

- PECC Seminar 2 on Blue Economy:
Sustainability and Beautification of Ports

The spill-over effects of a port shutdown from the perspective of X-events

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Contents

- *Introduction*
- *An outline of X-events*
- *Analysis results*
- *Policy Implication*
- *Conclusion*

Contents

- ***Introduction***
- *An outline of X-events*
- *Analysis results*
- *Policy Implication*
- *Conclusion*

Introduction

➤ South Korea Blackout on September 15, 2011

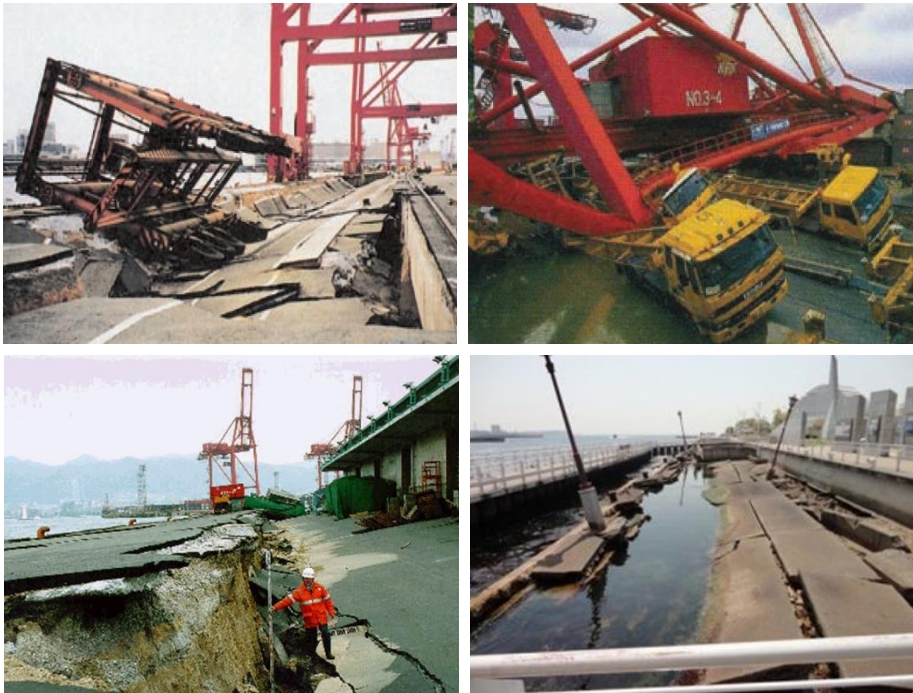


Introduction

➤ What if the port shutdown?

- ✓ Factor: natural disasters, port labor strikes
- ✓ Period: short-term, long-term
- ✓ Target: terminal, one port, all ports of the country

