

Humanitarian Operations

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Promoting human welfare – “Doing good with good OR”

- Natural and manmade disasters
- Ongoing problems
 - Energy, water, food, environment, poverty, terrorism & war, health, education, democracy, population



OR/MS Research in Public Sector

- Chaiken and Larson (1972), Methods for Allocating Urban Emergency Units: A Survey
- Larson (1972), Urban Police Patrol Analysis
- Larson and Odoni (1981), Urban Operations Research
- Jones and Eden (1981), O.R. in the Community
- Pollock, Rothkopf, Barnett (1994), eds., Operations Research in the Public Sector
- Ritchie (1994), ed., Community Works: 26 Case Studies Showing Community Operational Research in Action
- Johnson and Smilowitz (2007), Tutorial on Community-Based Operations Research
- Kaplan (2008), Adventures in Policy modeling! Operations Research in the Community and beyond

Public sector examples

- Improving the performance of fire and police departments
- Delivery of meals to senior citizens (Meals-on-Wheels)
- Delivery of blood to hospitals
- Housing
- Needle exchange
- Drug policy – enforcement vs. treatment?
- Guns and violence
- Interlibrary loan delivery
- Public transportation

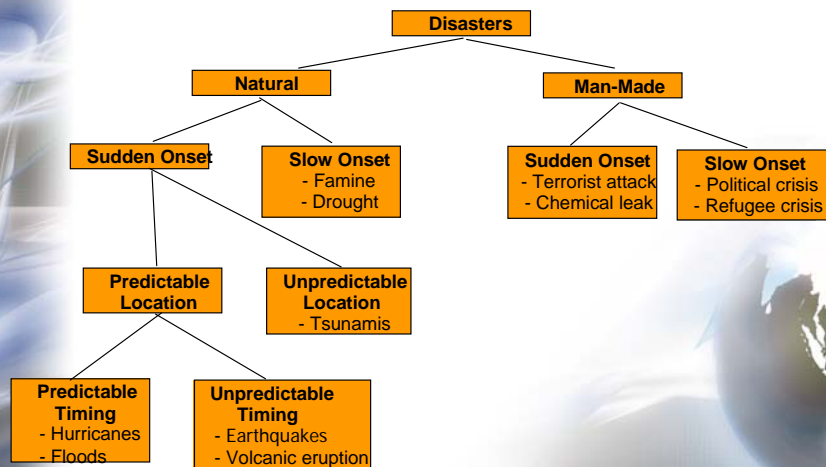
“Routine” events vs. “disasters”

Outline

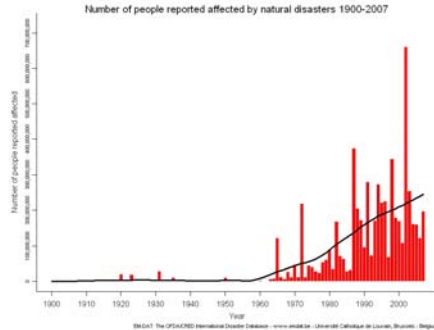
- Overview and motivation
- Players/stakeholders
- Demand
- Supply
- Challenges
- Examples

Challenges, differences from the for-profit world,
potential research directions

Types of disasters



Impact of disasters on people

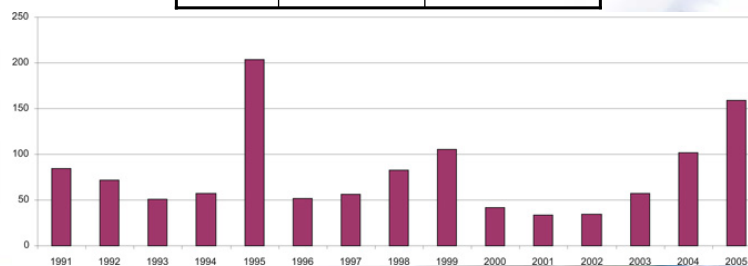


- 6,637 natural disasters between 1974-2003 worldwide⁽¹⁾
 - More than 2 million deaths
 - 5.1 billion cumulatively affected people
 - 182 million homeless people
 - Reported damage: US\$1.38 trillion
- Only in 2005, over 180,000 deaths and over US\$ 200 billion economic loss occurred⁽²⁾

