

Lecture 1: Background and Introduction

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Motivation Behind Offering This Course and Course Goals

- **The number of disasters is growing, as well as the number of people affected by them.**
- **Logistics plays a central role** in all phases of disaster management and supporting humanitarian operations.
- The fundamental task of a logistics system is to deliver the **appropriate supplies**, in **quality condition**, in the **right amounts**, to the locations at the time that they are needed.

Motivation Behind Offering This Course and Course Goals

However, due to the inherent nature of disasters, humanitarian logistics is faced with unique challenges:

- the critical infrastructure, including the **transportation, communication, and electric power systems**, may have been **severely negatively impacted** and their functionality compromised;
- there is **a short time window in which to respond with the critical needs products**, which must be delivered in order to prevent loss of life and human suffering, and
- there may be **great uncertainty due to the disruptions**, among other complications.

Motivation Behind Offering This Course and Course Goals

This course covers the **challenges** and **solutions** associated with humanitarian logistics in emergency mitigation and preparedness, disaster response, and recovery.

The course overviews **similarities** and **differences** between **commercial** supply chains and **relief** chains, introduces performance metrics, and provides tools for the analysis and design of supply chains for humanitarian critical needs products, as well as for the coordination and teaming of humanitarian organizations.

It also covers such **major issues** as risk management, material convergence, and competition for financial funds for disasters.

Motivation Behind Offering This Course and Course Goals

This course is based on primary source reading materials, including journal articles, case studies, newspaper articles, and videos.

Background – Definitions of Logistics

The word *logistics* comes from the Greek *logistikos*, which means “skilled in calculating,” and from medieval Latin, where *logisticus* means “of calculation.”

The Random House dictionary defines *logistics* as the branch of military science and operations dealing with the procurement, supply, and maintenance of equipment, the movement of personnel, the provision of facilities, and with related matters.

Some Background – Definitions of Logistics

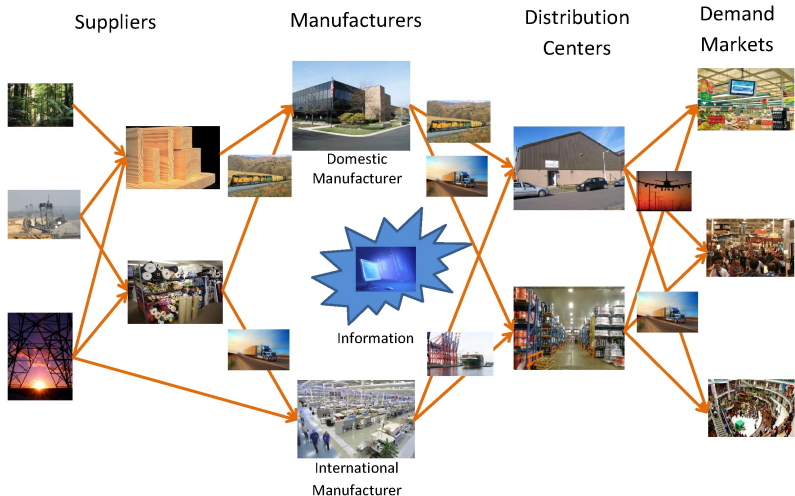
The US Department of Defense (2002) defined *logistics* as the science of planning and carrying out the movement and maintenance of forces ... those aspects of military operations that deal with the design and development, acquisition, storage, movement, distribution, maintenance, evacuation and disposition of material.

**There is an old military saying, which speaks volumes:
Armchair generals talk strategy. Real generals talk logistics.**

Some Background – Definitions of Logistics

Business Logistics - The science of planning, design, and support of business operations of procurement, purchasing, inventory, warehousing, distribution, transportation, customer support, financial and human resources. – (MDC, LogLink / LogisticsWorld, 1997).

A Complex Logistical Network

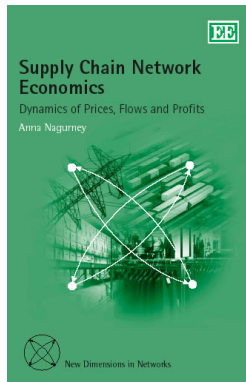


Supply Chains

In this course, we will use *supply chains* and *logistics* interchangeably.

Supply Chains

According to Nagurney (2006): Supply chains are the **critical infrastructure and backbones** for the production, distribution, and consumption of goods as well as services in our globalized *Network Economy*.