< Kobe earthquake (1995) >



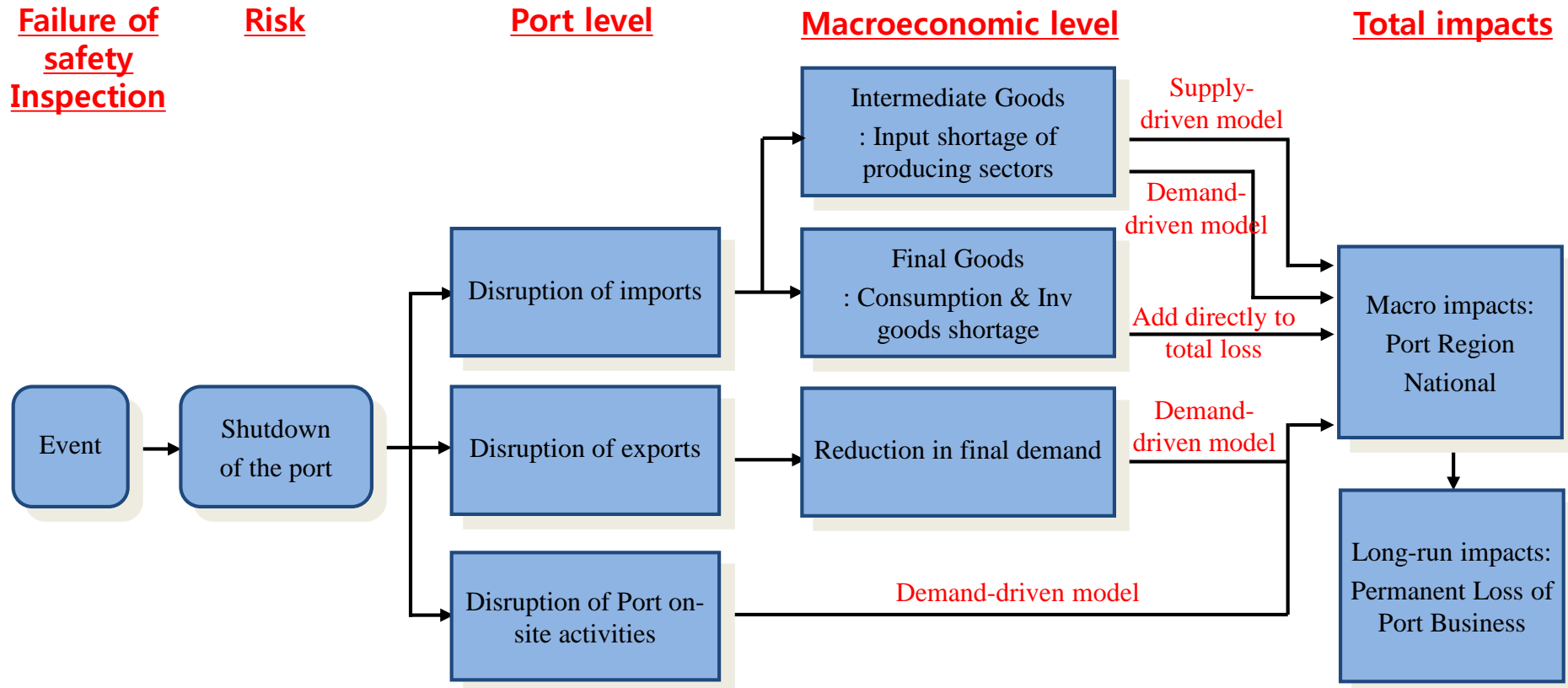
< Long Beach Port strike (2002) >



Introduction

➤ Methodology

- ✓ Input-output analysis



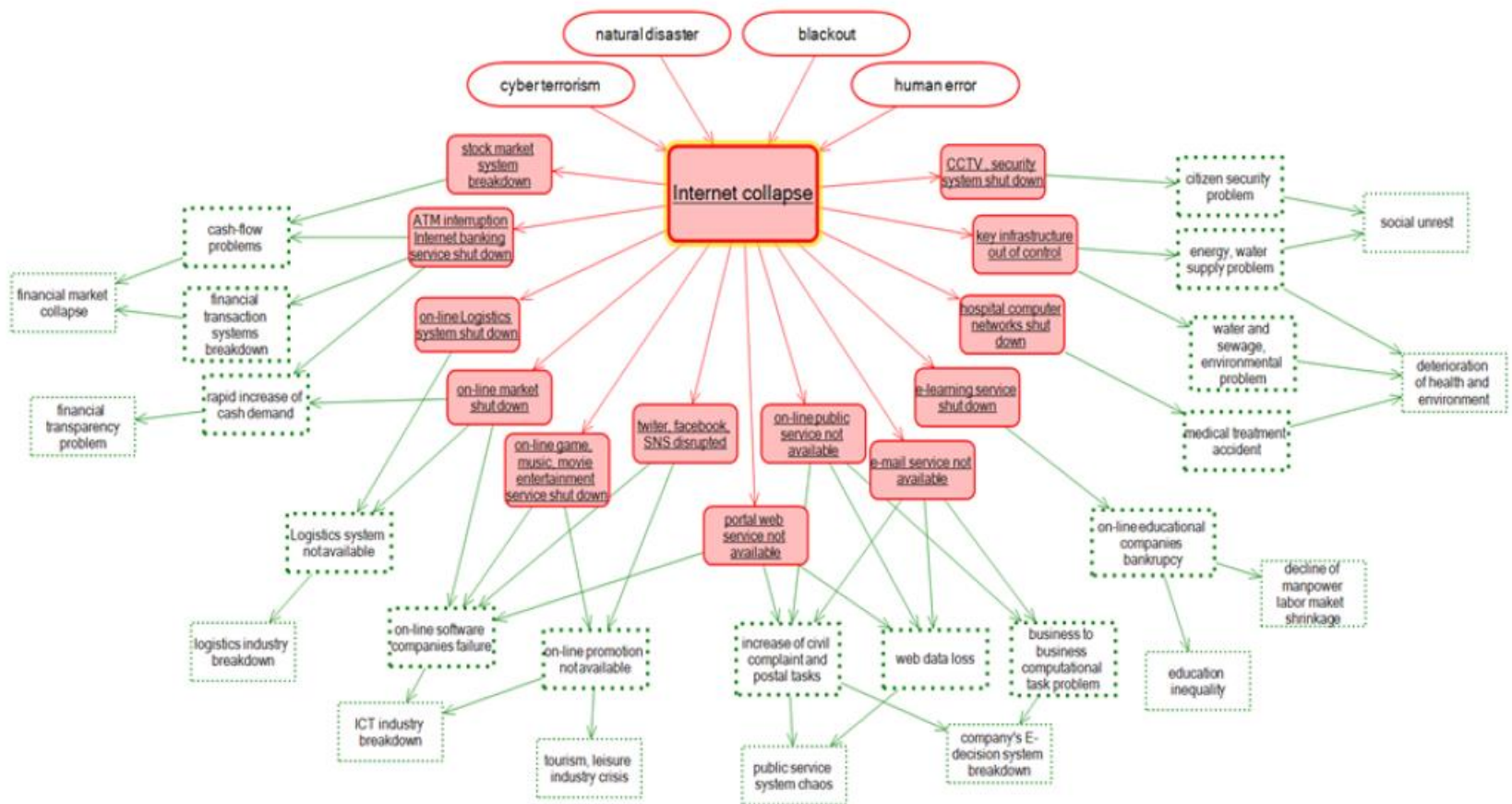
Source: Rose and Wei(2013)