Sources: (1) THIRTY YEARS OF NATURAL DISASTERS 1974-2003: THE NUMBERS - Centre for Research on the Epidemiology of disasters
 (2) <http://www.weforum.org/en/initiatives/drr/index.htm>

Economic losses due to disasters

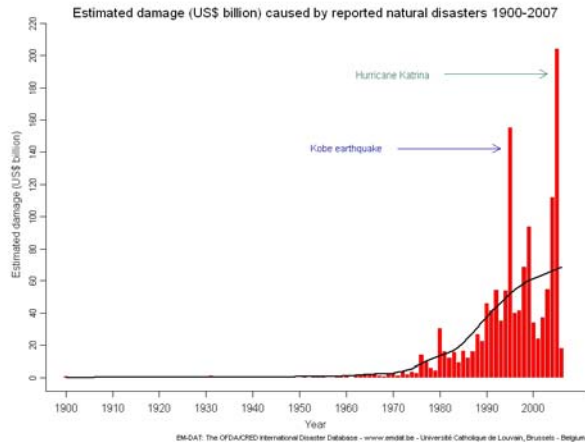
	# people died/year	Economic damage/year
Last 50 years	~100,000	US\$10.6 billion
Last 15 years	~41,000	US\$29 billion



Total economic damages: all natural disasters (in current US\$ billion) 1991 - 2005

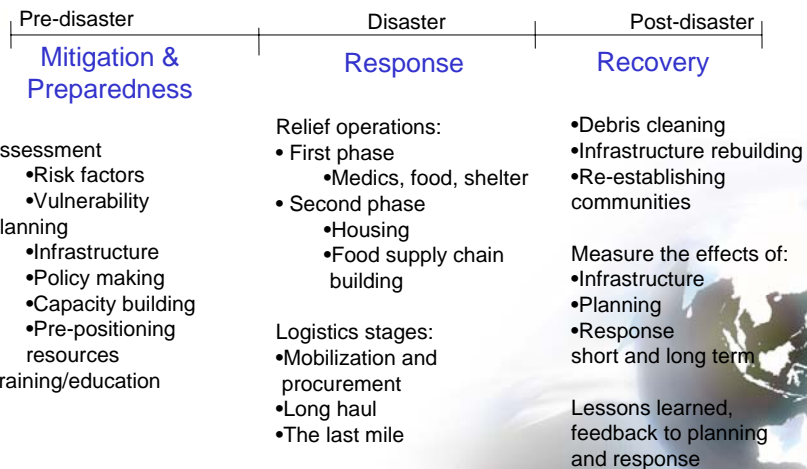
Sources: http://www.unescap.org/pdd/publications/themestudy2006/13_ch7.pdf, <http://www.unisdr.org/disaster-statistics/impact-economic.htm>

Economic losses due to disasters



Relief is a "growth market", with governmental aid doubling from 1990 to 2000

Disaster Timeline



Players/stakeholders

Donors & suppliers

- Government
- Foundations
- Companies

Recipient agency

- NGOs
- IFRC
 - World Vision
 - WFP
 - CARE
 - Red Cross
 - ...
- Governments

Delivering agency

- Global or local NGOs
- Local organizations or governments
- Military

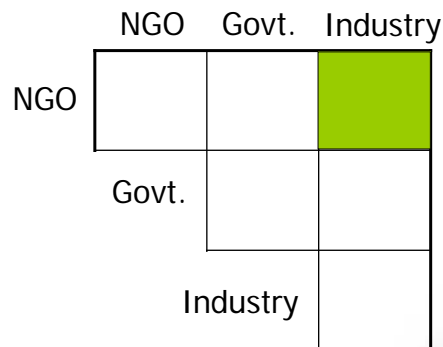
People in need



Coordination and collaboration is key!

- UNJLC, institutionalized in 2002, "facilitate and support the coordination of logistics capabilities among co-operating humanitarian agencies"
- AidMatrix – portal to match donors and agencies

Inter-organizational collaboration



- Fedex & Heart to Heart International and Red Cross
- UPS & CARE (& Georgia Tech)
- DHL & IFRC (Red Cross and Red Crescent) and UN

Why should industry care?