Supply Chains



Supply chains may span thousands of miles, involve numerous suppliers, retailers, and consumers, and be underpinned by multimodal transportation and telecommunication networks.

Examples of Commercial Supply Chains

- ▶ food and food products
- ▶ high tech products
- ▶ automotive
- ▶ energy (oil, electric power, etc.)
- ▶ clothing and toys

Supply Chains



Humanitarian and Healthcare Supply Chains

In this course, we will be focusing on humanitarian and healthcare supply chains.

Humanitarian Relief Chains



Healthcare Supply Chains



Supply Chains

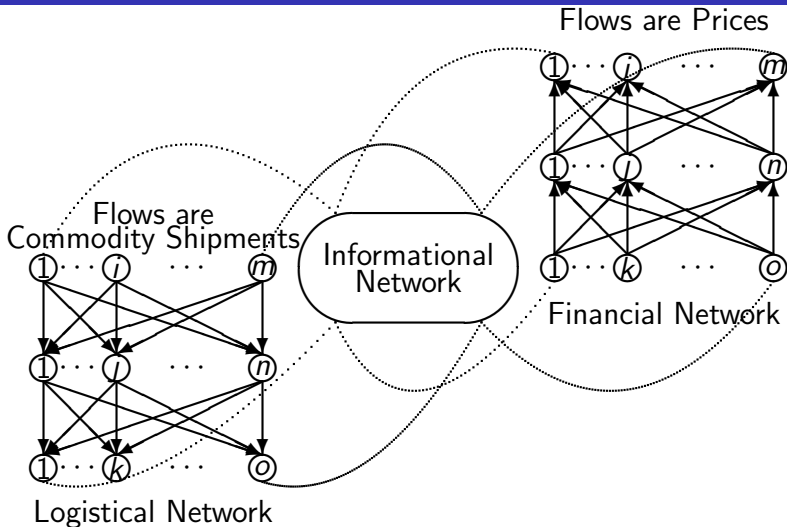
Supply chains may be characterized by **decentralized decision-making** associated with the different economic agents or by **centralized** decision-making.

Supply chains are, in fact, **Complex Network Systems**.

Hence, any formalism that seeks to model supply chains and to provide quantifiable insights and measures must be a system-wide one and network-based.

Indeed, such crucial issues as the stability and resiliency of supply chains, as well as their adaptability and responsiveness to events in **a global environment of increasing risk and uncertainty** can only be rigorously examined from the view of supply chains as network systems.

Multilevel Network Structure of the Supply Chain



A. Nagurney, K. Ke, J. Cruz, K. Hancock, and F. Southworth, 2002. Dynamics of supply chains: A multilevel

(logistical/informational/financial) network perspective, *Environment and Planning B* 29, 795-818.

Characteristics of Supply Chains Today

- ▶ **large-scale nature** and complexity of network topology;
- ▶ **congestion**, which leads to nonlinearities;
- ▶ **alternative behavior of users of the networks**, which may lead to paradoxical phenomena;
- ▶ **possibly conflicting criteria associated with optimization**;
- ▶ **interactions among the underlying networks themselves**, such as the Internet with electric power networks, financial networks, and transportation and logistical networks;
- ▶ recognition of **their fragility and vulnerability**;
- ▶ policies surrounding them may have major impacts not only economically, but also **socially, politically, and security-wise**.

What is Humanitarian Logistics?

The Fritz Institute, working with senior logisticians, came up with the following definition since there was a clear need: *it is the process of planning, implementing and controlling the efficient, cost-effective flow of and storage of goods and materials as well as related information, from point of origin to point of consumption for the purpose of meeting the end beneficiary's requirements* (Thomas and Mizushima (2005)).