Introduction

✓ X-events case study

- extreme event, unknown quantity X

< Internet collapse scenario in Korea >



Source: STEPI(2012)

Introduction

➤ 7 shocks and Finland: project report

1. The European Monetary Union breaks down
2. Nokia's is acquired by one of its competitors
3. China suffers weaker growth and introspection
4. Pulp and paper industry is leaving Finland
5. The consumer price of energy drops by 90%
6. Internet crashes
7. Floods and droughts cause severe damage in Europe

Introduction

➤ Domestic literatures



6-shocks under Korean context

- ✓ Internet collapse
- ✓ Nuclear accidents in Northeast Asia
- ✓ Abrupt energy price change (rise & fall)
- ✓ Food crisis in Korea
- ✓ Pandemic in Korea
- ✓ Retirement age in 75 years old

Scenarios for mega disasters

- ✓ Global warming by climate change
- ✓ A new kind of contagious disease
- ✓ Terrorism against people
- ✓ Cyber terror
- ✓ Safety accident

Introduction

- Spill-over effects of the port shutdown from the perspective of X-events
 - ✓ The development of a port risk management system for safety and resilience
 - ✓ The port shutdowns are extreme events with low probability and high impacts.
 - ✓ Various X-event issues should be analyzed to address future uncertainty.
 - ✓ Systematic research for handling future risk is urgently needed.
 - ✓ Drawing a scenario map and a causal loop of the port shutdown

- Policy instruments for building resilience and recovery to the port shutdown
 - ✓ Preparing measures on prevention, reduction, and recovery from the port shutdown
 - ✓ Formulating strategies to deal with many situations induced by the port shutdown
 - ✓ Examining economic impacts as well as social impacts
 - ✓ Suggesting an effective application method of manual on port risk management

