Understanding the Complexity of Emergency Supply Chains

North Dakota State University presentation for Ph.D. students & faculty

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Agenda

• Complex versus complicated
• Defining emergency supply chain
• Sources of complexity within military expeditions
• Common sources of complexity
• Areas of further study

• A proposed model for evaluating effective supply chains

• Thoughts
• Discussion
Complicated vs. Complex

• **Complicated:** “Things that are complicated have many parts, but those parts are joined, one to the next, in relatively simple ways...they ultimately can be broken down into a series of neat and tidy **deterministic** relationships.”

• **Complex:** “Complexity, on the other hand, occurs when the number of interactions between components increases dramatically—the interdependencies that allow viruses and bank runs to spread; this is where things quickly become **unpredictable.**”

  --General (Ret) Stanley McChrystal

  “Team of Teams” (2005)
Defining emergency supply chains: a framework
Defining emergency supply chains: inherent characteristics

• Born from crisis (urgency)

• Effectiveness vs. efficiency; “at all costs.”

• Disruption vs. emergency; “on the fly.”

• Disruption versus responsiveness

• Non-applicability of strategies
  • Robustness, proactive
  • Agile
Establishing the military expedition supply chain

- Retail location
- Automated system
- Wholesale supplier
- Deployment
- Manual system
- Supporting headquarters

NONDEPLOYED

DEPLOYED
Retail stocks on hand’s ability to meet military expeditionary demand

**Demand**

- Number of Requisitions
- Day of the Operation (Units of 1)

**ASL Fill Rate**

- Day of the Operation (Units of 1)
Impacts on disaster relief requisition lead time

- Time to sort unwanted donations
- Time to generate donations
- Time to negotiate prices
- Affect of damaged infrastructure on throughput
- Competition with military forces for throughput
- Time to coordinate strategic transportation
Two parallel supply chains, contributing towards the same desired outcome, but not necessarily in unison
Areas for further study

• Tempo and nature of decoupling points within emergency supply chains
• Efficacy of establishing supplementary stockage listings for military expeditionary forces
• Efficacy of additive manufacturing for emergency supply chains
• Efficacy of emerging methods of sensing, forecasting and responding to emergency supply chain demand
A Proposed Model for Approaching and Evaluating Effective Supply Chains

(Shatzkin, 2017)
Thoughts

• The future: Data science, omni-channel, predictive analytics

• Simulation, statistics, computer science and software
• Focus, feasibility, patience, tempo, balance
• Fear of not knowing
Discussion