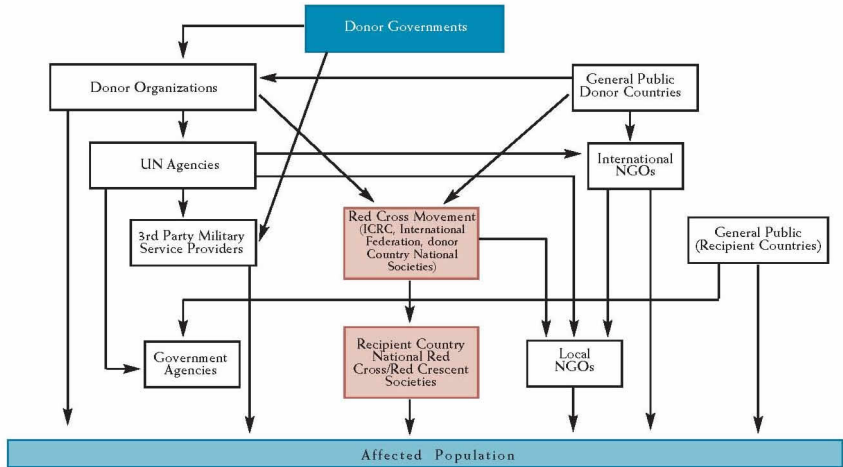
For humanitarians, logistics consists of the processes and systems involved in mobilizing people, resources, skills and knowledge to help vulnerable people affected by disaster (Van Wassenhove (2006)).

What is Humanitarian Logistics?

Disaster relief (and associated cost) is approximately 80% logistics; hence, more transparent, efficient, and effective logistics operations and supply chain management in disasters cannot only save lives but enables better preparedness for natural as well as man-made disasters.

Moreover, donors, who pledge millions in aid and goods, see the impact of the aid.

Humanitarian Sector Funding Flows



Source: A. Thomas and L. R. Kopczak, 2005. From logistics to supply chain management: The path forward in the humanitarian sector, Fritz Institute. DAC report on the sector.

What is a Disaster?

As noted in the *Fragile Networks: Identifying Vulnerabilities and Synergies in an Uncertain World* book by Nagurney and Qiang (2009): The Emergency Events Database (2008) defines a *disaster* as an event that fits at least one of the following criteria:

- 1). 10 or more people killed;
- 2). 100 or more people affected;
- 3). results in a declaration of a state of emergency;
- 4). results in calls for international assistance.

What is a Disaster?

According to the Federal Emergency Management Agency (FEMA) (1992), a catastrophe disaster is an event that:

- results in large numbers of deaths and injuries;
- causes extensive damage or destruction of facilities that provide and sustain human needs; produces an overwhelming demand on state and local response resources and mechanisms;
- causes a severe long-term effect on general economic activity;
- and severely affects state, local, and private-sector capabilities to begin and sustain response activities.

What is a Disaster?

From these definitions, we see that although disasters may have different meanings, depending on the specific domain, **they have one thing in common: they have a catastrophic effect on human lives and a region's or even a nation's resources.**

Classification of Disasters

	Natural	Man-made
Sudden-onset	Earthquake Hurricane Tornadoes	Terrorist Attack Coup d'Etat Chemical leak
Slow-onset	Famine Drought Poverty	Political Crisis Refugee Crisis

Classification of Disasters

L.N. Van Wassenhove, 2006. Blackett Memorial Lecture: Humanitarian aid logistics: supply chain management in high gear, *Journal of the Operational Research Society* **57**, 475-489.

Examples of Disasters

- The Indian Ocean earthquake and (Indonesian) tsunami on December 26, 2004 resulted in over 230,000 deaths in 14 countries;
- Hurricane Katrina, August 23, 2005, with over 1,800 people dying in the hurricane and subsequent floods;
- Cyclone Nargis hit Burma on May 2, 2008 and resulted in over 138,000 fatalities;
- The Sichuan earthquake on May 12, 2008 was reported to have caused about 68,000 deaths;
- The Haiti earthquake that struck on January 12, 2010 with government reporting over 300,000 deaths and the Chilean one on February 27, 2010 with over 500 losing their lives;
- The triple (earthquake/tsunami/nuclear) disaster in Japan on March 11, 2011 with a death toll over 18,000.

The Triple Disaster in Japan on March 11, 2011



Superstorm Sandy

Superstorm Sandy struck the northeastern US and beyond on October 29, 2012. It killed at least 125 people in the United States, including 54 in Haiti. Sandy is being blamed for about \$62 billion in damage and other losses in the US, the vast majority in New York and New Jersey a number that could increase. **It was the second-costliest storm in US history to that date after 2005's Hurricane Katrina**, which caused \$128 billion in damage in inflation-adjusted dollars. Sandy caused at least \$315 million in damage in the Caribbean.