- Corporate social responsibility
- Responsibility towards employees
- Companies need to be involved in security and relief because “being dead is bad for business”
Entrepreneur Stanley Weiss
Business Executives for National Security

Industry support (Tsunami)

- UPS
 - Millions in **monetary aid**
 - **Airlifted** medical supplies and emergency relief items
 - Employees in affected areas **collected clothing and blankets for donation**
 - Engineers offered **logistics expertise**
 - **Donated** to Gifts In Kind International to help deliver products to emergency efforts and community-based health and human services agencies around the world
- FedEx
 - **Complimentary shipping and storing** of emergency supplies
 - **Trained volunteers** and financial support
 - **Transportation services** for distribution of medical supplies
 - Pharmaceuticals, first aid, hygiene kits, water purification systems

- Money
- Resources
 - Capital
 - Human
- Expertise

Industry support (Tsunami)

- COSCO (Chinese shipping company)
 - Offered emergency seaborne transportation
 - Contributed to the Red Cross (10 million RMB)
- DHL (logistics subsidiary of Deutsche Post World Net)
 - Donated flight charters and money
- Deutsche Post World Net
 - Transported customer donated items to collection center where goods were auctioned and funds donated to aid organizations

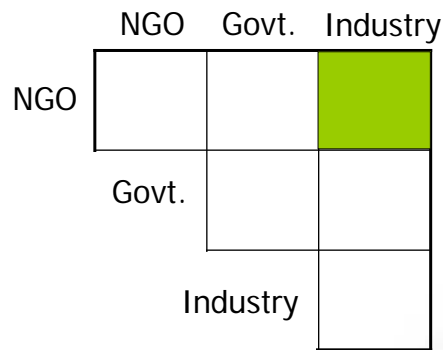
"Logistics companies and Asian Tsunami relief", Ethical Corporation Jan 2005

Walmart (Hurricane Katrina)

- Significant cash and supplies assistance
 - Donated \$18 million in cash for emergency efforts
 - Provided \$3 million in merchandise and in-kind donations to shelters
 - Provided \$13 million assistance to store employees
 - Raised \$8.5 million from customer contributions
- Other contributions
 - Opened a "tent store" with survival supplies in needy areas
 - Allowed vacant facilities to be used as shelters, supply depots and food pantries
 - Relocated displaced employees to other stores
- In one town, in the first few days more than 90% of supplies were coming from Walmart

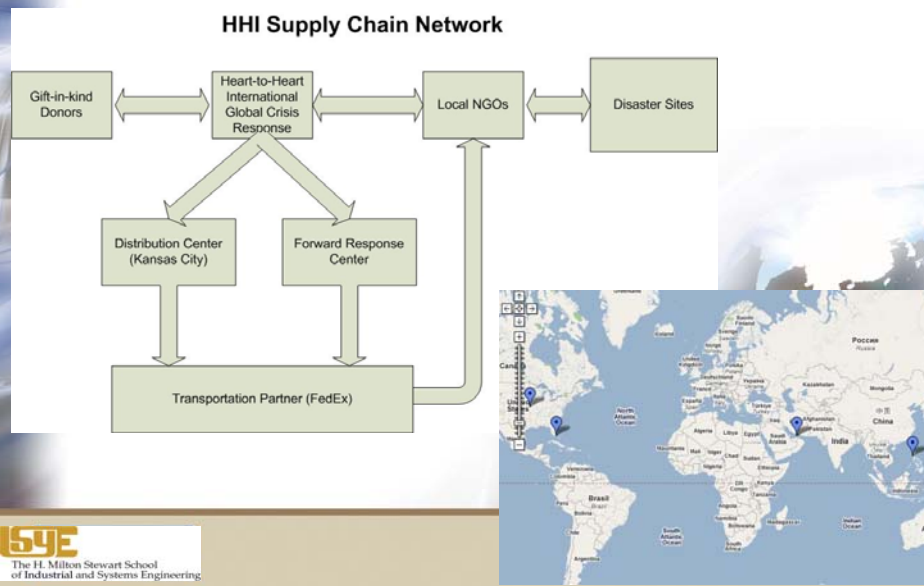
www.walmartfacts.com

Inter-organizational collaboration



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Fedex & HHI



DHL & UN

- Deutsche Post World Net (owner of DHL) announced partnership with United Nations to strengthen disaster preparedness
 - Will train UN workers, local groups, and custom officials
 - Training and partnership offered between the disasters is key...
 - "Often it's not the goods that are lacking or the airplanes to bring in the goods, but the knowledge of how to distribute them in the right way"