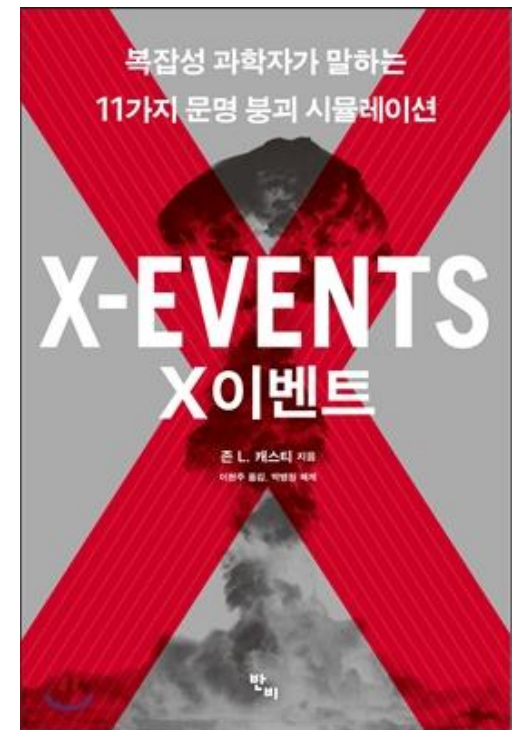
Contents

- *Introduction*
- ***An outline of X-events***
- *Analysis results*
- *Policy Implication*
- *Conclusion*

An outline of X-events

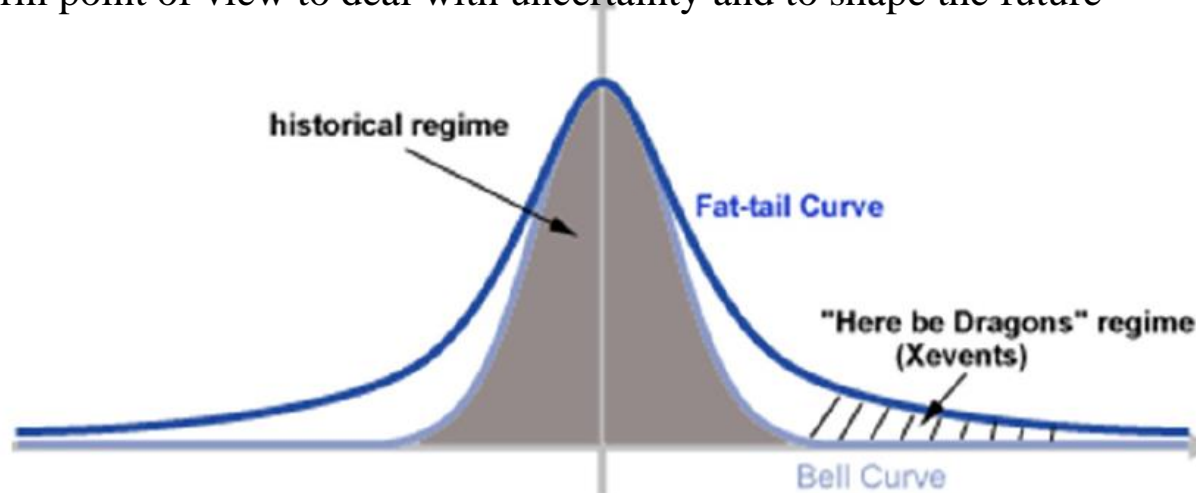
➤ The definition of the X-events

- ✓ The X-events are defined as the extreme events induced by nature and human beings with low probability and high impacts
- ✓ Significant implications of X-events depend on institutions and the coordination among members.
 - Given that spill-over effects of X-events differently come from responsiveness and adaptableness of societies, it is difficult to stipulate the scope of X-events universally and objectively.
- ✓ X-events can serve as a trigger of some events as well as a driving force that leads to the following events as they increases in time and space (Casti, 2009).



An outline of X-events

- ✓ Limited historical data
 - General forecasting such as weather forecasting is based on rich and broad historical record.
 - If the historical record is too limited, the “rare” and “unlikely” case turns into the “surprising” case.
- ✓ Almost all X-events, while costly at the aggregate level, may induce a positive response according to time horizon of the events.
- ✓ As today’s complex society is unstable and unpredictable, decision makers must have a long term point of view to deal with uncertainty and to shape the future