2017 Set a Record for Losses from Natural Disasters

According to *The New York Times*, January 4, 2018, insurers are set to **pay out a record \$135 billion to cover losses from natural disasters in 2017.**

Overall losses, including uninsured damage, came to \$330 billion, according to Munich Re of Germany. The tally was second only to 2011, with the triple disaster in Japan and with losses of \$354 billion in today's dollars.

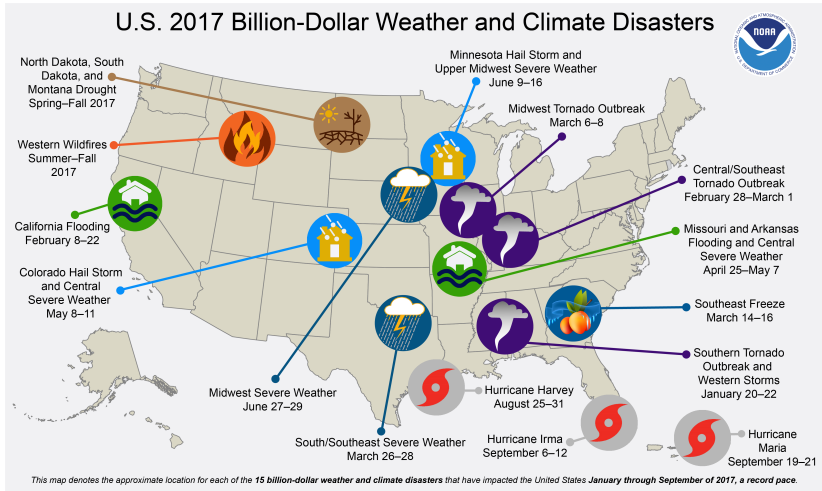
The US made up 50% of the losses, compared with just over 30% on average.

2017 Set a Record for Losses from Natural Disasters

Hurricane Harvey, which made landfall in Texas in August 2017, was the most costly disaster of 2017, causing losses of \$85 billion. And *The New York Times* reports that, together with Hurricanes Irma (hitting Florida) and Maria (devastating Puerto Rico), **the 2017 hurricane season caused the most damage ever, with losses reaching \$215 billion.**

Plus, the **damage of wildfires in California drove insured losses to about \$8 billion.**

Billion Dollar Disasters in the United States in 2017



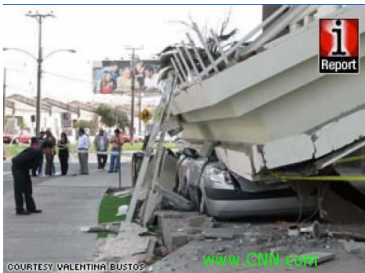
Video and Commentary of Devastation Wreaked by Hurricane Katrina and the Aftermath

Click on underlined text for video.

[Images of Devastation of Hurricane Katrina in August 2005](#)



The Haitian and Chilean Earthquakes



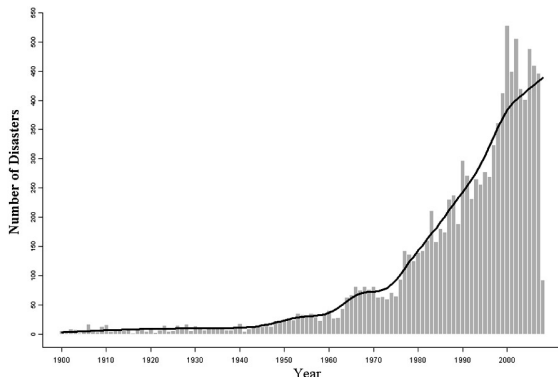
Graphic Video of the Aftermath of the Haiti Earthquake from *The New York Times*

Click on underlined text for video.

[Graphic Video of the Aftermath of the Haiti Earthquake from *The New York Times*](#)

The Impact of Disasters

Disasters have brought an unprecedented impact on human lives in the 21st century and the number of disasters is growing. From January to October 2005, **an estimated 97,490 people were killed in disasters globally; 88,117 of them because of natural disasters.**



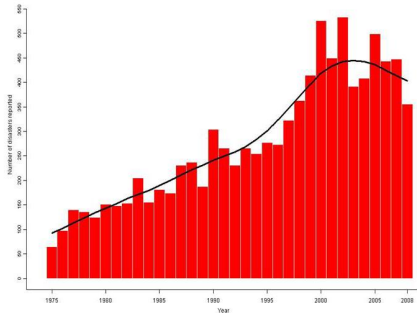
The Impact of Disasters

The number of disasters is increasing globally, as is the number of people affected by disasters. At the same time, with the advent of increasing globalization, viruses are spreading more quickly and creating new challenges for medical and health professionals, researchers, and government officials.