Monika Wulf-Mathies of DHL

Inter-organizational collaboration

	NGO	Govt.	Industry
NGO			
Govt.			
Industry			

- Disaster Resource Network

Disaster Resource Network

- Initiative of World Economic Forum
 - Facilitate the development of public-private partnerships
 - Cross-industry guiding principles for private sector engagement in humanitarian relief
 - Support the engagement of private sector companies in response operations
- Consists of trained specialists from the airline and air cargo industry
 - Emirates Air, Aramex, Chapman Freeborn, DHL, DNATA, and TNT (TPG)
- 60+ private sector volunteers with **release time from employers**
- Developed in aftermath of Iran earthquake
- Airport Emergency Team took over Sri Lanka Colombo airport after tsunami
 - **Reorganized unloading** off the tarmac and directly to trucks to increase bottleneck capacity
 - **Kept track of shipments** arriving and reported back to organizations
- Moved 3000 tons of aid to Louisiana after Hurricane Katrina
 - Brought in **pallets**, leased **forklifts**
 - **Organized** a warehouse
- Delivered 6000 sets of shelter, food and water after Pakistani earthquake



Source: Wall Street Journal Nov 22, 2005 and World Economic Forum website <http://www.weforum.org/en/initiatives/drn/index.htm>

Demand drivers

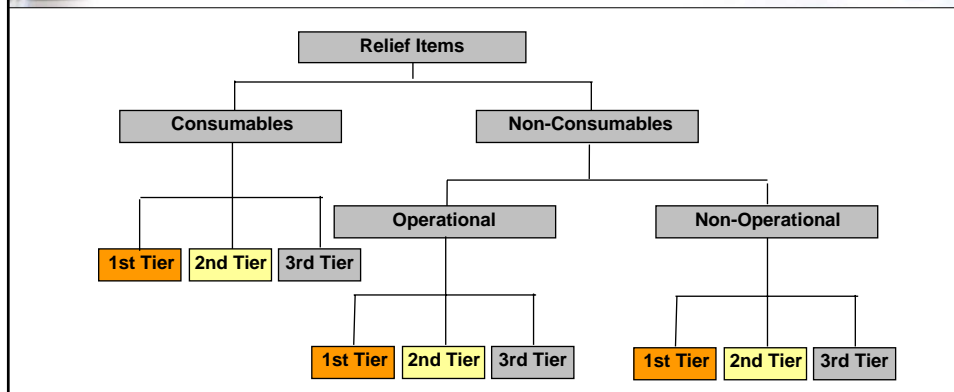
- Type, magnitude, location of the hazard
- Vulnerability
 - Local infrastructure, education, local economy, access to resources, local government and institutions, population size, recent events
- Local capacity
 - How well prepared is the community?

$$\frac{\text{Vulnerability}}{\text{Capacity}} \times \text{Hazard}$$

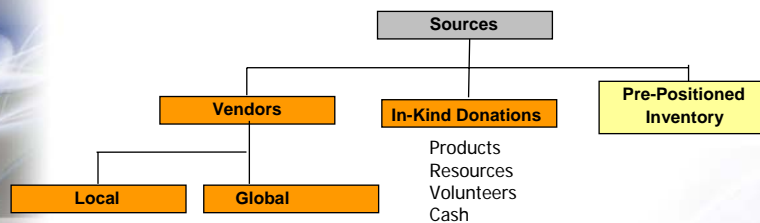
⇒ Highly unpredictable and dynamically changing!