An outline of X-events

➤ Main X-event examples



Swine influenza/ SARS



The fall of Berlin Wall



Global financial crisis



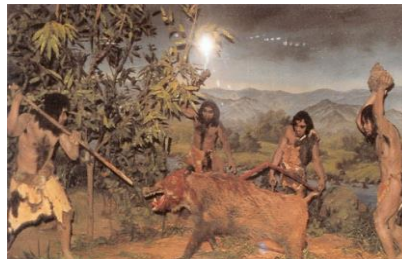
**2011 Tohoku earthquake
and tsunami**

An outline of X-events

➤ Causes of X-events

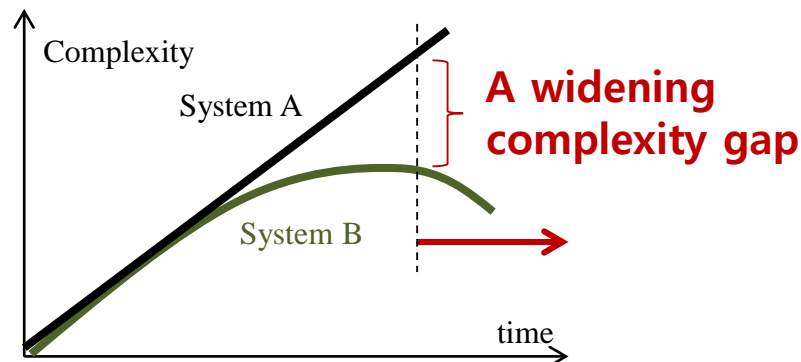
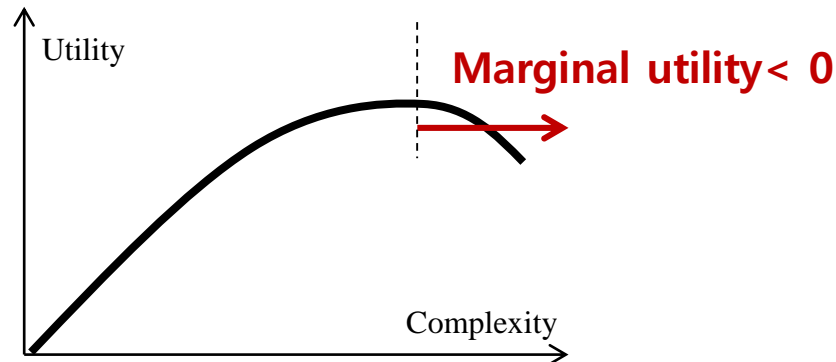
- ✓ Complexity gap between two subsystems
- ✓ Joseph Tainter (1988) 「Collapse of Complex Societies」
- ✓ Complexity in social systems has grown to solve new problems.
 - diversification, specialization, and the necessary of coordination and integration
- ✓ New tool, organization/job, and technology system
- ✓ Human beings naturally increases complexity in social system, which generates cost and benefit according to the economic principle.
 - the law of diminishing returns
- ✓ Moreover, complexity in each subsystem increases at a different speed.
- ✓ If the marginal utility is negative or complexity gap between subsystems widens?

→ risk, collapse



An outline of X-events

➤ Complex gap between social systems



The law of complexity:

⇒ “If the control system could not reduce the complexity gap, the system would be destroyed.

- ✓ The Arab Spring: government vs public
- ✓ 2011 Tohoku earthquake: nature vs human being
- ✓ Global financial crisis of 2007-08: finance services vs regulators
- ✓ Eurozone/EU: EU regulation vs world markets

An outline of X-events

➤ The characteristics of X-events

- ✓ It is essentially impossible to forecast X-events.
 - “rare”, “improbable”, and “unlikely”
 - When will the terrorism such as 9/11 attacks take place? How much impact of it?
 - We have to prepare for reducing negative impacts of X-events like natural disasters.

➤ The purpose of X-event research

- ✓ Different approach from existing methodologies
 - Preparing reluctant events with low probability
- ✓ Developing tools to specifically understand ‘Unknown Unknowns’
 - Building an early warning system for detecting the approach of extreme events
- ✓ Minimization of cost & maximization of benefit
 - Maximizing the possibility of positive events which will lead to innovation

An outline of X-events

➤ The recent trend of X-events

✓ Globalization & networking

- More networked societies are highly exposed to X-events.

: Global financial crisis and Tohoku earthquake affected decline in production of Nokia.

→ Finland's GDP sharply fell by 8.2%.

- Due to closely connected relations of global economy, each country may be seriously affected through secondary spill-over effects.

