Spectrum



Zone of Strategic Fit



Components of a supply chain

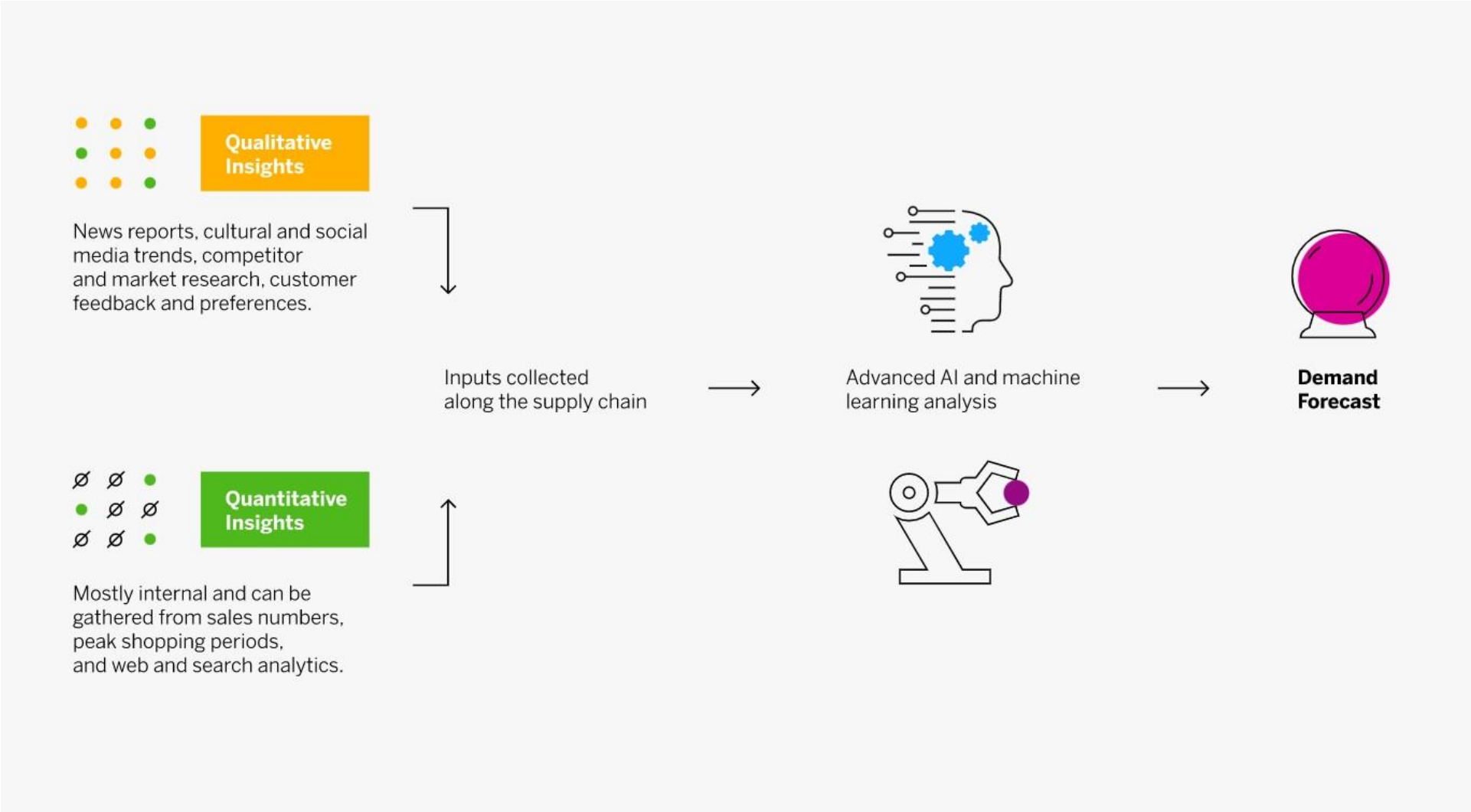




What is demand forecasting

- Demand forecasting refers to the process of planning and predicting goods and materials demand to help businesses stay as profitable as possible.
- **Why is demand forecasting important for modern supply chains?**
- Demand forecasting is important to the supply chain because it helps to inform core operational processes such as demand-driven material resource planning (DDMRP), inbound logistics, manufacturing, financial planning, and risk assessment.