Between 2000 and 2004, the average annual number of disasters was **55%** higher than in the period 1994 through 1999, with **33%** more humans affected in the former period than in the latter (cf. Balcik and Beamon (2008) and Nagurney and Qiang (2009)).

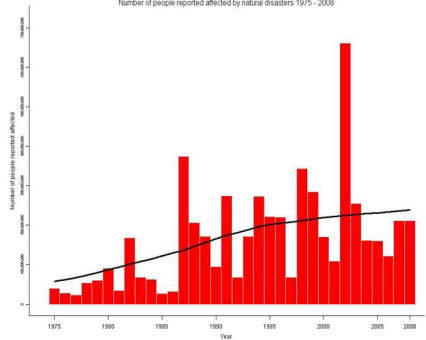
Natural Disasters (1975–2008)

Natural disasters reported 1975–2008



EPH-GAT The GFSC/WHO International Disaster Database - International Institute of Health in London, England - England

Number of people reported affected by natural disasters 1975–2008



EPH-GAT The GFSC/WHO International Disaster Database - International Institute of Health in London, England - England

There are also examples of healthcare disasters, which can include flu pandemics, the fairly recent Ebola crisis, as well as cholera outbreaks, which occurred post the Haiti earthquake, during the recover phase, and is now occurring in Yemen.

H1N1 (Swine) Flu

As of May 2, 2010, worldwide, more than **214** countries and overseas territories or communities reported laboratory confirmed cases of pandemic influenza H1N1 2009, including over **18,001** deaths (www.who.int).

Parts of the globe experienced serious flu vaccine shortages, both seasonal and H1N1 (swine) ones, in late 2009.



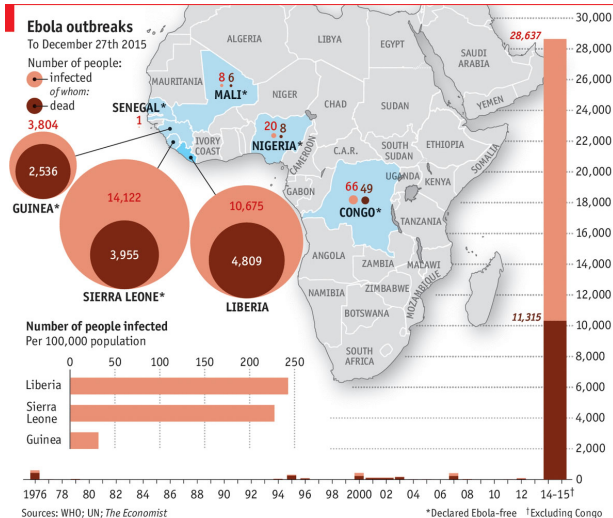
The Ebola Crisis in West Africa



The Ebola epidemic (2014-2015) in West Africa was the largest outbreak of Ebola. According to the World Health Organization, as of December, 2015, the death toll was about 11,000, impacting Liberia, Guinea, and Sierra Leone.

Image thanks to cnn.com.

The Ebola Crisis in West Africa



Economist.com

Image thanks to The Economist.

Professor Anna Nagurney

SCH-MGMT 597LG Humanitarian Logistics and Healthcare

Debbie Wilson Worked with Doctors Without Borders in Liberia for 6 Weeks in Fall 2014



She spoke on the importance of logistics in February 2015 in this course.

[Link to Debbie Wilson's slides from her lecture](#) 

The Syrian Refugee Crisis

One of the major examples of a slow-onset crisis, still taking place, is the Syrian refugee crisis.

The Syrian Refugee Crisis

Syria's civil war has created **the worst humanitarian crisis of our time**. Half of the country's pre-war population more than 11 million people have been killed or forced to flee their homes.

This crisis dates to March 2011, when anti-government demonstrations began, as part of the Arab Spring. The peaceful protests quickly escalated after the government's violent crackdown, and armed opposition groups began fighting back. By July 2011, according to Mercy Corps, army defectors had started to organize the Free Syrian Army and many civilian Syrians took up arms to join the opposition.