✓ Commonization & enlargement

- Paradigm shift, leverage and imbalance, urbanization, technological development



Contents

- *Introduction*
- *An outline of X-events*
- ***Analysis results***
- *Policy Implication*
- *Conclusion*

Analysis results

➤ Round-table brainstorming session with experts

- ✓ Time/Location: 2014. 10. 20.(Mon)/ KMI 14th meeting room
- ✓ Purpose: examining enablers and triggers and drawing causal loop
- ✓ Participants: 13 persons

Division	Organization	Department	Participant
Private company /association	<ul style="list-style-type: none"> ✓ Hutchison Korea Terminals ✓ Korea Port Logistics Association 	<ul style="list-style-type: none"> ✓ Safety and Security Team ✓ Logistics Operation Department 	<ul style="list-style-type: none"> ✓ 1 ✓ 1
University	<ul style="list-style-type: none"> ✓ Chung-Ang University 	<ul style="list-style-type: none"> ✓ Department of administration 	<ul style="list-style-type: none"> ✓ 1
Institute	<ul style="list-style-type: none"> ✓ IDI ✓ STEPI ✓ KMI 	<ul style="list-style-type: none"> ✓ City Infra Research Division ✓ Future Research Center ✓ Port Research Department 	<ul style="list-style-type: none"> ✓ 1 ✓ 1 ✓ 5
Government	<ul style="list-style-type: none"> ✓ MOF ✓ National Disaster Management Institute ✓ etc 	<ul style="list-style-type: none"> ✓ Port Management Division ✓ Safety Research Division ✓ etc 	<ul style="list-style-type: none"> ✓ 1 ✓ 1 ✓ 1