Supply Types

- Relief items
- Personnel/volunteers
- Other resources



Supply Sources



- Procure after the fact (until recently)
 - Most donations are earmarked for a particular disaster
- High uncertainty in the quantity, timing, and the type of donations
- Competition among NGOs for supply sources
- Tradeoffs in the choice of suppliers
- Supply availability highly dependent on the location
- Low visibility into existing inventory

Challenges with Donations

- Right product? Right place?
 - South African Food Crisis in 2002 (Tomasini and Van Wassenhove, 2004)
 - Worst food crisis in Africa in a decade
 - Most of the food donated by U.S. government
 - Rejected by local governments, stockpiles at ports or in transit
 - Inappropriate donations can cause bottlenecks in the supply chain
- The impact of the donations on local economy
 - U.S. agribusiness → US govt → deliver overseas → NGOs → sell in local markets → use \$\$ for projects
 - CARE gave up \$45 million in food aid (2007)

Delivery

- Long haul and last mile
 - Financial, staff, equipment, supplies
- Transportation & communication infrastructure
 - Highly dependent on the location
 - May be damaged or disrupted
 - Dynamically changing conditions
- Political situation in the affected area and around
 - Cyclone in Myanmar vs. earthquake in China



Burmese soldiers waiting on the tarmac at Yangon International Airport on Monday to unload aid flown in from Dubai.
Source: New York Times

Current state of SCM in most NGOs

- Decentralized
 - Across country offices, or even within the same country office
- No SCM “unit”, no (or very few) staff with SCM training
- Lack of standard procedures
 - “Ad hoc” operations for each response, establish/dismantle a unit for each disaster
 - Highly dependent on the staff and volunteers at that time
 - Lessons learned not carried over
- Lack of performance measurements (NGO and vendors)
- Little or no visibility about inventory
- Low usage of “technology”

Current state of disaster response – Tsunami example

- Assessment and planning
 - 62% said assessment plan was insufficient
 - Significant transportation difficulties
- Supply chain management
 - Only 26% had access to software for visibility
 - Plan of action was not communicated with the field
 - Few objectives or measurements in place for supply chain
- Collaboration and coordination
 - 44% did not work with other NGOs when planning supply chain
 - Organizations were chasing the same products

*Logistics and the Effective Delivery of Humanitarian Relief, Fritz Institute survey report

Compare with SCM in Walmart

- Sophisticated technology used for SCM
 - Design, planning, execution, communication
- Standardized/synchronized processes
- High visibility into resources and inventory
- Focus on SCM, trained experts
- Changes in demand, supply, and infrastructure are not “sudden onset”

SCM and Humanitarian Efforts

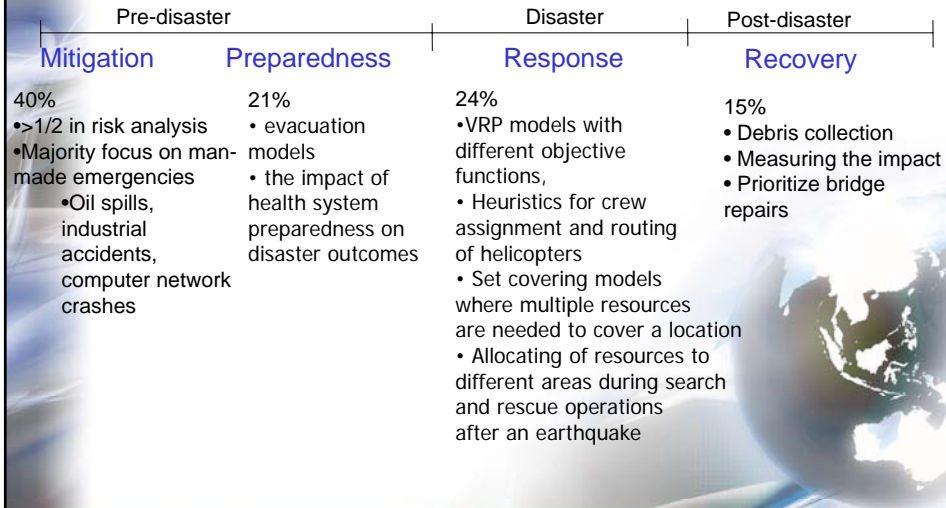
- “What is needed are supply managers without borders: people to sort goods, identify priorities, track deliveries and direct the traffic of a relief effort in full gear”

Doctors Without Borders spokesman, on refusing donations of money
Economist.com Global Agenda, Jan 5, 2005