How does demand forecasting work?



Preventing supply chain disruptions

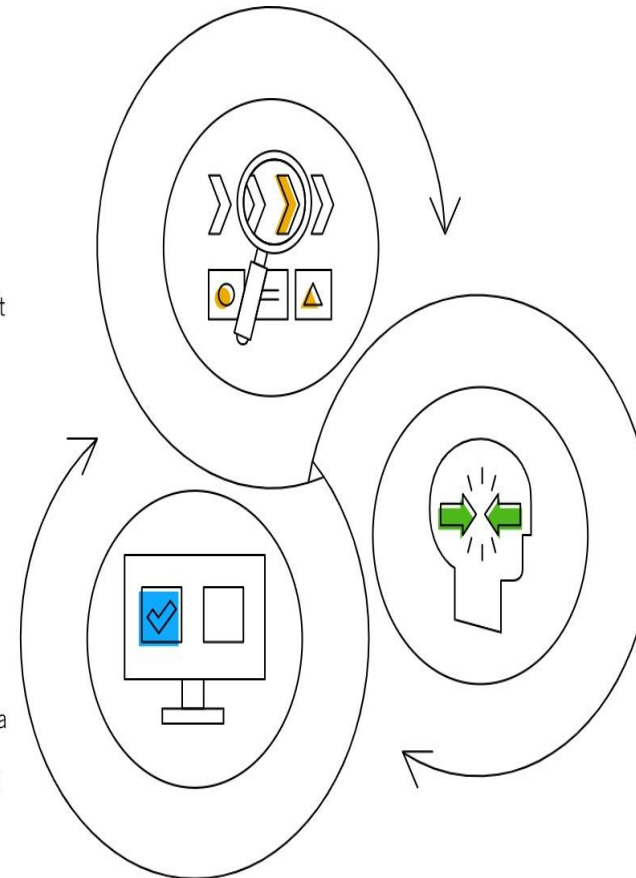
Supply chain control towers allow supply chain executives to see, decide, and act in real time.

1 SEE

- Identify causes of exceptions
- Trace problems to their origin
- See across silos including ERP systems, warehouse management, order management

3 ACT

- Drive better and faster decision making based on an all-encompassing view of the data combined with granular visibility which optimizes the supply chain



2 DECIDE

- Use scenario-based modeling and analytics to create both reactive and predictive alerts
- Assess the impact of exception conditions
- Understand and prioritize issues as they arise



Performance Measures

1. Evaluation and measurement of the firm's current and past performance
2. Future goals as expressed by the firm's strategy

Types of Measures:

- Financial
- External
- Internal

Financial Measures

1. Absolute Performance: Revenue, Profit, Costs, Net Income etc
2. Performance relative to assets: Accounting Ratios
3. Survival Strength: Cash Flow

External Measures

A firm must attract and retain customers by providing goods and services that meet or exceed their expectations

Four critical attributes of customer expectations are:

Cost

Response time

Variety

Quality

Internal Measures

Internal measures are the predictor of customer satisfaction

- Cost: Efficient processes, less failure
- Response time : Capacity to ensure minimum wait time,
- Variety : Product designs to ensure higher SKUs
- Quality : Features, performance, reliability, serviceability, aesthetics

Example of Vendor managed inventory solution

- True Commerce [VMI Solution](#)



Questions

References

Jacobs, F. R., Shankar, R., & Chase, R. B. (2024). Operations and supply chain management (17th ed., Chapter 1). McGraw Hill.

Chopra, S., & Kalra, D. (2019). Supply chain management (7th ed., Chapters 1-2). Pearson.

Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., & Shankar, R. (2022). Designing and managing the supply chain: Concepts, strategies, and case studies (4th ed., Chapter 1). McGraw Hill.