***Supply Chain Management – Information***

Fall 2019

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| 🡨 Flow of Information 🡨

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| Supplier | 🡪 | Manufacturer | 🡪 | Distributor | 🡪 | Retailer | 🡪 | Customer |

🡪 Flow of Material 🡪 |

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| **Bullwhip Effect** | **Information Technology** |
| From Simchi-Levi Text, Chapter 5. | From Simchi-Levi Text, Chapter 14. |
| *Demand Variability Increases* *Upstream in a Supply Chain* | *For Supply Chain efficiency,**do not develop Information System maturity**ahead of Business Process maturity* |
| \*Results (5)\*Causes (5)\*Approaches (5)\*Trade-offs (4)\*Management (3) | \*BPS & IS & SCOR\*SCIT -Goals (Collect, Access, Analyze, Collaborate) -DSS (Analysis, Modeling)\*Components -Network design -Tactical planning -Operational planning -Operational execution |

**Bullwhip Effect – Chapter 5**

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| Supplier | 🡪 | Manufacturer | 🡪 | Distributor | 🡪 | Retailer | 🡪 | Customer |

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| **Bullwhip Effect**

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| Demand Variability (2) Increases Upstream in a Supply Chain |
| (2)3 > (2)2 > (2)1 >(2)0 |

🡪 Flow of ***Material*** Downstream 🡪

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| Supplier |  | Manufacturer |  | Distributor |  | Retailer |  | Customer |
| Demand | 🡨 | Demand | 🡨 | Demand | 🡨 | Demand | 🡨 | Demand |
| Variability | (2)3 | Variability | (2)2 | Variability | (2)1 | Variability | (2)0 |  |

🡨 Flow of ***Information*** Upstream 🡨. |

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| 🡪 Flow of ***Material*** Downstream 🡪 |
|  | (2)3 > |  | (2)2 > |  | (2)1 > |  | (2)0 |  |
| Supplier | 🡨 | Manufacturer | 🡨 | Distributor | 🡨 | Retailer | 🡨 | Customer |
| 🡨 Flow of ***Information*** Upstream 🡨 |

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| ***Results due to the Bullwhip Effect*** |
| When a supply chain is based on forecasted demand, (PUSH system),the bullwhip effect will result in:1) Order quantities within the Inventory policies increase upstream.2) Inventory levels from Production orders increase upstream.3) Capacity utilization increases upstream.4) Distribution requirements increase upstream.5) Cost and waste increase upstream. |
| When a supply chain is based on realized demand, (PULL system),ideally, the bullwhip effect is eliminated. (Although often impractical) |

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| 🡪 Flow of ***Material*** Downstream 🡪 |
|  | (2)3 > |  | (2)2 > |  | (2)1 > |  | (2)0 |  |
| Supplier | 🡨 | Manufacturer | 🡨 | Distributor | 🡨 | Retailer | 🡨 | Customer |
| 🡨 Flow of ***Information*** Upstream 🡨 |

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| **Causes of Increase in Demand Variability, 2 , related to the Bullwhip Effect.**1.Forecasting within a base-stock level policy. 2.Lead time (Information & Material). 2 ∝ LT3.Batch ordering. 2 ∝ Q4.Price fluctuations (Forward buying). 5.Inflated orders (Gaming). | **Approaches to Cope with** **the Bullwhip Effect.**1.Centralized information2.EDLP (Everyday low pricing)3.EDI (Electronic Data Interchange)4.Cross-docking5.VMI (Vendor managed inventory). |
| **Trade-offs that impact the Bullwhip Effect.**1.Large lot sizes reduce ordering cost and small lot sizes reduce inventory carrying cost.2.Large lot sizes reduce transportation costs and small lot sizes reduce warehouse capacity costs.3.Large lead times support transportation and small lead times support inventory handling.4.Large product variety better matches demand and small product variety reduces inventory complexity.. |
| **Management of the Bullwhip Effect***Objective: Balance Inventory Costs with Customer Service*1. Planning:-Sequential Planning (Local Optimization)-Integration (Global Optimization)2. Information:-Information Uncertainty (Centralized vs. Distributed Information)-Demand Variability (Forecasting)3. Policies:-Lot Size (Upstream Orders, Downstream Shipments, and Backorders)-Lead Time (Upstream Information Processing and Downstream Material Shipments). |

**Information Technology – Chapter 14**

**Business Process Systems Correlated with Information Systems**

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| Reference: Heinrich, C.D., and D. Simchi-Levi. “Do IT Investments Really Change Financial Performance?” *Supply Chain Management Review*, May 2005, pp.22-28. |

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|  | Business Process Systems (BPS)Level I. Disconnected processesLevel II. Internal integrationLevel III. Intra-company integrationLevel IV. Multi-enterprise integration. |  | Information Systems (IS)Level I. Independent, redundant systemsLevel II. Shared across systemsLevel III. Internally visible dataLevel IV. Internally/externally shared data. |  |
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|  |  | SCOR Evaluation of Planning Areas 1. Strategic planning 2. Demand planning 3. Supply planning 4. Supply-demand balancing 5. Procurement planning 6. Manufacturing planning 7. Delivery planning. |  |  |
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Results of evaluations on 75 supply chains in companies with different combination of

business process systems maturity and information systems maturity.