Divisions between secular and religious fighters, and between ethnic groups, continue to complicate the politics of the conflict.

The Syrian Refugee Crisis

SYRIAN REFUGEE CRISIS

Families Fleeing Violence

About **11 million Syrians** are on the run, including some 4.8 million who have been forced to seek safety in neighboring countries. Inside Syria, more than 6.3 million people are displaced and **13.5 million** are still in need of humanitarian assistance.



TURKEY **2,764,500**

SYRIA
6,325,978 million people internally displaced

IRAQ
228,894

As of December 16, 2016
Sources: <http://data.unhcr.org/syrianrefugees/regional.php>
[UNOCHA.org/syria](http://unocha.org/syria)



Expert Panel on International Refugee Crisis

In November 2016, the Radcliffe Institute for Advanced Study at Harvard University convened an expert panel on the international refugee crisis.

Click on underlined text for video.

[Video of the panel at Radcliffe on the International Refugee Crisis](#)

Of special relevance to this class is the presentation by Dr. Abdulkarim Ekzayez of Save the Children International Syria Response. His presentation can be viewed by scrolling to 40 minutes of the panel video.

The Impact of Disasters

Although the average number of disasters has been increasing annually over the past decade **the average percentage of needs met by different sectors in the period 2000 through 2005 identifies significant shortfalls.**

According to Development Initiatives (2006), based on data in the Financial Tracking System of the Office for the Coordination of Humanitarian Affairs, from 2000-2005, **the average needs met by different sectors in the case of disasters were:**

- ▶ 79% by the food sector;
- ▶ 37% of the health needs;
- ▶ 35% of the water and sanitation needs;
- ▶ 28% of the shelter and non-food items, and
- ▶ 24% of the economic recovery and infrastructure needs.

Disaster Response

Disaster response may be at the local/regional, national, or international levels (Van Wassenhove and Pedraza Martinez (2012)).

Typically, the immediate response to disasters comes from *local* systems. These systems are comprised of governmental agencies NGOs (non-governmental agencies) with local representation, National Societies of Red Cross and Red Crescent with local branches, the army, fire and police departments, and other civil agencies.

When the local response system is overwhelmed by the size of the disaster, the national system is activated.

If the national system does not have the capability/capacity to respond and the affected country approves it, **the international system is activated.**

Disaster Response

The international disaster response system is organized in clusters (food, health, shelter) and is coordinated by the OCHA – the United Nations Office for the Coordination of Humanitarian Affairs.

The response, as a whole, should be led by the national government of the hosting country, with respect for the national sovereignty (Van Wassenhove and Pedraza Martinez (2012)).

Humanitarian Supply Chains

The ultimate humanitarian supply chain has to be able to respond to multiple interventions on a global scale as quickly as possible, and within a short time-frame.

Therefore, such supply chains need to be multiple, global, dynamic and temporary.

L. N. Van Wassenhove, 2006. Blackett Memorial Lecture: Humanitarian aid logistics: supply chain management in high gear, *Journal of the Operational Research Society* **57**, 475-489.

Humanitarian Supply Chains

Due to the enormous impact of disasters, disaster management and humanitarian logistics have become topics that are drawing attention from researchers in various disciplines.

Practitioners and researchers are working more closely together to learn from one another and to push knowledge in this growing and very challenging field forward.

Bellagio Conference on Humanitarian Logistics

Humanitarian Logistics: Networks for Africa



Rockefeller Foundation Bellagio Center Conference, Bellagio, Lake Como, Italy
May 5-9, 2008

Conference Organizer: **Anna Nagurney**, John F. Smith Memorial Professor
University of Massachusetts at Amherst

<http://supernet.isenberg.umass.edu/hlogistics/hlogistics.html>

Humanitarian Supply Chains

In this course, we will be covering the foundations of humanitarian logistics and healthcare supply chains **with a focus not only on qualitative analysis and conceptual studies** but also on **quantitative methods and analytical tools**.

The course will use **both primary and secondary sources** and will also feature **experienced practitioners** who will share their knowledge.

In addition, videos in which experts share the state-of-the-art of supply chain management and humanitarian logistics in times of disasters (and post) will also be viewed.

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