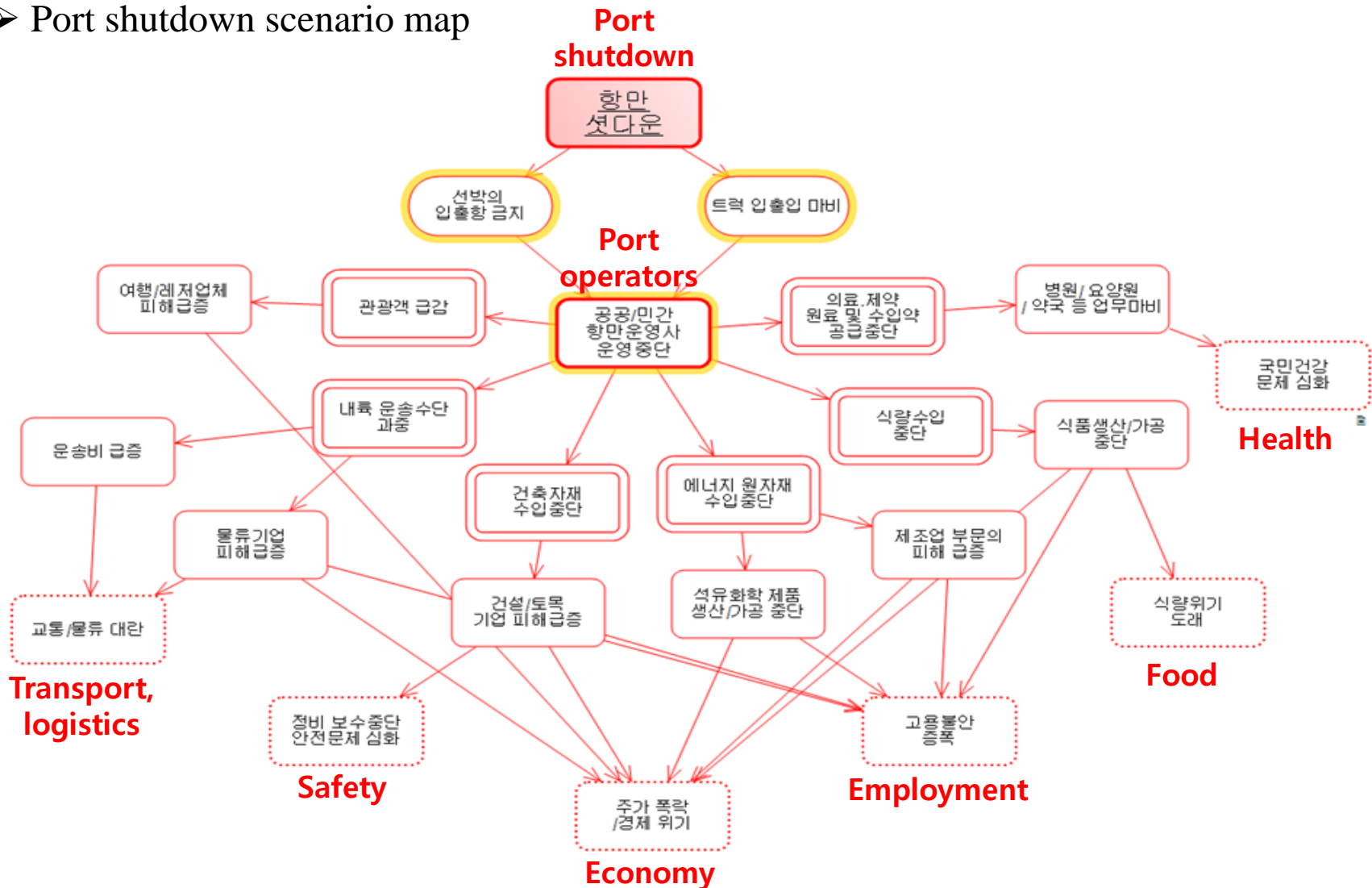
Analysis results

➤ Triggers of port shutdown

- ✓ Terrorism
 - Due to the rise of tension between neighboring nations, a local collision may happen.
 - The port network is likely to be disrupted by cyber-terror attacks of external forces.
- ✓ Simultaneous port labor strikes
 - A total of 20,000 people such as port labors, cargo handling workers, and port security personnel will go on strike in protest of social security and employment policy.
- ✓ Diffusion of new contagious diseases with high fatality
 - When patients infected by SARS or swine flu appear in specific berths, many facilities like those berths and the port must be immediately stopped with isolation of patients.
- ✓ Unexpected natural disasters such as earthquakes and tsunami
 - When strong natural disasters like 2011 Tohoku earthquake take place, port facilities built with low earthquake-resistant grade would be destroyed.
- ✓ Combined triggers
 - More than two triggers would happen simultaneously or sequentially.

Analysis results

➤ Port shutdown scenario map



Analysis results

➤ Spill-over effects by sector

Sector	Spill-over effects
Manufacturing, petrochemical	<ul style="list-style-type: none"> ✓ Problem in production of petrochemicals, semiconductors, and automobiles, and steel by the interruption of import of raw materials ✓ The interruption of export will cause severe damage to the domestic economy and trade deficit. ✓ It will be difficult to produce and supply petrochemicals, and producers and consumers will be faced with an energy shortage.
Food production, processing	<ul style="list-style-type: none"> ✓ In case of port shutdown, enormous food crisis is expected to take place sequentially. ✓ Because reserve requirement for food except for rice is not regulated, the production and distribution of elementary food based on wheat and bean will cause trouble. ✓ Like suffered baking companies, the crisis of the food and beverages may come.
Logistics, distribution	<ul style="list-style-type: none"> ✓ Deepened traffic congestion of port cities and increased congestion of substitute ports ✓ As inland transportation costs rise sharply, the logistics cost in the whole industry will jump. ✓ Due to the decrease in transport order quantity, the logistics companies will suffer huge losses.
Employment labor	<ul style="list-style-type: none"> ✓ The corruption of supply of raw materials will develop into the crisis of manufacturing and processing companies. ✓ Restructuring for solving the economic crisis of producers may provoke employment instability of industrial workers. ✓ Employment instability of port labors
Health and medical	<ul style="list-style-type: none"> ✓ Serious problems of the import of medicines and raw materials for making pharmaceutical products ✓ The stockpile of drugs and vaccines required in hospitals, pharmacies, health centers, and sanatoriums will be reduced, and securing the stock of emergency drugs will be increasingly crucial. ✓ The rise in medicine price and the interruption of treatment can threat the national health system.