*“Maturity is defined as immature to mature as levels proceed from I to IV.”*

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|  | Supply Chain | Information System (IS) |  |
|  | Performance | Level I | Level II | Level III | Level IV |  |
|  |  |  |  | *Immature* | *Mature* |  |
|  | Business Process System (BPS) | Level I | *Immature* | **A**Low performance | **D**Worst performance |  |
|  | Level II |  |
|  | Level III | *Mature* | **B**Better performance | **C**Best performance |  |
|  | Level IV |  |
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Ordinal relationship based on efficiency and profitability from least efficient to most efficient

is reported to be D🡪A🡪B🡪C

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| *For Supply Chain efficiency,**do not develop Information System maturity**ahead of Business Process maturity* |

***Supply Chain Management (SCM): Information Technology***

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| Supply Chain Information Technology | 🡪 | *enables* | 🡪 | Supply Chain Management |
| (SCIT) |  | 🡪 |  | (SCM) |

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| SCIT Goals: |  | Collect | 🡪 | Access | 🡪 | Analyze | 🡪 | Collaborate |  |  |
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| SCIT 🡪 |  | ERP | 🡪 | DSS | 🡪 | SCM |
|  |  | (ERPII) |  | (APS) |  |  |

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|  |  | ***DSS Structure*** |  |  |
|  |  | Data AnalysisSystem Modeling |  |  |
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| **Input** | **🡪** | **Analytical Tools** | **🡪** | **Presentation Tools** |
|  |  |  |  |  |
| ERP |  | Data Warehouses |  | Reports & Tables |
| SRM |  | OLAP |  | Data Visualization |
| CRM |  |  |  | Simulations/Animations |
| SCM |  | Data Mining |  | GIS |
|  |  | Statistics |  |  |
| Data Bases |  |  |  |  |
| OLTP |  | Operations Research |  |  |
| Data marts |  | Simulation |  |  |
|  |  | AI/ES |  |  |

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|  | **Data****Base** |  | **Data****Warehouse** |  | **Data****Mart** |  |
|  | DefinedSources |  | MultipleSources |  | FocusedSubset |  |
|  | GeneralScope |  | EnterpriseScope |  | FocusedScope |  |
|  | OLTPOnline TransactionProcessing |  | OLAPOnline AnalyticalProcessing |  | UserInterface |  |
|  | Defined processes |  | Complexqueries |  | Repeatableapplications |  |
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**Supply Chain System Components**

1. Strategic – Network design (Long-term)

2. Tactical Planning – Supply chain master planning

3. Operational Planning – Operational planning (Short-term, Local)

4. Operational Execution – Transactional (Daily Procedures)

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|  |  |  |  | **Supply Chain System Components** |  |
|  | 1. Strategic – Network design (Long-term) |  |
|  |  | 2. Tactical Planning – Supply chain master planning (Aggregate planning for PUSH-based supply chain.)

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| Production | Integrate | Production Plans / (source) |
| Transportation | Storage Requirements / (capacity) |
| Inventory | Inventory Policies / (distribution) |

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|  |  |  | 3. Operational Planning – Operational planning (Short-term, Local) (Integrate system plans with master plan. Application of CPFR.)* + Demand (e.g., forecasting)
	+ Inventory (e.g., inventory policy, safety stock)
	+ Transportation (e.g., mode selection, routing)
	+ Production (e.g., schedules)
	+ MRP (starting point)

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|  |  |  |  | 4. Operational Execution – Transactional (Daily Procedures) (ERP, CRM, SRM, SCM, event management.)* + ATP: Available to promise
	+ CTP: Capable to promise
	+ PTP: Profitable to promise

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| ERP 🡸🡺DSS |
| SCIT Implementation:  | Sole-source | “Best-of-breed” | Combination |
| SCIT Selection Factors: | 1.2.3. | 1.2.3. | 1.2.3. |

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| Sales & Operation Planning (S&OP) – Integration.(Integrate supply chain system components to satisfy supply chain strategy.) |