- “We don’t need a donors’ conference, we need a logistics conference”

European Ambassador at post-Tsunami donor conference
New York Times, Jan 6, 2005

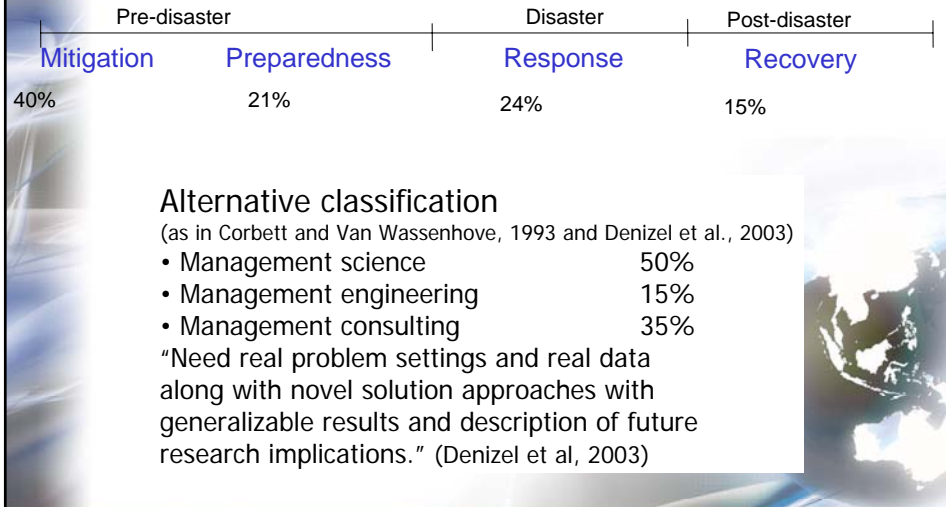
OR/MS Research Across Disaster Timeline



12% on natural disasters, 48% on man-made emergencies, 40% general methods

Source: Altay and Green (2005), OR/MS Research in Disaster Operations Management

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Examples

- CARE: Inventory pre-positioning
 - Marco Gutierrez, Pinar Keskinocak (Georgia Tech) and Serhan Duran (METU)
 - Rigoberto Giron, John Solomon, David Gazashvili (CARE)
- Red Cross: Planning for pandemic flu
 - Ali Ekici, Pinar Keskinocak, Julie Swann, Pengyi Shi (Georgia Tech)
 - Marilyn Self (Red Cross)
- Debris collection
 - Antonio Cabrajal, Ozlem Ergun, Pinar Keskinocak, Monica Villarreal (Georgia Tech)

Summary of problem characteristics

- High complexity
- High uncertainty, dynamically changing environments, information may not be available or reliable
- Timing is key for decisions and actions
- Multiple players, multiple perspectives, multiple/conflicting objectives
- Difficult (but very important!) to assess the potential impact and consequences of actions (short term and long term)
- Important to consider the human/social/behavioral component
- Interdisciplinary nature

Lots of opportunities for adapting existing models and methods or developing new ones!




Center for Humanitarian Logistics

MISSION: Positive humanitarian “impact” worldwide

To improve humanitarian logistics and ultimately the human condition by system transformation and organization effectiveness through education, outreach, and solutions.

Education Outreach Research/Applications

Co-directors: Ozlem Ergun, Pinar Keskinocak, Julie Swann

Resources on the Web for Disaster News

- <http://www.disasternews.net/>
- <http://www.cbsnews.com/digitaldan/disaster/disasters.shtml> & <http://www.headlinespot.com/subject/disaster/> (they contain links to many different US national/international disaster news pages)
- http://www.sciencedaily.com/news/earth_climate/natural_disasters/
- <http://www.foxnews.com/specialsections/naturaldisaster/>
- <http://redcross.wordpress.com/> (American Red Cross)
- http://www.nsf.gov/news/newsmedia/disaster_news/index.jsp (National Science Foundation)
- <http://nhss.cr.usgs.gov/> (by U.S. Geological Survey, with interactive, real-time maps)
- <http://www.alertnet.org/> (by Reuters foundation)
- <http://www.nationalservicerresources.org/disaster-updates> (a weekly update of disasters)