Analysis results

➤ Causal loop and social meaning

✓ Vicious cycles in case of port shutdowns

Feedback loop A	<ul style="list-style-type: none">✓ If the substitution rate of inland transportation exceeds the allowance limit, its disorder occurs.✓ It has a negative impact on available substitution ports.✓ Substitution ports would be disrupted, and the inland transportation would be overloaded.
Feedback loop B	<ul style="list-style-type: none">✓ A sharp increase in prices according to the interruption of supply chain systems (feedback loop A)✓ Panic buying in circulation market, starting from daily necessities✓ The failure of general market functions can lead to social unrest and panic buying again.
Feedback loop C	<ul style="list-style-type: none">✓ When the failure of market functions and social unrest take place, domestic and foreign capitals will leave to foreign countries.✓ If compensation for damages by export disruption raises a financial crisis, capitalists and the middle class will emigrate suddenly.✓ This can lead to financial crisis, which will result in a vicious cycle of large social unrest.

✓ Key points of vicious cycles

- The crisis of energy supply system
- The collapse of labor market

Contents

- *Introduction*
- *An outline of X-events*
- *Analysis results*
- ***Policy Implication***
- *Conclusion*

Policy implication

➤ Policy implication

✓ Designating substitute berths of port

- In the case of strategic items (nuclear fuels and major grains) that are vital for stable economic lives of people, the port operation should be transformed from centralized functions to the stabilization for sustainable supply and demand
- Preparing elaborate contingency plans of port functions against the emergency

✓ Formulating welfare policies for port labors

- Korean port operators have secured freight volumes via a severe competition between them, which produced poor working conditions of port labors.
- Given that collective action of port labors may lead to the port shutdown, the policy for assuring the financial stability of port operators should be promoted.
- Preparing the basis for increasing welfare of port labors – i.e. better working conditions

Policy implication

- ✓ Establishing governance structures for responding risks during total periods
 - Stipulating the standardization manual on action plans regarding prevention, reduction, and recovery in the port shutdown
 - Constructing the combined early warning monitoring system for sharing signals of port risk between ministries
 - Discussing assigning emergency road networks connected to ports for transporting strategic items with related ministries
 - Establishing governance structures for responding risks during total periods to minimize the disorder in case of emergency

- ✓ Building parallel inspection and safety systems in each berth
 - As logistics nodes, ports are much exposed to contagious diseases.
 - National overall control systems are difficult to quickly handle unexpected accidents such as the spread of contagious diseases.
 - Building safety systems including parallel inspection to labors and freights

Policy implication

- ✓ The status of the standardization manual on disasters
 - Arranging the standardization manual on the port shutdown in charge of MOF

Division	Ministry	Types of disasters
Natural disasters (4)	NEMA	✓ Damage by storm and flood, earthquake, the eruption of a volcano
	MOF	✓ Red tide ('14.5)
Social disasters (24)	Korea Forest Service	✓ Forest fire
	ME	✓ Toxic chemicals spill accident, water pollution, drinking water(regional water supply)
	MOF	✓ Large marine pollution, vessel accidents('14.8)
	MOLIT	✓ Utility tunnel disasters, dam failures, subway accidents, KTX accidents, drinking water(metropolitan water supply), transportation by land
	NEMA	✓ Great fire in multiple dense facilities
	NSSC	✓ Radiation leakage by neighboring countries, nuclear power safety(radiation leakage)
	MAFRA	✓ Domestic animal disease
	MOHW	✓ Contagious disease, health and medical treatment
	MSIP	✓ Information and Communication, GPS electric wave interference, cosmic radio wave disaster
	FSC	✓ Finance information system
	MOTIE	✓ Nuclear power safety(shutdown), electricity, demand and supply of oil
	MOEL	✓ Large human accidents in places of business('14.8)

Contents

- *Introduction*
- *An outline of X-events*
- *Analysis results*
- *Policy Implication*
- **Conclusion**

Conclusion

- Analysis on the port shutdown in the perspective of X-events
 - ✓ Application of a new methodology to analyze the port shutdown
 - ✓ Presenting main enablers and triggers which provoke the disconnection of port services
 - ✓ Describing feedback loops leading to chained spill-over effects in case of the port shutdown
 - ✓ A reliable starting point in policy regarding prevention, reduction, and recovery
 - ✓ Deriving social spill-over effects of port shutdowns

- The development of port risk management system
 - ✓ The arrangement of the standardization manual on the port shutdown in charge of MOF
 - ✓ The preparation of elaborate contingency plans of port functions
 - ✓ The establishment of governance structures for port risk management during total periods

- *Thank you*

- **Q & A**

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